



Arkansas Aquatic Nuisance Species Management Plan



May 14, 2013

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EXECUTIVE SUMMARY

Arkansas, “The Natural State,” has abundant aquatic resources in the form of rivers, streams, lakes, reservoirs, springs, and groundwater. World-class fisheries for bass and trout attract anglers from around the country for competitive tournaments as well as recreational fishing. Arkansas is located entirely within the Mississippi River drainage and is home to important aquatic habitats, such as some of the few remaining bottomland hardwood wetland areas in the south. Due to the presence of six distinct eco-regions, the aquatic fauna is one of the most diverse in the country.

In addition to its natural assets, Arkansas is second in the nation in aquaculture production. The state leads the nation in the production of baitfish, hybrid striped bass fingerlings, largemouth bass food-fish, and triploid grass carp (used for aquatic vegetation control). Arkansas is also third in catfish production. The Arkansas Game and Fish Commission (AGFC) and the U.S. Fish and Wildlife Service (USFWS) operate five warmwater and three coldwater hatcheries that raise and distribute millions of fish into public waters around the state.

Aquatic nuisance species (ANS) are a growing concern for many natural resource agencies. ANS are aquatic (and sometimes terrestrial) organisms that, when introduced into new habitat, can threaten the diversity or abundance of native aquatic species. ANS can also put at risk the ecological stability of infested waters, or the commercial, agricultural, aquacultural, or recreational activities dependent upon such waters. Native species can be affected through increased competition for food and nutrients. Many non-natives carry diseases that can be transferred to native species or humans. Aquatic weeds can choke out waterways, clog pipes, and restrict recreational use of a water body. According the US Geological Survey’s Non-indigenous Aquatic Species webpage, of the 99 species introduced into Arkansas waters outside their natural range, over half are not native to the United States (US Geological Survey, 2007). It has been estimated that economic damages associated with non-indigenous species effects and their control climb over \$130 billion dollars a year in the United States (Pimentel 2000).

AGFC led the creation of an Arkansas ANS Task Force. The Task Force began its work on April 17, 2007, and completed the Arkansas plan on March 14, 2013. Forty-four individuals representing 30 agencies, organizations, and trade associations participated in this effort. Dr. Carole Engle, University of Arkansas at Pine Bluff, was contracted to coordinate the plan development process.

This plan’s goal is to prevent the introduction, establishment, and spread of aquatic nuisance species, and to eradicate, where feasible, existing aquatic nuisance species in order to minimize economic and environmental harm in Arkansas. Objectives include:

1. Developing and implementing a means to coordinate education, monitoring, detection, and management activities related to aquatic nuisance species within Arkansas and with other states.
2. Developing and implementing comprehensive educational programs on aquatic nuisance species in Arkansas targeting the highest priority species and pathways, with an emphasis on both preventive and corrective actions.

3. Developing and implementing a mechanism for early identification, reporting, and eradication, where possible, of aquatic nuisance species in Arkansas.
4. Preventing the introduction of new aquatic nuisance species to Arkansas.
5. Monitoring, containing, and managing existing aquatic nuisance species in Arkansas.
6. Identifying potential new aquatic nuisance species and new pathways for introduction into Arkansas.

The focal species identified in this plan are categorized as pathogens, plants/algae, mollusks, crustaceans, insects, fish, birds, and mammals. Within each category those already present in Arkansas are discussed separately from those not yet present.

Many focal species are already present in Arkansas. These include 4 pathogens (Amphibian Chytrid Fungus, Catfish Trematode, Parasitic Copepods, Infectious Pancreatic Necrosis), 13 plants (Alligatorweed, Brazilian Waterweed, Common Reed, Curly Pondweed, Didymo, Duck Lettuce, Eurasian Watermilfoil, Giant Lyngbya, Hydrilla, Purple Loosestrife, Uruguayan Primrose, Water Hyacinth, Water Lettuce), 1 insect (Asian Tiger Mosquito), 1 crustacean (Gapped Ringed Crayfish), 2 mollusks (Asian Clam, Zebra Mussels), 7 fish (Bighead Carp, Black Carp, Silver Carp, Northern Snakehead, White Perch, Yellow Bass, Yellow Perch), 2 birds (American White Pelican, Double-crested Cormorant), and 2 mammals (Beaver, Nutria). *Please note that while American White Pelican, the Double-crested Cormorant, and the Beaver are native species that are considered nuisance species in Arkansas, they do not meet the definition of an aquatic nuisance species according to the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA as amended by NISA, 1996) and that while the Asian tiger mosquito is considered a nuisance species in Arkansas, it does not meet the definition of an aquatic species according to Aquatic Nuisance Species Program documents. USFWS State Plan funding via NANPCA will not be used to fund activities related to these species.*

Even more species are recognized as threats that have not yet found their way to Arkansas, including 9 pathogens (Infectious Hematopoietic Necrosis, Koi Herpes Virus, Muscle Microsporean, Salamander Iridovirus, Spring Viremia Of Carp Virus, Taura Syndrome Virus, Viral Hemorrhagic Septicemia, Whirling Disease, White Spot Syndrome Virus), 3 plants (Giant Salvinia, Golden Algae, Roundleaf Toothcup), 6 crustaceans (Australian Red Claw Crayfish, Chinese Mitten Crab, Everglades Crayfish, Rusty Crayfish, Smooth Marron, Yabby), 8 mollusks (Big-Ear Radix, Channeled Apple Snail, Chinese Mystery Snail, Ghost Ramshorn Snail, New Zealand Mud Snail, Quagga Mussel, Quilted Melania, Red-Rim Melania), and 5 fish (Alewife, Blueback Herring, Eurasian Ruffe, Round Goby, Sticklebacks).

Pathways are the avenues by which ANS can be introduced into the state. This plan groups these pathways into three categories: 1) unintentional introductions, 2) deliberate, unlawful introductions, and 3) introduction through natural spread.

A major emphasis of this plan is preventing the introduction of new ANS into the state. The primary mode of prevention includes a strong emphasis on educational programs and development of a rapid response structure. Plans of action were developed for several different

types of responses, depending upon the type of organism and the type of identification mechanism required.

The plan was developed partially to comply with NISA 1996 (P.L. 104-332), which encouraged the development of comprehensive aquatic invasive species management plans. Once approved by the national ANS Task Force, these state plans are eligible for federal funds to assist implementation. This plan has resulted in statewide collaboration to protect freshwater resources from adverse effects of ANS.



Arkansas Aquatic Nuisance Species Task Force:

Front row left to right: John Turner (ANRC), Patty Eklund (UAPB), Marilyn Barrett-O’Leary (SARP), Dr. Carole Engle (UAPB), Brian Wagner (AGFC), Kelly Winningham (AGFC), Dr. Susan Weinstein (ADH), Dr. Eric Park (ABOFGA).

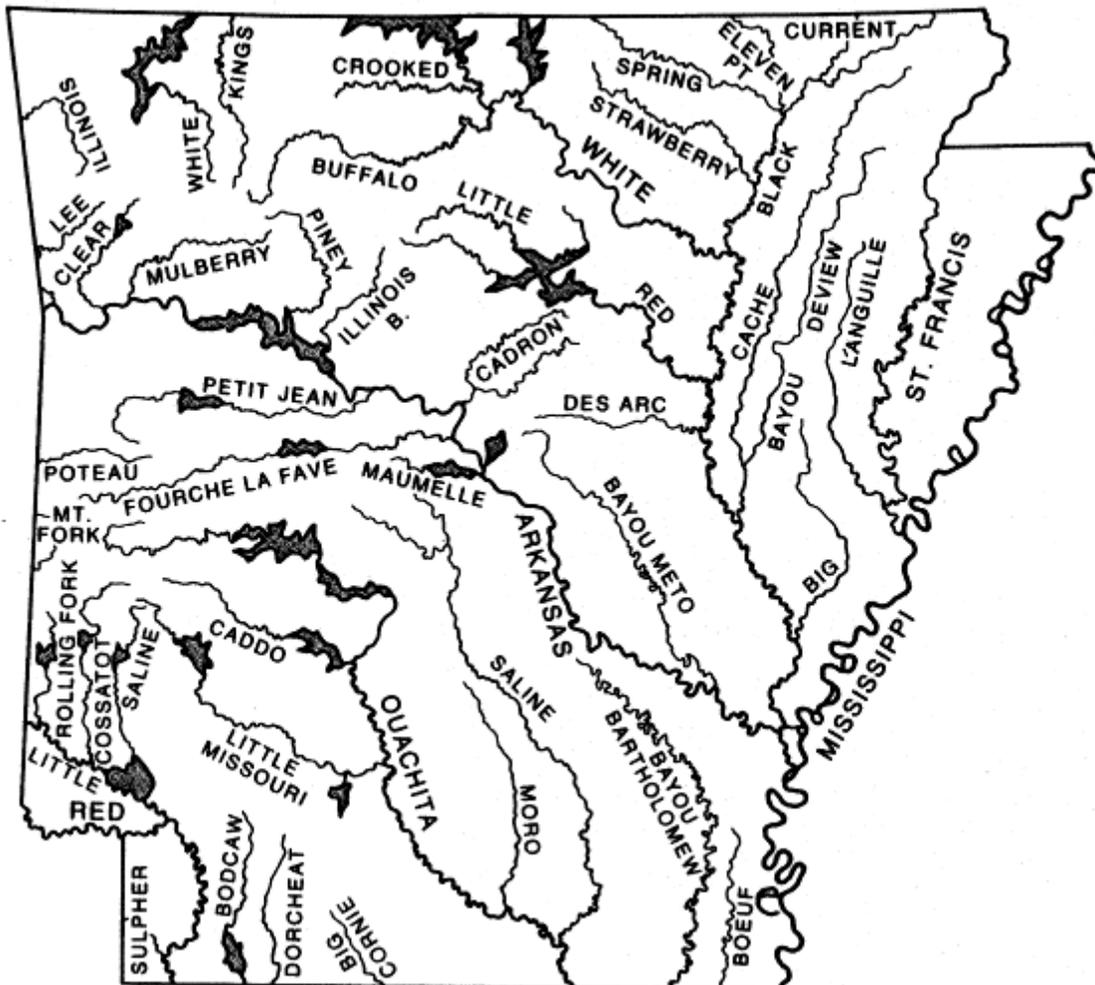
Back row left to right: Clint Turnage (APHIS/WS), Shawn Egan (Lake Norfork Chamber of Commerce), Jim Wallace (ASPB), Charles “Bo” Collins (Catfish Farmers of AR), Mark Sattelberg (USFWS), Rachael Higdon (AAD, Aquaculture Division), Jerry Williamson (Arkansas Farm Bureau), Johnny Cantrell (USCOE), Mark Gibson (Arkansas Green Industry Association), Melody Parsley (ADH), Dr. Nathan Stone (UAPB), Richard Standage (USFS), Lee Holt (AGFC), and Mark Oliver (AGFC).

A complete list of members is included as Appendix A to this document.

INTRODUCTION

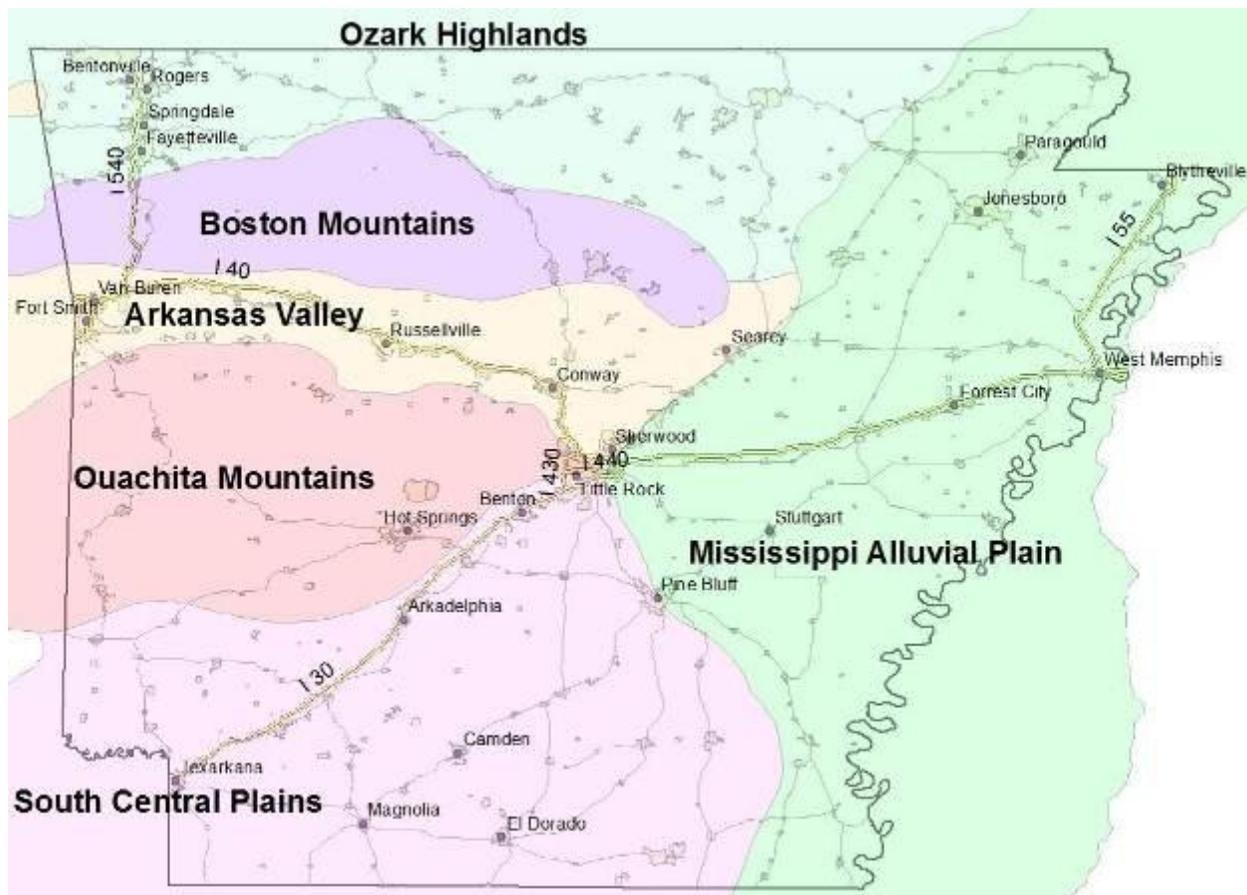
The Natural Setting

Arkansas, “The Natural State,” has abundant aquatic resources. There are more than 600,000 acres of lakes and reservoirs and 20,000 miles of streams (Robison and Buchanan, 1988). These include a wide variety of habitats such as upland and lowland streams, small to very large springs (Mammoth Spring is the fourth largest spring in the U. S.), big rivers, small to very large reservoirs, natural lakes, oxbows and cut-offs, bayous, swamps, underground stream systems and numerous ponds constructed for various purposes. The Mississippi River forms the eastern border of Arkansas and there are five additional major river basins within the state: the Red, White, Ouachita, St. Francis and Arkansas.



Major rivers of Arkansas.

Arkansas is also home to important aquatic habitats such as some of the few remaining bottomland hardwood wetland areas in the south and cave stream systems inhabited by endangered species.



The Ecoregions of Arkansas.

Arkansas encompasses parts of six different Ecoregions, each of which provide distinct sets of environmental conditions. The Delta, or Mississippi Alluvial Plain, is the historic floodplain of the Mississippi River. This region is still linked by hydrology to the Mississippi River and is prone to flooding. The natural vegetation is largely southern floodplain forest, although the dominant land use is agriculture, with soybean, cotton and rice being the major crops in the region. Almost all of the aquaculture industry is located within the Delta region. It is also a major migratory corridor for birds during the fall and spring migrations. The Gulf Coastal Plain is primarily oak-hickory-pine forest uplands and southern floodplain forest in the bottomlands. Lumber and pulp wood production and livestock grazing are major land uses. The Ouachita Mountain region is composed of numerous ridges, hills and valleys with oak-hickory-pine forests dominating the landscape. Logging and recreation are the major land uses. The Arkansas River Valley is an alluvial valley between the Ouachita and Ozark Mountains. It is made up of plains, hills, floodplains and scattered mountains. Upland areas have been cleared for pasture or hay production. The Boston Mountain region is primarily forested, with maximum elevations higher than in the Ozark Mountains. Water quality is exceptional in streams of this region. Red and white oaks dominate the uplands, while the drier south and west facing slopes are home to short leaf pines. Clear, cold spring-fed streams are commonly found throughout the Ozark Mountain Region. The majority of the land is used for recreation, logging, housing, and livestock farming, including poultry.

The Biodiversity

Due in part to the variety of habitats these ecoregions provide, Arkansas is inhabited by a diverse fauna of 215 fish species (Robison and Buchanan, 1988). Only five states have more native freshwater fish species than Arkansas. There are four species of fish in Arkansas that are federally-listed as threatened or endangered (T&E): the Ozark cavefish (*Amblopsis rosae*), the yellowcheek darter (*Etheostoma moorei*), the leopard darter (*Percina pantherina*), and the pallid sturgeon (*Scaphirynchus alba*). Others are being assessed for listing.

Of the 300 freshwater mussel species recognized in North America, Arkansas is home to 81 - more than any other state west of the Mississippi River. Only nine states have more mussel species than Arkansas, with the greatest mussel richness occurring in the southeastern United States. Freshwater mussels are ranked as the third most imperiled group of animals in Arkansas, according to the Arkansas Game and Fish Commission's State Wildlife Action Plan (Anderson, 2006). Of the 25 species of animals in Arkansas that are listed as T&E by the U.S. Fish and Wildlife Service, 9 (36%) are freshwater mussels: Ouachita rock pocketbook (*Arkansia wheeleri*), Curtis pearlymussel (*Epioblasma florentina curtisi*), turgid blossom (*Epioblasma turgidula*), pink mucket (*Lampsilis abrupta*), Arkansas fatmucket (*Lampsilis powelli*), speckled pocketbook (*Lampsilis streckeri*), scaleshell (*Leptodea leptodon*), fat pocketbook (*Potamilus capax*), and winged mapleleaf (*Quadrula fragosa*).

North America is the global center of crayfish diversity, with over 400 of the world's approximately 550 species. Arkansas is home to roughly 60 of these species, more than any other state west of the Mississippi River and 5th among all states. Crayfish are ranked as the most imperiled group of animals in Arkansas, according to AGFC's Arkansas Wildlife Action Plan. Only two of Arkansas' crayfish are listed as T&E by the U.S. Fish and Wildlife Service (Benton County cave crayfish, *Cambarus aculabrum*, and Hell Creek cave crayfish, *Cambarus zophonastes*), but experts consider crayfish to be vastly under-protected. Taylor et al. (2007) considered 48% of North America's crayfish species to be in need of protection, and Stein et al. (2000) found 51% to be imperiled.

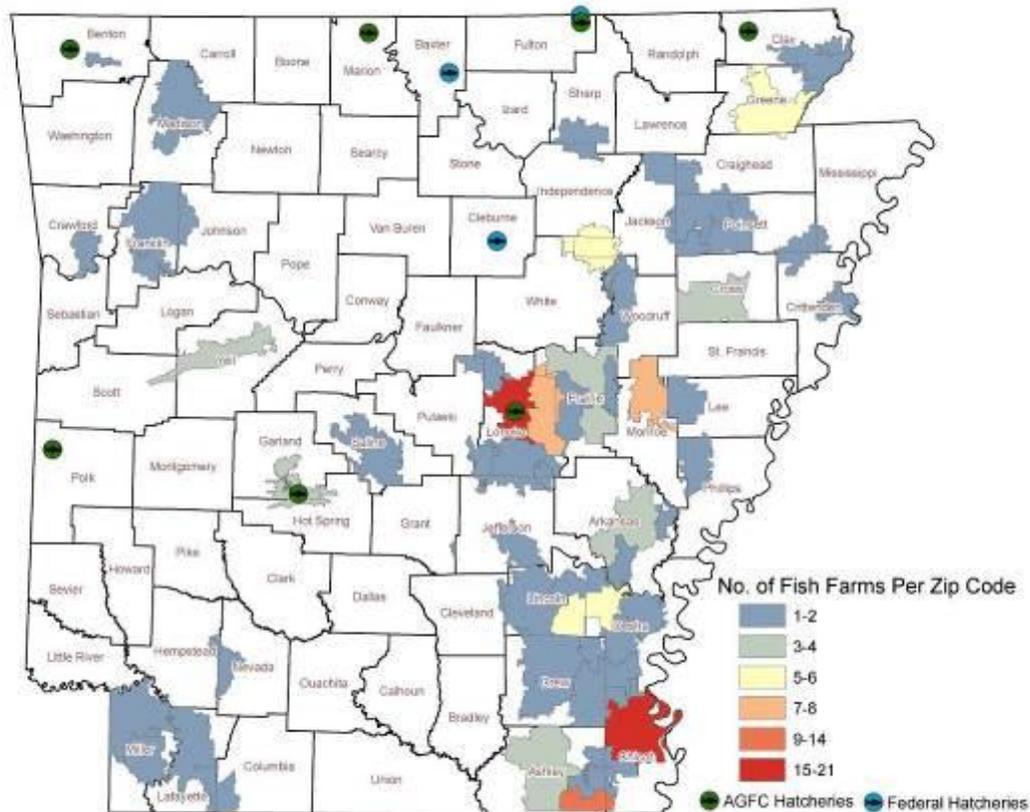
There are approximately 120 species of amphibians and reptiles in Arkansas, several of which are in the process of being identified as part of larger species complexes. Arkansas is facing imminent threats to its native amphibian fauna due to infectious disease (i.e., chytrid fungus) and commercial harvest. Only one of our native amphibian and reptile species is federally listed - the American Alligator, *Alligator mississippiensis*. This listing is only Threatened Due to Similarity of Appearance - a means to track and regulate control of crocodilian meat and hides from commercial enterprises.

The Human Element

The diversity of aquatic habitats in Arkansas allows for numerous recreational activities enjoyed year-round by people from across the country. High quality fisheries for bass, walleye, trout, and other sport fish species attract many anglers from within the state, around the country, and abroad. According to the 2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (USDOI-USFWS and USDC-USCB 2006), there were 655,000 fishing trips within the state, which was 11th in number among inland states and 21st among all states (including

Great Lakes states). Fishing revenue to the state for that year was valued at \$420,571,000. Arkansas has produced a number of world record fish (including current world records for brown trout, walleye, and hybrid striped bass). Thousands of competitive fishing tournaments (including the first \$1 million bass tournament) are held in the state every year.

Other wildlife-associated recreation, which is intrinsically connected to water resources, was valued at \$606,701,000 for 2006 (USDOI-USFWS and USDC-USCB 2006). In addition to fishing and wildlife-associated recreation, other water recreation, such as paddling, swimming, boating, skiing, SCUBA diving, jet skiing, and sailing are also popular and extremely important to the economy of the state. Following agriculture, tourism is Arkansas's second highest revenue producer and much of it is water-oriented.



Distribution of federal, state, and private aquaculture facilities in Arkansas.

In addition to its natural aquatic resources, Arkansas is the second-leading aquaculture producing state in the United States. Arkansas leads the nation in the production of baitfish, hybrid striped bass fingerlings, largemouth bass food-fish, and triploid grass carp for aquatic vegetation control. It is third in the U.S. in catfish production. There are 225 fish farm permits currently on record with AGFC. AGFC operates four warmwater and one coldwater hatchery that produce a wide variety of cold, cool, and warmwater fish for distribution to public waters around the state. AGFC also operates a number of satellite fish culture facilities such as nursery ponds and net pens as well. USFWS has two trout hatcheries and one warmwater hatchery in the state for the

purpose of producing fish for public waters in Arkansas and elsewhere. Annually, millions of fish are stocked within the state.

Several river systems have been modified to accommodate shipping, mostly by barge, of commodities. Internally, the Arkansas River (McClellan-Kerr Arkansas River Navigation System) is the major shipping artery in Arkansas. The uppermost port on the system is at Tulsa, Oklahoma. In 1997, 12,896,887 tons of commodities such as chemical fertilizer, farm products, sand/gravel and rock; iron and steel; and petroleum products were transported on the river. U. S. Army Corps of Engineers maintains a minimum nine-foot navigation channel in the Arkansas River. The U. S. Congress has approved deepening the channel to 12 feet. In 1986, according to the Arkansas River Historical Society Museum, an ocean-going German cargo vessel traveled to the Tulsa Port of Catoosa. Other rivers, such as the White, Ouachita and Red, also support some shipping. The Mississippi River, of course, is the main inland shipping waterway in the country.

The Arkansas River valley and the Mississippi River delta in the state contain vast and extensive farming operations. These operations utilize enormous quantities of surface and ground water.

The abundance of water resources in Arkansas, especially in the Ouachita and Ozark mountains has led to construction of dams whose primary purposes are hydropower and flood control. Reservoirs owned and operated by the USACE (Little Rock and Vicksburg Districts), power companies (Arkansas Electric Cooperative Corporation, Entergy Arkansas Inc.), and municipalities (Fort Smith and Little Rock) generated 543 thousand mega-watt/hours in 2008 (Energy Information Administration 2008). Other major users of Arkansas' surface waters are municipal water supplies, general industry, and cooling water for coal- and nuclear-fired electric generating plants.

Beyond the consumptive and recreational uses of Arkansas's water resources is the widespread appreciation for the scenic beauty of many of the state's waterbodies. Though difficult to quantify, the value of these magnificent and soul-pleasing streams, lakes, and bayous to the quality of life in Arkansas is immense.

The Threat of Aquatic Nuisance Species

Invading ANS threaten one or more of the uses described above. Water hyacinths obstruct boat traffic along the Arkansas River and other lakes and streams. Zebra mussels and northern snakehead have direct and indirect impacts on native fish populations; the long-term effects of these introductions are unknown. Hydrilla interferes with boat traffic and other water recreation. For several reasons, the southeastern region of the United States is at special risk from invasive aquatic species (excerpted from Louisiana Sea Grant webpage, www.laseagrant.org):

- The Southeast has the highest habitat diversity in the country, with 47% of the nation's wetlands, 78% of its coastal marshes, 70 major river basins (including the Mississippi and Tennessee-Tombigbee waterways), and 26,000 miles of shoreline.
- Its warm climate and abundant rainfall can support many of the world's plants and animals.
- The region is home to 62% of the freshwater species found in North America and 75% of the North American mussel species.

- The southeast region has an abundance of disturbed habitat, plus 34% of the country's T&E fish populations, and 90% of its T&E mussel populations.
- Five of the nation's 10 most sprawling metro areas contribute to habitat disturbance.
- Four of the U.S.'s top 10 international ports host ships from all over the world, opening U.S. waters in the region to non-native species.

Many plant and animal species have spread throughout the world and into areas where they previously did not occur. People have transported seed and breeding stock of important sources of food and fiber as areas have been colonized throughout the world. In the United States, 98% of our food supply is derived directly from introduced species that were not native to North America (Diamond 1999). Other species have spread through natural dispersion. In more recent history, the pace of introductions has accelerated with the development of modern, rapid transportation systems and dramatic increases in international trade. The rate of human-mediated changes to the environment has also accelerated as the world's population has increased and new technologies have been developed. It is estimated that there are nearly 50,000 non-native species in the United States (Pimentel et al. 2000).

Sometimes plant or animal species can become a nuisance through their impacts on other species, natural ecosystems, human activities, or human health. It is important to note that not all non-native species become a nuisance. For this plan, an ANS is defined as an organism that threatens the diversity or abundance of native species, the ecological stability of infested waters, or the commerce, agriculture, aquaculture, or recreation dependent on such waters. This definition includes native as well as non-native species. The criteria used to select focal species include: 1) the extent to which the species is invasive and becomes a nuisance; 2) economic damage; 3) ecological damage; and 4) harm to human health; and 5) feasibility of management or control.

The state is bounded and/or crossed by river systems that link Arkansas with other states. With these shared waters come potential and existing shared ANS issues. Arkansas has long worked jointly with Missouri on management issues, as we share many major Ozark river basins, including the White, Spring, Black, and Eleven Point rivers, along with ANS issues such as inter-basin introductions of crayfish in the Spring River basin and recent discovery of zebra mussels in one of the White River reservoirs. The Arkansas River provides a corridor for ANS transfer between Arkansas and Oklahoma, with downstream spread of white perch and upstream transport of zebra mussels. Asian carp issues continue to increase on the Mississippi River, which we share with Louisiana, Mississippi, Tennessee, and Missouri. These are just some examples of where ANS issues cross political boundaries, showing the importance of coordination between ANS program implementation efforts among neighboring states.

The Development of a Plan

In 2004 AGFC began discussions with the Aquaculture/Fisheries Center at the University of Arkansas at Pine Bluff (AFC-UAPB). AFC-UAPB could provide support and coordination of the process of developing a state ANS Management Plan. In November 2006 a contract was entered into and a graduate student recruited by AFC-UAPB to coordinate the effort. On February 14, 2007 a core group of representatives from AGFC, AFC-UAPB, and SARP met to outline the process of developing the plan. The core group met again in early April and

frequently throughout the plan development process and began creation of the Arkansas ANS Task Force.

The core group identified an initial group of stakeholders and invited them to the Arkansas Task Force's first meeting, which was held in Little Rock at the Cooperative Extension Service facility on April 17, 2007. This and all subsequent Task Force meetings were open to public and preceded by a statewide press release – an example of one of the weekly Arkansas Outdoors press releases that included an Arkansas Task Force meeting is provided in Appendix F. Additional Task Force meetings were held on June 19, 2007; July 3, 2007; Aug 28, 2007; October 31, 2007; and Sep 22, 2008.

The Arkansas ANS Task Force was charged with drafting and implementing an Arkansas ANS Management Plan. The Task Force formed a partnership of state, federal, and private entities to develop a plan to prevent new introductions, control the spread of existing organisms, reduce or mitigate impacts, and meet the requirements of the National Aquatic Nuisance Species Task Force. The plan is intended to be a living document that will continue to evolve over time to focus on the highest priority issues.

AGFC provided a Chair for the Task Force and administrative oversight to the process. The Aquaculture/Fisheries Center at the University of Arkansas at Pine Bluff was contracted to coordinate Task Force activities and provide administrative structure to the writing, technical background, and editing of the plan. The Southeast Aquatic Resources Partnership (SARP) provided assistance in the form of their ANS Coordinator, Marilyn Barrett-O'Leary. Marilyn guided the Task Force through the creation of this management plan and offered valuable input throughout the year-long process. She was an invaluable asset to have on our Task Force and we thank her for her all her help.

The Task Force included representatives of 30 federal, state, and private agencies, organizations, and trade associations that have a vested interest in the management of aquatic resources in Arkansas. Representatives from some of the lead agencies involved in the management and protection of Arkansas' natural resources include the Arkansas Department of Environmental Quality (ADEQ), Arkansas Game and Fish Commission (AGFC), Arkansas State Plant Board (ASPB), US Army Corps of Engineers (USACE), US Fish and Wildlife Service (USFWS), and USDA Forest Service (USFS). Other representatives on the Task Force includes leaders of the aquaculture industry (Catfish Farmers of Arkansas (CFA), Arkansas Bait and Ornamental Fish Growers Association (ABOFGA), Arkansas Farm Bureau- Aquaculture Division), private associations (Arkansas Audubon Society, Arkansas Wildlife Federation, Norfolk Lake Chamber of Commerce, Lake Ouachita Citizen's Focus Committee), state agencies (Arkansas Department of Parks and Tourism, Arkansas Division of Health, Arkansas Green Industry, Arkansas Natural Resources Commission, Arkansas Natural Heritage Commission, Arkansas State Highway and Transportation Department), federal agencies (APHIS Wildlife Services, National Park Service) and universities (University of Arkansas at Pine Bluff- Aquaculture/Fisheries Center, University of Arkansas at Fayetteville).

Task Force members were expected to share experience and knowledge, participate in identifying goals and strategies, provide background information, and support implementation of the Plan. One emphasis of the process used was to document available facts to the extent possible. While much information on non-native and invasive species is available from public

sources, the quality of the information and its scientific validity are variable. Without the expertise and scientific reviews by our knowledgeable Task Force members, this management plan would not have been possible.

During plan development over 20 existing state ANS plans were reviewed as examples. Particular attention was paid to the plans developed by neighboring states, as coordination between adjoining states would be essential in plan execution. Of particular use were the plans of Louisiana and Mississippi, as Arkansas shares many issues with these states in areas of high ANS risk.

The draft plan was then revised based on input from members of the national ANS Task Force, presented for approval by the Arkansas Game and Fish Commission, made available for public comment, circulated among Arkansas Task Force members for a final review, and submitted to the Governor of Arkansas for adoption.

ADDITIONAL BACKGROUND INFORMATION

Private Aquaculture in Arkansas

Arkansas is the birthplace of warmwater aquaculture in the United States. Commercial goldfish and bait minnow production began in the 1940s and was followed by production of buffalo fish. Edgar Farmer of Dumas, Arkansas, harvested the first commercial crop of catfish in 1958. However, hatchery production of fish for stocking public waters dates back even earlier in Arkansas. Arkansas has one of the largest hatchery stocking programs in the United States.

Management and Control of Aquaculture Species in Arkansas

AGFC has regulatory authority over the fishery resources in Arkansas. Private aquaculturists are required to have a fish farming permit, regardless of the species raised. The permitting process includes a site inspection, and the permit must be renewed annually. The failure to differentiate between domestic and wild stocks has generated confusion and controversy around a few species. The wild counterparts of three species (bighead carp, black carp, and yellow perch) are identified as Species of Concern in this plan.

Holders of a fish farming permit may culture species on the Approved Aquaculture Species List, a list of 86 species of minimal risk to the aquatic environment if they were to escape anywhere in the state. Examples of species on the approved list include channel catfish, largemouth bass, golden shiners, and goldfish. These species may be freely imported into the state for aquaculture purposes. Current AGFC regulations prohibit the release of any species into the public waters of the state even if it is a species on the Approved Species List.

Culture of a species on the Restricted Species List requires a Restricted Species Possession Permit in addition to the fish farming permit. The Restricted Species Possession Permit is designed to provide an additional level of escape prevention and tracking of culture of these species. It requires the applicant to detail the location of the facility, measures taken to eliminate the possibility of escape, and the numbers and species to be held. Applicants are required to construct a barrier that prevents escape of juvenile and adult fishes from culture ponds, and pond drainpipes are double screened prior to any pond drainage with at least one screen being of a

mesh size small enough to prevent the passage of any permitted fish present in the pond. Restricted Species permits are renewed annually by the applicant.

Approvals to culture fish not on either list are evaluated on a case-by-case basis. The burden of proof to show adequate prevention of escape lies with the applicant. Upon receipt of an application to culture an unlisted species, AGFC biologists review the life history of the species to assess the risk of establishment as well as the culture plans to assess any possibility of escape. If the risks are acceptably low, an Unlisted Species Possession Permit is issued.

History of Asian Carp in Commerce

Asian Carp includes Silver Carp, Bighead Carp, and Black Carp. They are noteworthy because of the level of attention they have received nationally, Arkansas role in their introduction, and their importance in the state's aquaculture industry. Thus it is useful to provide this background information.

It has been reported that Asian carps first escaped to the wild from commercial fish farms in Arkansas. However, significant evidence exists contradicting these reports, and recent research has traced the network of federal agencies, states, universities, and private farms involved in the introduction of these species into the wild (Kelly et al. 2011; Mitchell and Kelly 2006). It is important to note that, while AGFC currently regulates culture of these species in Arkansas, decades ago there was little control in any state.

These species were introduced in Arkansas largely during the 1960s and 1970s, prior to development of current regulations. At this time concerns emerged over the effects of chemicals on the environment and Asian carps were viewed as an environmentally friendly biological control alternative. USEPA released several publications in the 1970s and 1980s related to the use of aquaculture for wastewater treatment (USEPA 1976, 1980a, b, 1982, 1983).

The U.S. Fish and Wildlife Service played a major role in the introductions, propagation, and distribution of Asian carps. State agencies such as the AGFC, the Illinois Natural History Survey, Arizona Game and Fish Department, and others were involved in the early years. Auburn University was actively involved in the early years, as were Memphis State University, the University of Florida, Louisiana State University, Mississippi State University, and the University of Arkansas at Pine Bluff.

Asian carps were introduced because of their unique feeding characteristics (filter-feeding efficiencies of silver and bighead carp, vegetation feeding efficiency of grass carp, and mollusk feeding efficiency of black carp). The first accidental release of grass carp was in 1966 by the U.S. Fish and Wildlife Service in Stuttgart, Arkansas. Other early reports of grass carp in the wild were from waters in Alabama, Georgia, and Florida. Silver carp, bighead carp, and black carp were first imported purposely by a commercial fish producer in Arkansas in 1973. All fish were transferred to the AGFC by March 1974, who first successfully spawned silver and bighead carp later that year. The first reports of silver carp in the wild were in Arizona in 1972 and in Arkansas in 1975, two years before bighead carp and silver carp were returned to private hatcheries for commercial production.

Silver carp were stocked in catfish ponds in the 1970s to control phytoplankton and improve water quality. While there is little detailed information on the number of ponds or farms stocked, this practice was short-lived because the jumping behavior of silver carp disrupted seining and harvesting operations.

Bighead carp, on the other hand, evolved into an industry. Fish farmers followed the advice of the USFWS and began to raise and sell bighead carp (Dupree and Huner 1984b). Live bighead carp were sold from farms via live haulers, wholesalers, distributors, and retail grocery stores to primarily Asian consumers (Stone et al. 2000). Before interstate transport of live bighead carp was prohibited under the Lacey Act, sales of this fish species were an important revenue source when catfish prices were low (Stone et al. 2000).

Grass carp are an important biological control agent used to manage aquatic vegetation in public and private water bodies, as well as in aquaculture facilities. Grass carp are stocked in 42% of catfish growout ponds (USDA 2003) for aquatic vegetation control. During harvest, grass carp are removed by hand from the live cars (net cages used to concentrate fish caught in the seining process).

Increasing populations of the American white pelican (*Pelecanus erythrorhynchos*) have introduced an exotic parasite, the catfish trematode (*Bolbophorus spp.*) to several major catfish-producing states. The trematode has caused economic losses in the catfish industry of approximately \$45 million annually (Venable et al. 2000; Terhune et al. 2003; Hanson and Wise 2005). The range and severity of infestations of the catfish trematode are growing. Snails are intermediate hosts for both the yellow grub (*Clinostomum complanatum*) and the catfish trematode. Ponds stocked with triploid black carp either eliminated the catfish trematode problem completely or had a decrease in the severity of infection (Dorman and Goodwin 2008). To date, the use of triploid black carp is the only effective means of controlling the catfish trematode (Wui and Engle 2007).

Native or Long-Established Non-Native Aquatic Nuisance Species

In some instances, and by various pathways, native or long-established non-native species (such as common carp, *Cyprinus carpio*) have become established as ANS outside the drainages where they naturally occur. Two examples are the expansion of gapped ringed crayfish (*Orconectes neglectus chaenodactylus*) and the yellow bass (*Morone mississippiensis*).

The introduction of the gapped ringed crayfish from the central White River drainage into the Spring River drainage was likely the result of live bait or pet release. It is replacing two native species, Hubbs' crayfish (*Cambarus hubbsi*) and coldwater crayfish (*O. eupunctus*).

Yellow bass were possibly transferred by mistake during state fish stocking efforts and have become established in several waters where they were historically absent. They are considered ANS because they compete with more desirable species. There are reports of intentional redistributions of yellow bass by anglers to new waters because they consider them desirable table fare.

Examples of other species that can have adverse impacts on natural fish assemblages or desirable sport fisheries include various species of bullheads (*Ameiurus spp.*), which are often misidentified

as channel catfish and redistributed to “improve” fishing opportunities in other waters where they may not have been present. A long-established non-native, the common carp, is occasionally used for bait and has been introduced into new waters through bait release.

Beaver (*Castor canadensis*), double-crested cormorant (*Phalacrocorax auritus*), and American white pelican (*Pelecanus erythrorhynchos*) are further examples of native species that have become ANS due to their effect on the environment or negative economic impacts to the aquaculture industry. Double-crested cormorants and American white pelicans are a major problem for fish farmers who must protect their fish and their livelihood from the foraging effects of these birds. Beavers can damage personal property as well as destroy river levees.

These species are included in this plan and should be addressed as ANS. They are highlighted in this background information because some readers may either think they are native or that they are beyond the scope of any management. However, they do not meet the definition of an aquatic nuisance species according to the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA as amended by NISA, 1996) and USFWS State Plan funding via NANPCA will not be used to fund activities related to these species.

These types of undesirable inter-basin transfers can be reduced through educational programs, regulation of live bait collection and use, and the use of HACCP procedures designed to prevent the transfer of non-target species through fish stockings.

PATHWAYS

The term “pathways” is defined as “the means by which species are transported from one location to another” (Kriesch 2007). Understanding how ANS are introduced and spread will provide guidance on developing control strategies. Prevention of introduction frequently is more effective and less costly than eradication or management following introduction. Many introductions of non-native species occurred legally and intentionally in the past. A number of ANS were introduced specifically to enhance sportfishing, to be trapped for fur, or for environmental enhancement. Over time, attitudes and views towards these introductions have changed and some are now considered ANS.

The following summarizes and describes the most important ANS introduction pathways that have been identified for Arkansas today: unintentional introductions, deliberate unlawful introductions, and introductions through natural dispersal.

ANS Transported Unintentionally

Most introductions of ANS have occurred by individuals unaware that their actions have constituted a “pathway of introduction.” This is likely the most frequent type of introduction. There is a strong need for educational programs to address these types of introductions.

Barges/shipping (including Flat bottom boats and construction platforms)

Inland waterways provide a cost effective means for transporting goods throughout the United States. The cost per ton mile (a ton of cargo moved one mile) for a barge is only \$0.97 compared to \$2.35 for rail and \$5.35 for trucking (Arkansas Waterways Commission 2002). Arkansas has more than 1,000 miles of navigable rivers and all 75 counties in the state are within 65 miles of a navigable waterway. These waterways provide direct access to major trade routes in the U.S. and internationally. In Arkansas alone, more than 15 million tons of cargo valued at more than \$2.7 billion are transported annually along the state's navigable rivers. The total economic impact of waterborne transportation in Arkansas is \$811 million annually (Nachtmann 2002).

There are four active commercially navigable waterways in Arkansas: the McClellan-Kerr Navigation System (Arkansas River), the Mississippi River, the Ouachita River, and the White River (Arkansas Waterways Commission 2002). Arkansas is one of 29 states with direct access to the inland waterway system and is ranked 12th in this resource (Arkansas Waterways Commission 2005). The McClellan-Kerr Navigation System runs through the state and allows for transport from the Tulsa Port of Catoosa in Oklahoma to the mouth of the Mississippi River. Public ports are located at Pine Bluff, Little Rock, and Fort Smith. Roughly 12 million tons of cargo was moved on the McClellan-Kerr Navigation System in 2005 (USACE 2005). The Mississippi River forms the eastern border of the state with public ports along the Arkansas portion located in Osceola, West Memphis, Helena, and Yellow Bend (Arkansas Waterways Commission 2002). Approximately 200 million tons of commodities pass by the state on this waterway each year (Arkansas Waterways Commission 2002). The Ouachita River extends 117 miles into Arkansas and also provides navigation in Louisiana. Public ports are located in Camden and Crossett. The White River is open to navigation on a seasonal basis from its mouth on the Mississippi to Newport, a distance of 225 miles (Arkansas Waterways Commission 2002). In addition to public ports there are numerous private terminals located on all of the above mentioned rivers (Arkansas Waterways Commission 2005).

According to the NANPCA the “discharge of untreated water in the ballast tanks of vessels and through other means results in unintentional introductions of nonindigenous species to fresh, brackish, and saltwater environments”. “Other means” includes commercial barge traffic. The zebra mussel (*Dreissena polymorpha*) was most likely introduced into the Great Lakes region by the release of larvae with ship ballast water into Lake St. Clair, Michigan in 1986 (Herbert and et al. 1989). Zebra mussels can now be found throughout the Mississippi River drainage and in states such as South Dakota, Nebraska, Connecticut, New York, Nevada, and West Virginia (Benson and Raikow 2007). ANS also attach to the hulls of boats, anchors and motors and are transferred from water body to water body in this manner.

The Arkansas Waterways Commission and the USACE provide the best mechanisms to distribute information on ANS to the shipping industry.

Boats (including watercraft, trailers, seaplanes, commercial fishing, recreational houseboats, boats of enforcement officers, state and federal biologists, and university researchers)

Arkansas had 205,745 registered boats in 2004 (USCG 2005). With over 7% of Arkansans having a registered boat, Arkansas ranks 9th in the nation in per-capita boat ownership. Boats moved from one body of water to another can transfer ANS if they are not cleaned and disinfected adequately. Any watercraft, seaplane, or trailer can be a pathway for introducing

ANS if not properly cleaned between water bodies. In Arkansas, boats are used for commercial fishing, recreation, enforcement of fishing regulations, fisheries management, and research.

ANS can be caught in propellers, attach to the bottoms of boats, or enter live wells. Proper washing and disinfection of each of these areas is essential to avoid spread of ANS. This is true of boats used within Arkansas and those that come brought in after use in other states.

Houseboats are a special case within the watercraft and trailer pathway, because when not in use they are often left docked in their home water body as opposed to being stored on a trailer or over-wintered in dry storage. With the long soak times of houseboats, fouling by attachment (zebra mussels) or by drifting aquatic weeds is more likely to occur. Houseboats are more prone to collect water without draining bilges; thus nuisance species may not be eradicated by drying. Moving of houseboats can be an ANS pathway either by transferring the boat from contaminated to non-contaminated water bodies or by washing ANS into non-contaminated water bodies directly or via storm sewers when cleaning. Houseboats are of particular concern in Arkansas due to their prevalence in large reservoirs within the state. Marinas and houseboat movers should be made aware of the increased potential for ANS contamination posed by movement of houseboats, and take appropriate actions to ensure arriving or departing houseboats are ANS-free prior to launching.

ANS species may be transferred from one location to another on the floats of seaplanes. The U.S. Coast Guard has recognized this pathway and, based on recommendations prepared by the National ANS Task Force, has issued voluntary guidelines to help control the spread of zebra mussels and other aquatic nuisance species. These guidelines can be found on the Internet at www.seaplanes.org (accessed October 2007). Currently there are no seaplane bases in Arkansas, and it may not appear to be an important pathway here, but it is important to recognize the pathway and that there are guidelines available to minimize the spread of ANS, if need arises.

Collectors

Aquatic species are popular as pets. Individuals of all ages enjoy collecting aquatic plants and animals for home aquaria, water gardens, or just to watch them for some period of time. An individual who collects aquatic plants and animals in different bodies of water may transfer ANS from one to the next if collecting gear is not adequately washed and disinfected, or if organisms are released in water bodies where they did not originate. Such release is a violation of AGFC regulations, but often people are unaware of the fact.

Dive operations (commercial, recreational, scientific gear)

Recreational divers come to Arkansas to enjoy the clear water of some reservoirs or for the opportunity to spearfish game fish, an activity that is banned in northern states such as Wisconsin and Illinois (Patten Traver, personal communication, 4/18/08). Spearfishing is especially popular during the summer months of June through September. Scuba diving and certification programs are available throughout the state. One dive shop located in Mountain Home, Arkansas, certifies 75-125 students of all levels over the course of a year (Patten Traver, dive instructor, personal communication, 4/18/08). There are also commercial dive operations in Arkansas, and biologists use diving for a variety of research projects. Dive gear includes boats,

wet suits, flippers, and scuba gear. This gear, if not properly washed and disinfected between uses in different water bodies has the potential of introducing ANS to new water bodies.

Escaped Captivity

Animals and plants that escape captivity and become established in the wild have potential to become nuisance species. Examples in Arkansas include silver and bighead carps, hydrilla, and Eurasian watermilfoil. Silver carp escapes from municipal sewage treatment plants have been documented, and that silver and bighead carp may have escaped from government hatcheries or commercial fish farms. Some of these escapes date back to an era when there was little awareness of the effects of introductions. Hatchery management has improved over the years and screening drains is now a standard operating procedure. Some escapes have been attributed to flooding.

Most fish farms today practice the 6/3 rule in which water levels are allowed to drop 6 inches below the desired freeboard level and then filled 3". This allows storage capacity to reduce pumping costs by maximizing rainfall and also minimizes the risk of overflow and fish escape. Pond construction recommendations include screens on drainpipes to further minimize the potential for fish escape.

Fishing gear (commercial, recreational, and scientific nets, seines, waders)

Arkansas has commercial fisheries for a variety of species. Commercial fishing gear includes gill nets, trammel nets, and hoop nets as well as boats. Recreational anglers use waders, hook and line, boats, live wells in boats, buckets, and stringers. Scientists also use waders, and a variety of nets, boats, and scientific equipment. If not adequately washed and disinfected, ANS can be transmitted by these types of gear.

Man-made water conveyance systems

ANS can be transported through water supply and control structures, including irrigation systems and water supply pipelines.

Arkansas had 4.1 million acres of irrigated cropland in 2002, which accounts for 12% of all farms in the state (USDA 2004). Overall, 29% of the cropland in the state is irrigated. In 2005, 84% of the irrigated water used came from groundwater supplies and only 16% from surface waters (Holland 2007). However, with declining water tables in several areas, there is increased water development based on surface water. This development includes the Grand Prairie and Bayou Meto projects, which are based on developing canals to divert water from the Arkansas River for irrigation. These projects have the potential to introduce ANS from the River.

Water supply pipelines that convey untreated surface water can transport ANS. In Arkansas, surface water accounted for approximately 34% of all water withdrawn in 2005 (Holland 2007). Major surface water sources include the Arkansas, Saline, and Ouachita rivers and Beaver, Bull Shoals, Maumelle, and Winona reservoirs. Both Maumelle and Winona provide municipal water supplies for Little Rock and North Little Rock, while Beaver Lake provides for five northwestern Arkansas counties.

Seafood Products

Seafood products sold in Arkansas come from a variety of sources. Some, like catfish, are raised in-state, processed either in Arkansas or a nearby state, and then sold in Arkansas or other states. Other seafood products, like crayfish, are raised outside of Arkansas but sold in Arkansas. Still others are caught from the wild and shipped to Arkansas. However, the majority of seafood sold is imported from other countries. Salmon, shrimp, tilapia, *Pangasius* (tra/basa) from Vietnam, and catfish from China are farm-raised, while grouper, orange roughy, cod, pollock, and tuna are caught from the wild.

Seafood products are sold as both fresh and frozen products and in a variety of forms. The USDA has regulatory authority over the safety of seafood in the U.S., both domestically-produced and wild-caught, and the USDC carries out inspections of seafood processing plants. These inspection and testing programs, however, are focused only on human health hazards. There is no testing for diseases that may be considered ANS.

Many viruses can survive freezing. Taura syndrome virus (TSV), for example, was introduced into Texas in a shipment of imported frozen shrimp received by a fish market. In the case of TSV, when the package was thawed, water draining from the package was discharged. TSV infected private shrimp farms in Texas and likely affected both marine and freshwater crustaceans. TSV would likely survive in the wild in freshwater environments in Arkansas. Fresh and frozen seafood, harvested from areas with TSV could spread this virus to Arkansas. Whitespot Syndrome Virus (WSSV, a focal species in this plan) can also survive freezing and potentially be transferred through fresh or frozen seafood and introduced into other areas. WSSV has been found in crayfish in Louisiana, both on farms and in the wild. WSSV could be introduced into Arkansas with either fresh or frozen crayfish. If introduced, WSSV would likely cause mortality on crayfish, freshwater prawn and marine shrimp farms as well as in wild crustacean populations.

No introductions have been documented in Arkansas from this pathway. However, TSV and WSSV are concerns. Imported seafood could also be the source of introduction of other viruses. The volume of seafood brought into Arkansas provides a significant opportunity for such introductions.

Fish management (state stocking, wild forage, out of state stocking)

The AGFC stocks many fish species throughout the state, which have included northern largemouth bass (*Micropterus salmoides*), Florida bass (*M. floridanus*), smallmouth bass (*M. dolomieu*), spotted bass (*M. punctulatus*), striped bass (*Morone saxatilis*), hybrid striped bass (*M. saxatilis x chrysops*), white crappie (*Pomoxis annularis*), black crappie (*P. nigromaculatus*), channel catfish (*Ictalurus punctatus*), blue catfish (*I. furcatus*), flathead catfish (*Pylodictis olivaris*), rainbow trout (*Oncorhynchus mykiss*), brown trout (*S. trutta*), cutthroat trout (*O. clarkii*), brook trout (*Salvelinus fontinalis*), bluegill (*Lepomis macrochirus*), redear sunfish (*L. microlophus*), warmouth (*L. gulosus*), green sunfish (*L. cyanellus*), walleye (*Stizostedion vitreum*), sauger (*S. canadense*), saugeye (*S. vitreum x canadense*), tiger muskie (*Esox masquinongy x lucius*), alligator gar (*Atractosteus spatula*), paddlefish (*Polyodon spathula*), grass carp (*Ctenopharyngodon idella*), threadfin shad (*Dorosoma petenense*), fathead minnow (*Pimephales promelas*), and Nile tilapia (*Oreochromis niloticus*). However, while the stocking

efforts have provided additional opportunities to anglers, accidental introductions have occurred. These accidental and unintentional stockings have resulted in the introduction of undesirable species that are native to Arkansas into waters that they formerly did not inhabit. Such species include gizzard shad (*Dorosoma cepedianum*) and yellow bass (*M. mississippiensis*).

Water-hauling vehicles (firefighting, fish hauling)

Although this may seem to be an unusual pathway, there is growing concern over ANS transfer via equipment used during firefighting in forested areas. Aircraft used in firefighting can dip large amounts of water to aid forest firefighting and possibly transfer ANS to new locations. There is particular concern with spreading species such as the New Zealand mudsnail with firefighting equipment transported across streams and rivers (New Zealand Mudsnail Management and Control Plan Working Group 2007). Montana currently has ANS protocols in place specifically to minimize the transfer of ANS via firefighting pathways.

Live fish, including bait, are hauled in oxygenated water to maintain proper water quality conditions for the fish being transported - conditions also suitable for water-borne diseases, fish, plants, and other organisms inadvertently loaded onto the truck with intended fish. There are no good data on the volume of live fish brought from out of state. AGFC and USFWS bring in trout eggs to hatch, some hatcheries have brought in fish from the wild for use as forage fish, catfish farmers may purchase fingerlings from out of state, and prawn and marine shrimp growers may import post-larvae to stock their ponds. Of particular concern to Arkansas is prevention of introduction of Viral Hemorrhagic Septicemia (VHS) from the Great Lakes states. AGFC requires that live fish brought into Arkansas from VHS-positive states must obtain a valid AGFC Fish Farm Health Inspection Permit prior to arrival. The greatest risk via this pathway is the disease organisms listed as focal species in Arkansas. These include WSSV, VHS, Spring Viremia of Carp Virus (SVCV), Koi Herpes Virus (KHV), Infectious Hematopoietic Necrosis (IHN), Infectious Pancreatic Necrosis (IPN), *Heterosporus* sp., and whirling disease.

The Arkansas Cooperative Extension Program, through the University of Arkansas at Pine Bluff's (UAPB) Aquaculture/Fisheries Center, has had a biosecurity education initiative underway for several years. In response to this initiative, ABOFGA led an effort to develop a HACCP Program and requested legislative approval for the Certification of Commercial Bait and Ornamental Fish in Arkansas (See Appendix C). This certification program was launched in 2007, following approval of the program guidelines by the ASPB (See Appendix B). Certified growers pay an annual fee and farms are inspected annually by ASPB. The inspectors are trained to detect both disease organisms and ANS species and failing an inspection results in the loss of certification. The UAPB biosecurity initiative has also resulted in development of "The Seinitizer," a seine reel that disinfects seines as they are reeled back onto the reel from the pond, disinfection recommendations for other nets and equipment used in ponds, and recommendations for fish health checks on all fish brought onto a farm. This education program could be expanded into a larger, state-wide program.

Deliberate, Unlawful Introductions

Some introductions of ANS have occurred deliberately. In Arkansas, it is unlawful to release any live plants or animals into the wild without permission from AGFC. Nevertheless, deliberate unlawful introductions have occurred.

Aquarium, pet, or water garden sympathy release

Releases of ANS into the wild have been reported by individuals who originally purchased the animals or plants as pets, for an aquarium, or for a water garden. Individuals who purchase these animals and plants appreciate and enjoy viewing them. When no longer able to keep them, for whatever reason, some individuals find it difficult to euthanize them and prefer to release them into the wild. They are understandable concerned with the welfare of the individual organism, but may not recognize the potential ecosystem-level effects. The state of Florida has reported the introduction and establishment of various organisms suspected of being released by pet owners.

There have been few reports of introductions of ANS in Arkansas from aquaria or pet owners. The risk of establishment of a species via this pathway in Arkansas is much lower than in a state like Florida because tropical species will not survive Arkansas winters. There is a national Habitattitude program to educate individuals on the potential risks of releases into the wild, which could be highlighted and encouraged in education efforts. Recommendations related to this pathway must consider animal welfare guidelines to minimize pain and discomfort to the organisms. USDA-CSREES and the American Fisheries Society have guidelines for proper and humane handling and treatment of fish, as well as appropriate methods for euthanasia.

Wild-caught bait and bait dumping

In 2006 freshwater anglers in the U.S. spent \$844 million on bait and 62% of anglers purchased bait (USDOI-USFWS and USDC-USCB 2006). Common live baits include various species of fish, earthworms, leeches, crickets, grasshoppers, aquatic (e.g., hellgrammites and dragonfly larvae) and terrestrial (e.g., wax worms, meal worms, maggots, web worms, and *Catalpa* worms) insect larvae, crayfish, freshwater shrimp, tadpoles, frogs, and salamanders. Additionally, clam or mussel meat, cut fish and their eggs, fresh and frozen shrimp and crayfish are also used as bait. Bait can be purchased from local vendors or increasingly via internet sales. This can result in introduction of ANS either in the form of the bait species itself, or as an unrecognized contaminant carried by the bait or its water, such as fish, amphibian, or crustacean viruses that are of concern.

In Arkansas, use of live organisms as fish bait is regulated by the AGFC. The AGFC Code Book dated 9-15-2011 states:

BAITFISH – Minnows, logperch, gizzard and threadfin shad, gar (other than alligator gar), bullhead catfish, crayfish, drum, bowfin under 6 inches, skipjack herring, brook and inland silversides, bigmouth, smallmouth and black buffalo, river carpsucker, banded and Ozark sculpin, bream 4 inches and under, and bream over 4 inches that are caught by hook and line.

MINNOWS – Small nongame fish commonly used for bait including bluntnose minnows, bullhead minnows, chubs, dace, fatheads, common carp under 6 inches, goldfish, shiners and stonerollers.

26.18	SALE, POSSESSION OR USE OF LIVE BAIT RESTRICTED
08-06	It is unlawful to sell as bait, possess while fishing, or use as bait live aquatic animals other than insects, freshwater shrimp, worms and baitfish as defined in Code 01.00C Baitfish.

Baitfish are wild-caught, extensively cultured, or farm-raised (Stone 2000) and in some states, wild-caught bait dominates the market. Wild-caught baits have been associated with the transfer of ANS in other states. Wild-caught baitfishes are often a mix of fish species (Meronek 1994) and can have significant ecological effects (Litvak and Mandrak 1999, Goodchild 1999). These baitfishes could also transfer nuisance aquatic plants, fish, zooplankton, and diseases (especially VHS and SVC). The odds of introducing nonindigenous species by bait bucket transfer are almost 100% (Ludwig and Leitch 1996). In contrast, farm-raised baitfishes provide a reliable source of a few known species of fish that are already widely distributed. In Arkansas bait shops, wild baitfishes are rare. The vast majority of shops sell primarily farm-raised baitfish - usually golden shiners, fathead minnows, and goldfish. At the request of Arkansas fish farmers ASPB administers a voluntary fee-based certification program to ensure that bait and ornamental fish farms "...provide high quality, farm-raised bait and ornamental fish, free of certain diseases, undesirable plants, undesirable animals, and other contaminants deemed injurious to fish or fisheries." It is estimated that over 95% of all Arkansas bait and ornamental fish production acreage is participating in the fish health inspections required by this certification program.

The Arkansas 2007 Fishing Guidebook lists the rusty crayfish, *Orconectes rusticus*, as having been introduced elsewhere through bait use and the rudd, *Scardinius erythrophthalmus*, as a species possibly in some Arkansas waters, "probably due to bait releases." The rudd was brought into the U.S. from Europe several times and populations apparently persist in several states (Fuller et al. 1999) and was re-introduced in 1980 by an Arkansas fish producer and sold as bait (Tave et al. 1993). There was a confirmed report (AGFC biologist) of a rudd found in Horseshoe Lake in Arkansas in 1991, but a later rotenone sample did not find any additional specimens. Occurrences are also reported from the Spring River and White River drainages but they do not seem to have established populations (Nico et al. 2009). When it was established that the rudd could hybridize with golden shiners (Burkhead and Williams 1991; Tave et al. 1993), the AGFC banned rudd as a bait species. It is also listed as a prohibited species under the Arkansas baitfish certification program.

The release of unused bait into any waterbody other than where they were caught is prohibited by AGFC regulations, yet it is done by some anglers after fishing, as an easy way to dispose of extra bait and perhaps with the idea that the dumped bait will serve as forage. Several states have educational programs targeting anglers, to encourage them not to dump live bait into the water. Currently in Arkansas, it is also illegal for anglers to use any wild-caught baitfish on Norfolk Lake unless said bait was caught on Norfolk Lake (AGFC 37.08-07). Baitfish purchased from an Arkansas licensed dealer on Norfolk Lake may also be used.

Egocentric stocking

There are individuals who take it upon themselves to stock fish or other organisms in a water body for their own use. An example in Arkansas may be the stocking of yellow perch in reservoirs in north Arkansas. Anglers from northern states who prefer to fish for yellow perch are thought to be responsible.

Introduction through Natural Spread

Natural carriers

ANS may gain access to new locations through natural movement or via natural carriers including birds, mammals, reptiles, amphibians, and mollusks. Purple loosestrife (*Lythrum salicaria*), for example, can easily be spread by seed when wetland animals travel from one river or lake to another, effectively introducing the plant to previously uninfected waters. Seeds and plant pieces may also attach to migrating waterfowl. Zebra mussels and aquatic snails have been found attached to numerous different aquatic animals including crayfish and turtles.

Movement (from adjoining states and within state)

Wind and water currents can spread ANS. Giant salvinia (*Salvinia molesta*) produces stems and leaves that are extremely buoyant, allowing it to be carried by water currents to uninfested areas where it can grow and propagate vegetatively (Oliver 1993). When many aquatic plants (e.g., hydrilla (*Hydrilla verticillata*), alligator weed (*Alternanthera philoxeroides*), Eurasian watermilfoil (*Myriophyllum spicatum*), and water hyacinth (*Eichhornia crassipes*)) are fragmented (either by boat motors, animals, mechanical removal, or wave currents) the fragments are able to survive and produce new plants. Wind and wave currents carry the fragments to new locations. In Millwood Lake, Arkansas, hydrilla is being spread by wind and wave action from the southeast corner of the lake (where it was introduced) to the northwest corner (J. Cantrell personal communication). Purple loosestrife plants have been spread along highways by wind dispersal of seeds.

GOAL

The goal of this plan is to prevent the introduction, establishment, and spread of ANS and to eradicate, where feasible, existing ANS in order to minimize economic and environmental harm in Arkansas.

This plan seeks to provide a framework to create an operating taskforce and a means to develop more specific action plans for species, pathways, and issues. The timeframes for executing the strategies herein and for development of specific issue action plans will depend on the availability, timing, and magnitude of funding.

OBJECTIVES AND PROPOSED STRATEGIES

OBJECTIVE 1 – Coordination:

To develop and implement a means of coordinating education, monitoring, detection, and management activities related to ANS within Arkansas and with other states.

Strategies:

1. Create and identify funding for a dedicated, full-time ANS Coordinator position for the state, staffed within AGFC. The ANS Coordinator will:
 - a. Act as the main point of contact for agencies involved in ANS management/control/monitoring and for the general public.
 - b. Provide reports to the Task Force and interface with all committees of the Task Force.
 - c. Collect, review, and make recommendations to decision makers on proposals to import potential aquatic nuisance species into Arkansas.
 - d. Represent Arkansas on national and regional ANS groups.
 - e. Collaborate with the Task Force to review program effectiveness and propose revisions to the plan, as needed.
 - f. Oversee creation and maintenance of an Arkansas ANS Task Force website.
 - g. Develop and update formal agreements among agencies and organizations relative to ANS management.
 - h. Develop recommendations, along with the Task Force, for addressing gaps in existing jurisdictions and regulations.
 - i. Develop a network, along with the Task Force, of knowledgeable contacts that can help identify species that are reported to the ANS Coordinator.
 - 1) University representatives.
 - 2) Individuals who are qualified to correctly identify various species.
 - 3) Experts from the National ANS Task Force expert's database.
2. Keep the Task Force intact
 - a. Organize annual meetings to coordinate educational, monitoring, detection, and management activities within the state.
3. Create a **Steering Committee** of Task Force members.
 - a. Members of the Steering Committee include:
 - i. Chair: Representative of AGFC (ANS Coordinator).
 - ii. Representative of ASPB.
 - iii. The Chair of each of the following sub-committees:
 - 1) **Private Industry Committee**- to include representatives from the aquaculture industry (ABOFGA, CFA), the nursery trade (Arkansas Green Industry), the pet trade (P.J.A.C.), the Arkansas Farm Bureau, and the tourism/chamber sectors (Chambers of Commerce, Department of Parks and Tourism).
 - 2) **Education Committee**- to include representatives from some or all of ADEQ, Arkansas Department of Parks and Tourism, AGFC, Arkansas Health Department, Arkansas State University, Arkansas Tech, Arkansas Waterways Commission, Southern Arkansas University, University of Arkansas at Fayetteville, University of Arkansas at Monticello, University of Arkansas at Pine Bluff, University of Central Arkansas.
 - 3) **Resource Management Committee**- to include representatives from APHIS/WS, ADEQ, Arkansas Department of Parks and Tourism (Division of State Parks), AGFC, Arkansas Highway Department, ANHC, Arkansas Natural Resources Commission, NPS, USACE, USFWS, USDA Forest Service.

- 4) **Rapid Response and Recovery Committee**- AGFC, Arkansas Department of the Military, Arkansas Health Department, ANHC, Office of Emergency Management, ASPB, USACE, APHIS Animal and Plant Health Inspection Services, USDA Forest Service, and an appropriate representative from private industry.
 - b. The Steering Committee will develop bylaws and submit them to the Task Force for approval. Bylaws will include provisions for the Steering Committee to create ad hoc committees and/or new committees as necessary.
4. Develop a permanent funding mechanism for ANS management in Arkansas.
 - a. Pursue Federal funding through the National ANS Task Force.
 - b. Explore opportunities for interagency cooperation for funding.
 - c. Explore opportunities for cooperative funding partnerships with other associations.
 - d. Pursue state funding for the implementation of the ANS Management Plan.

OBJECTIVE 2 – Education:

To develop and implement comprehensive educational programs related to ANS in Arkansas, targeting priority species and pathways and emphasizing prevention and corrective actions.

Strategies:

1. Create an **Education Committee** to coordinate ANS educational programs in the state.
 - a. University of Arkansas at Pine Bluff Aquaculture/Fisheries Center (liaison with the Cooperative Extension Service) and AGFC Educational Outreach Division co-chair this committee.
 - b. The Education Committee will report to the Steering Committee.
 - c. Set annual goals, develop programs, and involve other individuals, organizations, and agencies as appropriate.
 - d. Develop and implement a public awareness campaign about the threat of ANS and what citizens can do to help stop the introduction and/or spread of ANS in Arkansas, and utilize Protect Your Waters! and Habitattitude national campaigns.
 - e. Develop and implement educational programs that target specific groups that have been identified as potential pathways for ANS.
 - f. Develop and implement educational programs on 1) proper identification of ANS, 2) early reporting procedures, 3) species we want to keep out (new ANS), and 4) ANS already here that we need to confine and/or eradicate.
 - g. Develop a networking system between agencies of associates to contact for specific ANS information and/or materials.
 - h. Create printed materials (informational pamphlets, newsletters, posters, signs, press releases, etc.) for distribution.
 - i. Develop and maintain an educational section on an Arkansas ANS website.
 - j. Develop training programs on ANS monitoring for agency and enforcement staff (ADEQ, AGFC, universities, others) that are out in the field on a regular basis.
 - k. Incorporate ANS prevention training in the AGFC Boating Education Course.

1. Work towards expanding educational materials to include terrestrial nuisance species once aquatic species are addressed.
2. Create and identify funding for a dedicated ANS Education Coordinator position for the state, staffed within AGFC. The ANS Education Coordinator will:
 - a. Chair the Educational Committee.
 - b. Manage and keep track of all ANS educational activities as created by the Educational Committee.
 - c. Evaluate ANS educational programs.
 - d. Report to the Steering Committee.

OBJECTIVE 3 – Rapid Response and Recovery:

To develop and implement a mechanism for early identification, reporting, and eradication, where possible, of ANS in Arkansas, along with follow-up recovery as needed.

Strategies:

1. Develop **Rapid Response and Recovery Programs.**
 - a. ANS will be reported to ANS Coordinator through use of a call-in telephone number, email, and/or website.
 - b. The Rapid Response and Recovery Committee will decide on the appropriate course of action once the species identification is confirmed.
 - c. The Rapid Response and Recovery Committee will form Rapid Response and Recovery Teams appropriate to the species and locations involved.
 - d. Recovery Plan to be put in place as deemed necessary, appropriate, and reasonable by the Rapid Response and Recovery Team.
2. Develop plans of action for various ANS scenarios.
 - a. The Rapid Response and Recovery Committee, with assistance from the Task Force and/or appropriate sub-committees or ad hoc committees, will create protocols to follow for anticipated ANS scenarios. See the section following these objectives for initial guidance on plans of action.
3. Develop emergency funding mechanisms for various ANS scenarios.
 - a. The Steering Committee will pursue the funding sources.

OBJECTIVE 4 – Prevention:

To prevent the escape/introduction and establishment of ANS in Arkansas.

Strategies:

1. Review existing laws related to critical pathways for ANS and train enforcement personnel in recognizing and responding to potential violations.
 - a. The ANS Coordinator will work with entities having jurisdiction over critical pathways to understand existing laws and policies.
 - b. The ANS Coordinator will work with these entities and the Task Force to develop and propose needed laws and/or policies.

- c. The ANS Coordinator will work with the Education Committee to support training of enforcement personnel and natural resource managers.
2. Create a risk assessment process to evaluate the invasive potential of non-indigenous species imported into the state for recreational and commercial purposes.
 - a. The ANS Coordinator and the Steering Committee will work to identify and implement an appropriate risk assessment procedure based on established methodologies such as the Mississippi River Basin Panel's Rapid Risk Analysis process.
 - b. The ANS Coordinator will confer with other state ANS programs regarding potential new risks and share this information with Task Force members.
3. Develop and implement programs to control priority pathways of introduction for priority species.
 - a. The ANS Coordinator will work with Task Force committees and relevant entities to develop and implement measures to reduce the risk of introductions through critical pathways.
4. Coordinate research assessments to provide information to support effective preventions measures as needed.
 - a. The ANS Coordinator will work with Task Force committees to identify needed research.
 - b. As the need arises and is justified, all research will be coordinated through the ANS coordinator/representative and area universities.
 - c. The ANS Coordinator will collaborate with researchers and monitor execution of needed research.

OBJECTIVE 5 – Management and control of ANS:

To monitor, contain, and manage existing ANS in Arkansas.

Strategies:

1. Identify existing containment programs and prioritize containment resources toward the highest priority species and measures that control the spread of multiple species.
 - a. The Task Force will help AGFC and ASPB with identifying and prioritizing containment strategies to the best extent possible.
 - b. The ANS Coordinator will maintain and update a record of containment activities practiced in the state for various ANS that can be referred to when necessary, along with the contact information for the proper authority in charge of the activity.
2. Provide guidance and support for the control of ANS populations through rapid response and long-term ecosystem recovery efforts.
 - a. The Task Force will develop programs and information to assist public and private landowners in control of invasive species.
 - b. The Task Force will establish funding to assist public and private landowners with control of invasive species.

- c. The Task Force will develop long-term recovery and monitoring programs following rapid response efforts.
- 3. Assist resource agencies in implementing HACCP planning protocols when working in areas containing ANS.
 - a. The ANS Coordinator will work with Task Force committees, resource management agencies, and private entities to adapt, distribute, and implement HACCP protocols.

OBJECTIVE 6 – Potential new ANS and pathways for introduction into Arkansas:

Strategies:

1. Establish and coordinate a State invasive species research network.
 - a. The ANS Coordinator will assist in the development of state ANS research network.
 - b. This network will develop short- and long-term research capacity and will collaborate and communicate invasive species research needs to other institutions.
2. The ANS Coordinator, with assistance from the Steering Committee, will be the main contact who will have the knowledge of potential new ANS entering the state.
 - a. Attend Regional and National workshops.
 - b. Keep the Task Force and Steering Committee informed of potential new ANS.
 - c. Participate in clearing houses, list serves, and other informational databases that provide alerts on new ANS, particularly those in neighboring states.
 - d. Create and update a yearly “Watch List” of potential new ANS that could be of concern to Arkansas.
 - e. Coordinate with other state ANS Coordinators.
 - f. Coordinate regional compacts.

PROGRAM MONITORING, EVALUATION, AND ADAPTIVE MANAGEMENT

The need to monitor and evaluate the program’s effectiveness is clear. This is an element that is typically lacking in non-focused, diffused, crisis responses to ANS issues rather than coordinated programmatic efforts. This clearly underlines the need for a dedicated Coordinator, as emphasized in Objective 1 above, who will collaborate with the Task Force to review program effectiveness and propose revisions to the plan, as needed. It is envisioned that revisions will be warranted on a regular basis due to the rapidly changing threats and knowledge-base involved in ANS issues, making an adaptive management approach necessary. Formal revisions to the Plan with Task Force stakeholder input should be completed every 5 years.

In the absence of sufficient funding to conduct formal, quantitative program evaluations, key educational programs and outreach materials will be assessed qualitatively through discussions with stakeholders and at annual meetings of the Task Force. Reports from other states (e.g., at MRBP meetings) regarding the effectiveness of various educational outreach methods will also be used to shape future program directions. When additional funding becomes available, quantitative performance measures may be added to the plan.

RAPID RESPONSE PLANS OF ACTION

Upon receipt of a report of an ANS in the state, one of three generalized Plans of Action will be initiated. Important to consider are the jurisdiction involved, the location, and the appropriate identification mechanism.

First, the ANS coordinator will determine the jurisdiction involved in the report. If the report is a plant species, the jurisdictional authority is ASPB, while if it is an animal (fish, crayfish, mollusk, etc.), AGFC is the jurisdictional authority.

The second determination is whether the occurrence is on public or private property. If it is on private property, the ANS Coordinator will determine if it is on a certified farm under the Arkansas Bait and Ornamental Fish Certification program. If so, then the protocol authorized and approved by the ASPB, under the authority of Arkansas General Assembly, will be followed (See Appendix B). If the occurrence is on uncertified private property or public property, then the following Plans of Action will be followed based on the type of organism.

Finally, most occurrences will fall into one of three categories based on what is necessary to identify the organism in question. The three categories are:

- 1) Organisms that require only visual inspection for correct identification of species
- 2) Organisms that require laboratory testing for correct identification of species
- 3) OIE (World Organization for Animal Health) – reportable diseases

Identification

1. Organisms that Require Only Visual Inspection for Correct Identification of Species: The ANS Coordinator will notify the appropriate jurisdictional authority. Within 7 days of the initial report, the agency will collect samples and submit them to experts for confirmation. If the reported ANS occurs on private property, cooperation from the landowner will be sought prior to collecting samples, unless probable cause of a regulatory violation exists. If the ANS is on the federal noxious weed list, USDA/APHIS will be contacted. A sampling plan will be designed to assess the scope of the infestation. The water source and the areas that receive discharges will be identified. Sales and purchase records from private farms will be examined to determine whether fish or other organisms have been moved to other facilities and to identify supply sources.
2. Organisms that Require Diagnostic Inspection for Correct Identification of Species: The ANS Coordinator will notify the appropriate jurisdictional authority. Within 7 days of the initial report, the appropriate inspector will collect samples and submit them to experts for diagnosis and again for confirmation. The sampling procedures will be designed to assess the scope of the infestation. In addition to sampling for presence of the ANS, the source of water and the areas that receive any discharges will be identified. Sales and purchase records from farms and public hatcheries will be examined to determine whether fish or other organisms have been moved to other facilities (trace-outs) and to identify supply sources (trace-ins).
3. OIE (World Organization for Animal Health)-Reportable Diseases: Detection of an OIE-reportable aquatic animal pathogen is most likely to occur at an APHIS approved fish disease diagnostic laboratory. If such detection occurs, the laboratory is required to report the finding to APHIS through the Arkansas Area Veterinarian in Charge (AVIC). APHIS will notify the state veterinarian and AGFC of the problem. Any laboratory or fish health professional (approved or not) that detects an OIE reportable pathogen in organisms from Arkansas will also report the finding to the ANS Coordinator who will

notify AGFC and the AVIC. No private farm will be shut down until the finding is confirmed by the USDA/APHIS/NVSL unless there is a compelling public interest to the contrary.

Rapid Response and Recovery Team Formed and Activated

A Rapid Response and Recovery Team will be formed within 72 hours of the original report of an ANS. The team will include the appropriate jurisdictional authority as well as representatives of the private sector, if appropriate. Upon confirmation of the identification, the rapid response team will: 1) Assess the extent of infestation, 2) determine containment options, and 3) assess options to eradicate and/or prevent spread. The assessment or eradication work performed on private property will be conducted with the consent of the owner, unless probable cause of a law violation exists. In the case of OIE-reportable diseases, APHIS will likely ask for quarantine of the site. The decision as to whether eradication is desirable and/or feasible will include a cost analysis of alternative treatments and eradication methods. If the decision is that eradication is desirable and feasible, the appropriate means of eradication will be selected. If the decision is that it is not desirable and feasible, then the decision related to any subsequent actions is up to the farmer/landowner/agency. The eradication will be carried out under the supervision of the appropriate jurisdictional authority, or APHIS if appropriate. The team will complete its deliberations and finalize plans for eradication within 7 days from expert confirmation of the ANS (2 weeks following the initial report). Under normal conditions, the team will have an additional 2 weeks to begin the selected eradication procedure once the decision has been made, with the goal of completing it as quickly as possible. Complete eradication of ANS in the wild may take longer depending upon the relevant circumstances.

Post-Treatment Inspection and Liabilities

Post treatment inspection will occur immediately following eradication. If the inspection indicates a successful eradication, the landowner may continue business as normal. Farms will undergo an additional ANS inspection one month after the eradication; however, the inspection will not be conducted during a period when the ANS would not be expected to be present. In the event that the one-month period falls in a period when the ANS would not be expected to be present, the inspection would be postponed until the earliest possible time when conditions for detection are favorable. Post treatment assessment on private property will be conducted as appropriate for the species and with the consent of the landowner, unless the ANS presence was the result of an illegal activity. In the case of illegal actions, release of any seized private property will be in accordance with the findings of the presiding court. When the ANS exists in the absence of regulatory violations, the authorized agency will bear the cost of the assessment and eradication. The authorizing agency and property owner(s) will negotiate the resolution of any additional financial impacts. Where ANS occurs as the result of an illegal action, the authorizing state agency reserves the right to recoup all costs of assessment, containment and eradication as permitted by state law.

Long-Term Monitoring

Long-term monitoring will be decided on a case-by-case basis.

IMPLEMENTATION TABLE

This implementation table summarizes the management actions outlined under the strategies of the management plan. It follows the organization of the objectives, strategies, and actions present previously in this plan.

Beneath each objective the strategies are presented in shaded rows, followed by individual rows for each action. The strategy line includes total funds estimated for the strategy – if funds apply to a specific action item they are listed on the appropriate action line as well as being part of the total.

The first column presents a short description of the strategy or action. The second column lists potential funding sources, but does not intend to exclude the possibility of funds from other sources. The third column identifies the key agency/agencies in implementing the strategy/action. The fourth column lists some of the cooperating organizations that are key to implementation. The last four columns propose a timeline of activity by Arkansas state government fiscal year (e.g., FY14 is 1 July 2013 – 30 June 2014), with estimated funding needs. A check mark in one of these columns indicates that there is proposed activity on an action during that fiscal year. In cases where no cost is listed, it is assumed that cost of ARANSTF member time, travel, etc. will be provided by their respective agency.

Actions	Funding Source	Implementing Agencies	Cooperating Organizations	Recommended Schedule/Funds			
				FY14	FY15	FY16	FY17
OBJECTIVE 1 – Coordination							
Strategy 1.1 Create and identify funding for a dedicated, full-time ANS Coordinator position for the state.							
Strategy 1.1 Implementation (1 FTE)	AGFC ANSTF	AGFC		\$80,000	\$84,000	\$88,200	\$92,610
Action 1.1a. Act as the main point of contact for agencies involved in ANS management/control/ monitoring and for the public.				✓	✓	✓	✓
Action 1.1b. Provide reports to the Task Force and interface with all committees of the Task Force.				✓	✓	✓	✓
Action 1.1c. Collect, review, and make recommendations to decision makers on proposals to import potential aquatic nuisance species into Arkansas.				✓	✓	✓	✓
Action 1.1d. Represent Arkansas on national and regional ANS groups.				✓	✓	✓	✓
Action 1.1e. Collaborate with the Task Force to review program effectiveness and propose revisions to the plan, as needed.					✓	✓	✓
Action 1.1f. Oversee creation and maintenance of an ARANSTF website.					✓	✓	✓
Action 1.1g. Develop and update formal agreements among agencies and organizations relative to ANS management.				✓	✓	✓	✓
Action 1.1h. Develop recommendations, along with the Task Force, for addressing gaps in existing jurisdictions and regulations.					✓	✓	✓
Action 1.1i. Develop a network, along with the Task Force, of knowledgeable contacts that can help identify species that are				✓	✓	✓	✓

reported to the ANS Coordinator.	Funding Source	Implementing Agencies	Cooperating Organizations	Recommended Schedule/Funds
Actions				
Strategy 1.2 Keep the Task Force intact.				
Strategy 1.2 Implementation	AGFC, ANSTF, ASPB	AGFC, ASPB		\$10,000 \$10,000 \$10,000 \$10,000
Action 1.2a. Organize annual meetings to coordinate educational, monitoring, detection, and management activities within the state.			✓	✓ ✓
Strategy 1.3 Create a Steering Committee of Task Force members.				
Strategy 1.3 Implementation	ARANSTF member agencies	ARANSTF member agencies	ARANSTF member agencies	
Action 1.3a. Members of the Steering Committee selected.			✓	
Action 1.3b. The Steering Committee will develop bylaws and submit them to the Task Force for approval. Bylaws will include provisions for the Steering Committee to create ad hoc committees and/or new committees as necessary.			✓	
Strategy 1.4 Develop a permanent funding mechanism for ANS management in Arkansas.				
Strategy 1.4 Implementation	ARANSTF member agencies	Coordinator, ARANSTF	ANSTF	
Action 1.4a Pursue Federal funding through the National ANS Task Force.			✓	✓ ✓
Action 1.4b Explore opportunities for interagency cooperation for funding.			✓	✓ ✓
Action 1.4c Explore opportunities for cooperative funding partnerships with other associations.			✓	✓ ✓

Actions	Funding Source	Implementing Agencies	Cooperating Organizations	Recommended Schedule/Funds			
				✓	✓	✓	✓
OBJECTIVE 2 – Education: Strategy 2.1 Create an Education Committee to coordinate ANS educational programs in the state.							
Strategy 2.1 Implementation		AGFC	UAPB	\$10,000	\$45,000	\$30,000	\$30,000
Action 2.1a University of Arkansas at Pine Bluff Aquaculture/Fisheries Center (liaison with the Cooperative Extension Service) and AGFC Educational Outreach Division co-chair this committee.				✓	✓	✓	✓
Action 2.1b The Education Committee will report to the Steering Committee.				✓	✓	✓	✓
Action 2.1c Set annual goals, develop programs, and involve other individuals, organizations, and agencies as appropriate.				✓	✓	✓	✓
Action 2.1d Develop and implement a public awareness campaign about the threat of ANS and what citizens can do to help stop the introduction and/or spread of ANS in Arkansas, and utilize Protect Your Waters! and Habitattitude national campaigns.				\$5,000	\$5,000	\$5,000	\$5,000
Action 2.1e Develop and implement educational programs that target specific groups that have been identified as potential pathways for ANS.					\$2,500	\$2,500	\$2,500

Actions	Funding Source	Implementing Agencies	Cooperating Organizations	Recommended Schedule/Funds			
Action 2.1f Develop and implement educational programs on 1) proper identification of ANS, 2) early reporting procedures, 3) species we want to keep out (new ANS), and 4) ANS already here that we need to confine and/or eradicate.					\$2,500	\$2,500	\$2,500
Action 2.1g Develop a networking system between agencies of associates to contact for specific ANS information and/or materials.				✓	✓	✓	✓
Action 2.1h Create printed materials (informational pamphlets, newsletters, posters, signs, press releases, etc.) for distribution.				\$5,000	\$5,000	\$5,000	\$5,000
Action 2.1i Develop and maintain an educational section on an Arkansas ANS website.					\$20,000	\$5,000	\$5,000
Action 2.1j Develop training programs on ANS monitoring for agency and enforcement staff (ADEQ, AGFC, universities, others) that are out in the field on a regular basis.					\$10,000	\$10,000	\$10,000
Action 2.1k Incorporate ANS prevention training in the AGFC Boating Education Course.					✓	✓	✓
Action 2.1l Work towards expanding educational materials to include terrestrial nuisance species once aquatic species are addressed.							✓

Actions	Funding Source	Implementing Agencies	Cooperating Organizations	Recommended Schedule/Funds		
Strategy 2.2 Create and identify funding for a dedicated ANS Education Coordinator position for the state, staffed within AGFC.						
Strategy 2.2 Implementation (1 FTE)	AGFC, ANSTF	AGFC		\$60,000	\$63,000	\$66,150
Action 2.2a Chair the Educational Committee.				✓	✓	✓
Action 2.2b Manage and keep track of all ANS educational activities as created by the Educational Committee.				✓	✓	✓
Action 2.2c Evaluate ANS educational programs.				✓	✓	✓
Action 2.2d Report to the Steering Committee.				✓	✓	✓
OBJECTIVE 3 – Rapid Response and Recovery:						
Strategy 3.1 Develop Rapid Response and Recovery Programs.						
Strategy 3.1 Implementation	AGFC	AGFC		\$2,000	\$2,000	\$2,000
Action 3.1a ANS will be reported to ANS Coordinator through use of a call-in telephone number, email, and/or website.				\$2,000	\$2,000	\$2,000
Action 3.1b The Rapid Response and Recovery Committee will decide on the appropriate course of action once the species identification is confirmed.				✓	✓	✓
Action 3.1c The Rapid Response and Recovery Committee will form Rapid Response and Recovery Teams appropriate to the species and locations involved.				✓	✓	✓
Action 3.1d Recovery Plan to be put in place as deemed necessary, appropriate, and reasonable by the Rapid Response and Recovery Team.				✓	✓	✓

Actions	Funding Source	Implementing Agencies	Cooperating Organizations	Recommended Schedule/Funds
Strategy 3.2 Develop plans of action for various ANS scenarios.				
Strategy 3.2 Implementation		ARANSTF		
Action 3.2a The Rapid Response and Recovery Committee, with assistance from the Task Force and/or appropriate sub-committees or ad hoc committees, will create protocols to follow for anticipated ANS scenarios. See the section following these objectives for initial guidance on plans of action.			✓	✓
Strategy 3.3 Develop emergency funding mechanisms for various ANS scenarios.				
Strategy 3.3 Implementation		ARANSTF Steering Committee		\$50,000 \$50,000 \$50,000
Action 3.3a The Steering Committee will pursue the funding sources.			✓	✓
OBJECTIVE 4 – Prevention:				
Strategy 4.1 Review existing laws related to critical pathways for ANS and train enforcement personnel in recognizing and responding to potential violations.				
Strategy 4.1 Implementation		AGFC, ASPB	ARANSTF	
Action 4.1a The ANS Coordinator will work with entities having jurisdiction over critical pathways to understand existing laws and policies.			✓	✓
Action 4.1b The ANS Coordinator will work these entities and the Task Force to develop and propose needed laws and/or policies.			✓	✓
Action 4.1c The ANS Coordinator will work with the Education Committee to support training of enforcement personnel and natural resource managers.			✓	✓

Actions	Funding Source	Implementing Agencies	Cooperating Organizations	Recommended Schedule/Funds
Strategy 4.2 Create a risk assessment process to evaluate the invasive potential of non-indigenous species imported into the state for recreational and commercial purposes.				
Strategy 4.2 Implementation				
Action 4.2a The ANS Coordinator and the Steering Committee will work to identify and implement an appropriate risk assessment procedure based on established methodologies such as the Mississippi River Basin Panel's Rapid Risk Analysis process.		Coordinator	ARANSTF	
Action 4.2b The ANS Coordinator will confer with other state ANS programs regarding potential new risks and share this information with Task Force members.				
Strategy 4.3 Develop and implement programs to control priority pathways of introduction for priority species.				
Strategy 4.3 Implementation				
Action 4.3a The ANS Coordinator will work with Task Force committees and relevant entities to develop and implement measures to reduce the risk of introductions through critical pathways.		ARANSTF, ANSTF	ARANSTF, MRBP, other states' ANS programs	
Strategy 4.4 Coordinate research assessments to provide information to support effective prevention measures as needed.				
Strategy 4.4 Implementation				
Action 4.4a The ANS Coordinator will work with Task Force committees to identify needed research.		Coordinator	ARANSTF	
Action 4.4b As the need arises and is justified, all research will be coordinated through the ANS coordinator/				

representative and area universities.	Funding Source	Implementing Agencies	Cooperating Organizations	Recommended Schedule/Funds
Actions				
Action 4.4c The ANS Coordinator will collaborate with researchers and monitor execution of needed research.				✓
OBJECTIVE 5 – Management and control of ANS:				
Strategy 5.1 Identify existing containment programs and prioritize containment resources toward the highest priority species and measures that control the spread of multiple species.				
Strategy 5.1 Implementation		ARANSTF	ARANSTF	
Action 5.1a The Task Force will help AGFC and ASPB with identifying and prioritizing containment strategies to the best extent possible.		ARANSTF		✓
Action 5.1b The ANS Coordinator will maintain and update a record of containment activities practiced in the state for various ANS that can be referred to when necessary, along with the contact information for the proper authority in charge of the activity.		Coordinator		✓
Strategy 5.2 Provide guidance and support for the control of ANS populations through rapid response and long-term ecosystem recovery efforts.				
Strategy 5.2 Implementation		ARANSTF	ARANSTF	\$100,000 \$100,000 \$100,000 \$100,000
Action 5.2a The Task Force will develop programs and information to assist public and private landowners in control of invasive species.				✓
Action 5.2b The Task Force will establish funding to assist public and private landowners with control of invasive species.				\$100,000 \$100,000 \$100,000 \$100,000
Action 5.2c The Task Force will develop long-term recovery and monitoring				✓

programs following rapid response efforts.	Funding Source	Implementing Agencies	Cooperating Organizations	Recommended Schedule/Funds
Actions				
Strategy 5.3 Assist resource agencies in implementing HACCP planning protocols when working in areas containing ANS.				
Strategy 5.3 Implementation		Coordinator	ARANSTF, others	
Action 5.3a The ANS Coordinator will work with Task Force committees, resource management agencies, and private entities to adapt, distribute, and implement HACCP protocols.			✓	✓
OBJECTIVE 6 – Potential new ANS and pathways for introduction into Arkansas:				
Strategy 6.1 Establish and coordinate a State invasive species research network.				
Strategy 6.1 Implementation		Coordinator	ARANSTF, others	
Action 6.1a The ANS Coordinator will assist in the development of state ANS research network.			✓	✓
Action 6.1b This network will develop short- and long-term research capacity and will collaborate and communicate invasive species research needs to other institutions.			✓	✓
Strategy 6.2 The ANS Coordinator, with assistance from the Steering Committee, will be the main contact who will have the knowledge of potential new ANS entering the state.				
Strategy 6.2 Implementation		Coordinator	ARANSTF	
Action 6.2a Attend Regional and National workshops.			✓	✓
Action 6.2b Keep the Task Force and Steering Committee informed of potential new ANS.			✓	✓
Action 6.2c Participate in clearing houses, list serves, and other informational databases that provide alerts on new ANS, Action particularly those in neighboring			✓	✓

FOCAL SPECIES PROFILES

The USGS Nonindigenous Aquatic Species website lists 99 non-native and transplanted-native aquatic species in Arkansas (Fuller 2009).

Group	Family	Scientific Name	Common Name	Exotic / Native
Coelenterates	Olindiidae	Craspedacusta sowerbyi	freshwater jellyfish	Exotic
Crustaceans	Daphnidae	Daphnia lumholtzi	water flea	Exotic
Crustaceans	Temoridae	Eurytemora affinis	a calanoid copepod	Native?
Crustaceans	Cambaridae	Orconectes neglectus chaenodactylus	crayfish	Native
Fishes	Atherinidae	Menidia beryllina	inland silverside	Native
Fishes	Centrarchidae	Ambloplites constellatus	Ozark bass	Native
Fishes	Centrarchidae	Ambloplites rupestris	rock bass	Native
Fishes	Centrarchidae	Lepomis auritus	redbreast sunfish	Native
Fishes	Centrarchidae	Lepomis macrochirus	bluegill	Native
Fishes	Centrarchidae	Micropterus coosae	redeye bass	Native
Fishes	Centrarchidae	Micropterus dolomieu	smallmouth bass	Native
Fishes	Centrarchidae	Micropterus salmoides floridanus	Florida largemouth bass	Native
Fishes	Centrarchidae	Pomoxis nigromaculatus	black crappie	Native
Fishes	Channidae	Channa argus	northern snakehead	Exotic
Fishes	Characidae	Colossoma or Piaractus sp.	unidentified pacu	Exotic
Fishes	Characidae	Piaractus brachypomus	pirapatinga, red-bellied pacu	Exotic
Fishes	Cichlidae	Astronotus ocellatus	oscar	Exotic
Fishes	Cichlidae	Oreochromis aureus	blue tilapia	Exotic
Fishes	Cichlidae	Tilapia zillii	redbelly tilapia	Exotic
Fishes	Clupeidae	Alosa sapidissima	American shad	Native
Fishes	Clupeidae	Dorosoma petenense	threadfin shad	Native
Fishes	Cyprinidae	Carassius auratus	goldfish	Exotic
Fishes	Cyprinidae	Ctenopharyngodon idella	grass carp	Exotic
Fishes	Cyprinidae	Cyprinus carpio	common carp	Exotic
Fishes	Cyprinidae	Hypophthalmichthys molitrix	silver carp	Exotic
Fishes	Cyprinidae	Hypophthalmichthys nobilis	bighead carp	Exotic
Fishes	Cyprinidae	Leuciscus idus	ide	Exotic
Fishes	Cyprinidae	Mylopharyngodon piceus	black carp	Exotic
Fishes	Cyprinidae	Notemigonus crysoleucas	golden shiner	Native
Fishes	Cyprinidae	Notropis ozarcanus	Ozark shiner	Native
Fishes	Cyprinidae	Notropis potteri	chub shiner	Native
Fishes	Cyprinidae	Pimephales promelas	fathead minnow	Native
Fishes	Cyprinidae	Scardinius erythrophthalmus	rudd	Exotic
Fishes	Cyprinidae	Tinca tinca	tench	Exotic
Fishes	Esocidae	Esox lucius	northern pike	Native

Fishes	Esocidae	Esox lucius x E. masquinongy	tiger muskellunge	Native Hybrid
Fishes	Esocidae	Esox masquinongy	muskellunge	Native
Fishes	Esocidae	Esox niger	chain pickerel	Native
Fishes	Ictaluridae	Ameiurus catus	white catfish	Native
Fishes	Ictaluridae	Ameiurus nebulosus	brown bullhead	Native
Fishes	Ictaluridae	Ictalurus furcatus	blue catfish	Native
Fishes	Ictaluridae	Ictalurus punctatus	channel catfish	Native
Fishes	Ictaluridae	Noturus exilis	slender madtom	Native
Fishes	Moronidae	Morone chrysops	white bass	Native
Fishes	Moronidae	Morone chrysops x M. saxatilis	wiper	Native Hybrid
Fishes	Moronidae	Morone saxatilis	striped bass	Native
Fishes	Osmeridae	Osmerus mordax	rainbow smelt	Native
Fishes	Percidae	Perca flavescens	yellow perch	Native
Fishes	Percidae	Sander canadensis	sauger	Native
Fishes	Percidae	Sander canadensis x vitreus	saugeye	Native Hybrid
Fishes	Percidae	Sander vitreus	walleye	Native
Fishes	Salmonidae	Oncorhynchus clarkii	cutthroat trout	Native
Fishes	Salmonidae	Oncorhynchus mykiss	rainbow trout	Native
Fishes	Salmonidae	Salmo trutta	brown trout	Exotic
Fishes	Salmonidae	Salmo x Salvelinus trutta x fontinalis	tiger trout	Exotic Hybrid
Fishes	Salmonidae	Salvelinus fontinalis	brook trout	Native
Fishes	Salmonidae	Salvelinus namaycush	lake trout	Native
Mammals	Capromyidae	Myocastor coypus	nutria	Exotic
Mammals	Castoridae	Castor canadensis	beaver	Native
Mollusks-Bivalves	Corbiculidae	Corbicula fluminea	Asian clam	Exotic
Mollusks-Bivalves	Dreissenidae	Dreissena polymorpha	zebra mussel	Exotic
Mollusks-Cephalopods	Octopodidae	Octopus vulgaris	Common octopus	Native
Plants	Amaranthaceae	Alternanthera philoxeroides	alligatorweed	Exotic
Plants	Apiaceae	Conium maculatum	Poison hemlock	Exotic
Plants	Asteraceae	Pluchea odorata odorata	marsh fleabane, sweet scent	Native
Plants	Boraginaceae	Myosotis scorpioides	True forget-me-not	Exotic
Plants	Brassicaceae	Nasturtium officinale	water-cress	Exotic
Plants	Brassicaceae	Rorippa sylvestris	Creeping yellow cress	Exotic
Plants	Cabombaceae	Cabomba caroliniana	Carolina fanwort	Native
Plants	Commelinaceae	Murdannia keisak	marsh dewflower, aneilima, Asian spiderwort	Exotic
Plants	Fabaceae	Lotus corniculatus	Birdsfoot trefoil	Exotic
Plants	Haloragaceae	Myriophyllum aquaticum	parrot feather, Brazilian watermilfoil	Exotic
Plants	Haloragaceae	Myriophyllum spicatum	Eurasian water-milfoil	Exotic
Plants	Hydrocharitaceae	Egeria densa	Brazilian waterweed	Exotic
Plants	Hydrocharitaceae	Hydrilla verticillata	hydrilla	Exotic
Plants	Iridaceae	Iris pseudacorus	yellow iris	Exotic

Plants	Lamiaceae	Mentha aquatica	watermint	Exotic
Plants	Lamiaceae	Mentha gracilis	Creeping whorled mint, gingermint	Exotic
Plants	Lamiaceae	Mentha spicata	Spearmint	Exotic
Plants	Lemnaceae	Landoltia (Spirodela) punctata	dotted duckweed	Exotic
Plants	Lythraceae	Lythrum salicaria	purple loosestrife	Exotic
Plants	Menyanthaceae	Nymphoides peltata	yellow floating-heart	Exotic
Plants	Najadaceae	Najas minor	brittle naiad	Exotic
Plants	Nelumbonaceae	Nelumbo nucifera	sacred lotus	Exotic
Plants	Onagraceae	Ludwigia grandiflora	Uruguay waterprimrose, water primrose	Exotic
Plants	Poaceae	Agrostis gigantea	Redtop, black bent, water bentgrass	Exotic
Plants	Poaceae	Alopecurus geniculatus	water foxtail, marsh meadow- foxtail	Exotic
Plants	Poaceae	Echinochloa crusgalli Var. hispi shum, L.	Barnyard grass	Exotic
Plants	Polygonaceae	Polygonum caespitosum longisetum	oriental lady's thumb, bristly lady's thumb	Exotic
Plants	Polygonaceae	Polygonum persicaria	Lady's thumb, smartweed, spotted knotweed	Exotic
Plants	Polygonaceae	Rumex obtusifolius	Bitter dock	Exotic
Plants	Pontederiaceae	Eichhornia crassipes	water-hyacinth	Exotic
Plants	Potamogetonaceae	Potamogeton crispus	curly pondweed	Exotic
Plants	Primulaceae	Lysimachia nummularia	Moneywort	Exotic
Plants	Salicaceae	Salix alba	White willow	Exotic
Plants	Salviniaceae	Salvinia minima	water spangles	Exotic
Plants	Scrophulariaceae	Bacopa egensis	Brazilian water-hyssop	Exotic
Plants	Typhaceae	Typha angustifolia	Narrow-leaved cattail	Exotic
Reptiles-Snakes	Boidae	Eunectes notaeus	Yellow Anaconda	Exotic

Some of the listings reflect only a single report while other species have become established in the state. Of these, some have exhibited invasive characteristics. Still others have become invasive in other states and it is difficult to predict whether that will be the case in Arkansas or not. Of equal concern is the potential for additional species to spread to Arkansas and cause ecological or economic harm.

Given the large number of non-native and potentially cryptogenic species already in Arkansas, the Arkansas Task Force, representing an array of stakeholders in ANS issues in the state, was faced with the challenge of agreeing on a list selected focal species that are of greatest concern in the state. This list of species thought to pose the greatest risk was compiled based on other ANS plans and the combined knowledge and expertise of Task Force members and agreed upon by consensus of the Task Force.

The list includes both species already present in Arkansas and those not present as of 2008. The discussions of these species are grouped into the following categories: pathogens, plants/algae, mollusks, crustaceans, insects, fish, birds, and mammals – this was the main level of organization to allow quick access to information on a species by general taxonomic group. Within each category, species are sub-grouped by presence/absence in Arkansas, with present species presented first, and alphabetized by common name with each sub-group.

A summary table of species covered and key information is provided prior to the detailed profiles.

	In AR?	invasive	nuisance	health threat	economic damage	ecological damage	control
<u>Pathogens</u>							
Amphibian Chytrid Fungus	X	y	y	n	unknown	uncertain	none
Catfish Trematode	X	y	y	n	y	unknown	chem & bio, in aquaculture
Parasitic Copepods	X	y	unknown	n	unknown	unknown	none
Infectious Pancreatic Necrosis	X	y	unknown	n	unknown	unknown	trout eradication
Infectious Hematopoietic Necrosis		unknown	unknown	n	unknown	unknown	trout eradication
Koi Herpes Virus	?	unknown	y	n	y	n	possible on farms only
Muscle Microsporean		unknown	y	n	y	unknown	very difficult
Salamander Iridovirus		y	y	n	n	y	none
Spring Viremia Of Carp Virus		unknown	y	n	y	unknown	destroy fish & fallow pond
Taura Syndrome Virus		unknown	y	n	y	unknown	very difficult
Viral Hemorrhagic Septicemia		y	y	n	y	unknown	on ponds & hatcheries only
Whirling Disease		y	y	n	y	n	on ponds & hatcheries only
White Spot Syndrome Virus		y	y	n	y	unknown	none
<u>Plants/Algae</u>							
Alligatorweed	X	y	y	n	likely	likely	costly
Brazilian Waterweed	X	y	y	n	unknown	unknown	chem & bio
Common Reed	X	y	y	n	n	y	possible but perpetual
Curly Pondweed	X	unknown	n	n	n	unknown	chem & bio
Didymo	X	y	y	n	maybe	maybe	unlikely to be feasible
Duck Lettuce	X	maybe	maybe	n	unknown	unknown	uncertain
Eurasian Watermilfoil	X	y	y	n	y	likely	unlikely to be feasible
Giant Lyngbya	X	y	y	y	y	likely	unknown
Hydrilla	X	y	y	n	y	likely	unlikely to be feasible
Purple Loosestrife	X	y	y	n	n	possible	feasible
Uruguayan Primrose	X	y	y	n	n	n	unknown
Water Hyacinth	X	y	y	n	y	likely	unlikely to be feasible
Water Lettuce	X	y	y	n	y	y	feasible - mech & chem
Giant Salvinia		y	y	n	likely	y	feasible
Golden Algae		maybe	y	n	y	y	feasible
Roundleaf Toothcup		maybe	maybe	n	n	unknown	may be possible

	<u>In AR?</u>	<u>invasive</u>	<u>nuisance</u>	<u>health threat</u>	<u>economic damage</u>	<u>ecological damage</u>	<u>control</u>
<u>Birds</u>							
American White Pelican	X	n	y	n	y	n	feasible
Double-crested Cormorant	X	n	y	n	y	n	feasible
<u>Crustaceans</u>							
Gapped Ringed Crayfish	X	y	y	n	n	y	unlikely to be feasible
Australian Red Claw Crayfish		y	maybe	n	n	n	unlikely to be feasible
Chinese Mitten Crab		y	y	n	y	unknown	unlikely to be feasible
Everglades Crayfish		unknown	unknown	n	n	unknown	unlikely to be feasible
Rusty Crayfish		y	y	n	y	y	unlikely to be feasible
Smooth Marron		unknown	unknown	n	n	unknown	unlikely to be feasible
Yabby		y	y	n	some	likely	unlikely to be feasible
<u>Insects</u>							
Asian Tiger Mosquito	X	y	y	y	y	unknown	unlikely to be feasible
<u>Mammals</u>							
Beaver	X	n	y	n	y	possible	feasible
Nutria	X	y	y	n	n	possible	feasible
<u>Mollusks</u>							
Asian Clam	X	y	y	n	y	y	unlikely to be feasible
Zebra Mussels	X	y	y	n	y	y	difficult in wild
Big-Ear Radix		y	y	y	n	possible	unknown
Channeled Apple Snail		y	y	n	y	unknown	unlikely to be feasible
Chinese Mystery Snail		y	possibly	potential	unknown	unknown	unknown
Ghost Ramshorn Snail		y	possibly	potential	unknown	unknown	unknown
New Zealand Mud Snail		y	possibly	unknown	unknown	y	unknown
Quagga Mussel		y	y	n	unknown	unknown	unlikely to be feasible
Quilted Melania		y	unknown	potential	unknown	possible	unknown
Red-Rim Melania		y	y	unknown	unknown	possible	unknown
<u>Fish</u>							
Bighead Carp	X	y	y	n	unknown	unknown	unknown
Black Carp	X	unknown	unknown	n	n	unknown	unknown
Silver Carp	X	y	y	y	unknown	unknown	unknown
Northern Snakehead	X	y	y	n	maybe	maybe	difficult
White Perch	X	y	y	n	unknown	y	unknown
Yellow Bass	X	y	y	n	n	possible	unknown
Yellow Perch	X	y	y	n	n	unknown	unknown
Alewife & Blueback Herring		y	y	n	n	likely	feasible but costly
Eurasian Ruffe		y	y	n	maybe	y	maybe
Round Goby		y	y	n	unknown	y	unlikely
Snakeheads		y	y	n	unknown	unknown	feasible but costly
Sticklebacks		unknown	unknown	n	n	unknown	unknown

Each species was scored for invasiveness, nuisance, health threat, economic damage, ecological damage, and control feasibility. For control ranking we summed the first 5 and subtracted control feasibility, thinking that if control feasibility was scored high (i.e. bad – low feasibility) we would be less likely to want to try control. Then we split them roughly into thirds where there were breaks in the score totals. I only included species already in AR in control rankings. We summed all scores for species already in AR in order to rank the importance of containing the invasion. Then I split them roughly into thirds where there were breaks in the score totals.

	Control Rank	Containment Rank
Giant Lyngbya	high	high
Water Lettuce	high	high
Asian Tiger Mosquito	high	high
Zebra Mussels	high	high
Silver Carp	high	medium
Asian Clam	high	high
White Perch	high	medium
Eurasian Watermilfoil	high	high
Hydrilla	high	high
Water Hyacinth	high	high
Alligatorweed	high	high
Catfish Trematode	medium	high
Common Reed	medium	medium
Brazilian Waterweed	medium	low
Purple Loosestrife	medium	low
Beaver	medium	low
Nutria	medium	low
Northern Snakehead	medium	medium
Bighead Carp	medium	medium
Yellow Bass	medium	medium
Didymo	low	high
Gapped Ringed Crayfish	low	high
Yellow Perch	low	low
American White Pelican	low	low
Double-crested Cormorant	low	low
Amphibian Chytrid Fungus	low	medium
Uruguayan Primrose	low	low
Duck Lettuce	low	low
Infectious Pancreatic Necrosis	low	low
Parasitic Copepods	low	medium
Black Carp	low	low
Curly Pondweed	low	low

The same process that yielded the containment ranks was used to generate prevention ranks for species not yet in the state.

	Prevention Rank
Rusty Crayfish	high
Yabby	high
White Spot Syndrome Virus	high
Chinese Mitten Crab	high
Channeled Apple Snail	high
Round Goby	high
Salamander Iridovirus	high
Viral Hemorrhagic Septicemia	high
Eurasian Ruffe	high
Whirling Disease	high
Giant Salvinia	high
Big-Ear Radix	high
Golden Algae	medium
Quagga Mussel	medium
Alewife & Blueback Herring	medium
Muscle Microsporean	medium
Spring Viremia Of Carp Virus	medium
Taura Syndrome Virus	medium
New Zealand Mud Snail	medium
Red-Rim Melania	medium
Snakeheads	medium
Koi Herpes Virus	low
Chinese Mystery Snail	low
Ghost Ramshorn Snail	low
Quilted Melania	low
Australian Red Claw Crayfish	low
Infectious Hematopoetic Necrosis	low
Roundleaf Toothcup	low
Everglades Crayfish	low
Smooth Marron	low
Sticklebacks	low

Pathogens

Already present in Arkansas as of 2008

Amphibian Chytrid Fungus Disease [Chytridiomycosis] (*Batrachochytrium dendrobatidis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	unknown	uncertain	none

Chytridiomycosis or amphibian chytrid fungus disease is caused by the chytrid fungus *Batrachochytrium dendrobatidis*, formally described by Longcore et al. (1999). It has been identified as an emerging infectious disease that has spread rapidly. It has a wide range of host species that have exhibited little immune response. Its origin has been traced to international trade of the African clawed frogs *Xenopus laevis* and *X. tropicalis* for use in laboratory pregnancy tests during the mid-1930s. It has been linked directly to amphibian declines and extinctions in Eurasia, Australia, Oceania, and Central, North, and South America over the past 15 years. In the United States it has been found in over a dozen states, including Arkansas. Lannoo et al. (2011) surveyed amphibians on Department of Defense installations across the United States, and concluded that the chytrid fungus is widespread and can be considered endemic.

This fungus has three life stages: an aquatic, motile infectious stage (zoospore); a parasitic stage that grows in the superficial keratinized cell layer of the amphibian epidermis (thallus); and the body that discharges new zoospores in the environment (zoosporangium). This fungus typically lives in water or moist soil; and is known to thrive in cool to cold-water environments (17-25°C) making amphibians that inhabit mountain or boreal habitats most susceptible. This moisture requirement is necessary for transmission and development; the fungus dies if desiccated. This is the first and only known chytrid species that is pathogenic to vertebrates.

Possible invasion pathways and vector species include:

1. Domestic and international trade in amphibians for use as fish bait, pets, food (e.g., bullfrogs), zoo/aquarium exhibit animals, or laboratory research specimens.
2. Transport of contaminated water or soil containing the fungal zoospores; e.g., fish stocking by state or federal agencies, infected water, and larval transport.
3. It has also been suggested that transport via soil (mud) on domestic livestock, vehicle tires and wheel rims, footwear, shovels, and other similar mechanisms can help spread zoospores.
4. Research has shown that sub-clinical infections can be transmitted by other amphibian species such as the bullfrog, *Rana catesbiana*, tiger salamander, *Ambystoma tigrinum*, marine (cane) toad, *Bufo marinus*, African clawed frogs, *Xenopus* sp., and dwarf African clawed frogs, *Hymenochirus curtipes*.
5. Alternative host taxa include freshwater shrimp.
6. Waterfowl toes have been shown to serve as reservoirs for the chytrid fungus (Garmyn et al. 2012)."

Catfish trematode (*Bolbophorus damnificus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	yes	unknown	In aquaculture situations only

The catfish trematode is a digenetic parasite that has a three-host life cycle that includes a snail (typically the ram’s horn snail), a fish, and a bird as the final host (Terhune et al. 2003). The American white pelican has been named the specific bird host of the parasite in the southeastern United States due to their growing preference for foraging on catfish ponds (King 1997). The pelican releases eggs of the trematode into the pond as miracidia, where they hatch and find the ram’s horn snail (Terhune et al. 2003). The miracidia mature in the snail and are released as larval trematodes called cercariae. The cercariae infect the catfish, which are eaten by the pelican, where they mature into adult flukes. Without the pelican or the ram’s horn snail, the trematode cannot complete its life cycle and cannot cause harm to catfish.

Significant fish losses occur in ponds that have been exposed to the trematode (Terhune et al. 2002). The trematode appears as small bumps under the skin of infected catfish, usually in the tail, causing decreased feed consumption rates of the fish as well as decreased production efficiency (Terhune et al. 2003, Hanson and Wise 2005). Losses from trematode infestations to the major catfish-producing region were estimated at US \$45.4 million annually (Hanson and Wise 2005). This represents a loss of over 10% for the industry in 2004.

In 2003 a trematode infected pond was identified in Chicot County, southeastern Arkansas. A statewide survey of catfish ponds conducted in 2006 found that approximately 19% of ponds sampled had trematodes (Dorman and Goodwin 2008). Trematodes were found only in ponds sampled in the southeast, with 50% of farms in the southeast region having the trematode.

Current methods for managing catfish trematode infestations include keeping birds away from the fish production site, removing aquatic vegetation from the edges of ponds (to remove snail habitat), biological control of snails with triploid black carp (*Mylopharyngodon piceus*) and the use of hydrated lime or copper sulfate on pond edges to reduce snail populations (Terhune et al. 2003).

Parasitic Copepods (*Achtheres sp.*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Unknown	No	unknown	unknown	none

Copepods are small marine or freshwater crustaceans of the subclass Copepoda. This subclass contains the largest number of parasitic crustaceans (Post 1983). Parasitic copepods spend most of their life cycle attached to fish, feeding on their bodily fluids. Their body consists of a head region and abdomen. Copepods have a single eye and three appendages that comprise the mouthpart. Females carry two long egg sacs attached to their abdomen.

The parasitic copepod *Achtheres pimelodi* was found in striped bass collected from the South Fork of Lake Ouachita in 2006. The parasite was attached in the mouth and on the gill area of the fish. While all fish collected in the gillnetting sample had some of the parasites, the infestation was considered to be light or moderate. Another parasitic species, *Achtheres micropteri*, has been documented in Beaver Lake and Lake Fort Smith (Becker et al. 1966, Cloutman 1975). In fact, the incidence of *A. micropteri* infestation on three bass species sampled in Beaver Lake increased from 1962-1963 (Becker et al. 1966).

Achtheres has been found in Tennessee although they are not considered to cause significant fish kills. In Virginia, *Achtheres* was thought to contribute to a striped bass die-off; however the bass were already in poor condition from reduced numbers of shad present in the water body. However, little research has been done on the species to determine how harmful the parasite may be to fisheries.

Infectious Pancreatic Necrosis (IPN)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Unknown	No	unknown	unknown	Trout eradication

IPN is a fish virus that produces severe mortality, especially when introduced into previously unexposed populations. It was first discovered in cultured trout on a private fish hatchery on the Spring River in the 1970s, and is now widely spread in Arkansas trout waters. IPN is primarily a threat to the trout fisheries of North Arkansas and to the hatcheries that support those fisheries. IPN kills young rainbow trout, the trout populations in Arkansas are currently a put and take fishery, and all the trout hatcheries in the state, including all state and federal hatcheries, utilize above ground water sources for the culture of trout. If IPN carrier fish are in the water source for the hatcheries the pathogen can be brought into the hatcheries and affect fish production and stocking for the entire state. Trout fishing in Arkansas brings lots of dollars into the economy and some cities rely heavily on the tourism it generates. This pathogen could impact the abilities of the hatcheries to supply fish for anglers. Trout are the only known susceptible species in Arkansas. There is no harm to human health. Vaccines may be helpful in control of IPN. Once introduced into a trout population, the virus becomes permanently established. Eradication would require destruction of infected populations.

Not present in Arkansas as of 2008

Infectious Hematopoetic Necrosis (IHN)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Unknown	Unknown	No	unknown	unknown	Trout eradication

IHN is a fish virus that is native to the western United States. It can produce severe losses in previously unexposed populations, especially in cultured trout and salmon. It is an OIE reportable disease (see earlier discussion of OIE reportable diseases in Rapid Response Plans of Action section). IHN is primarily a threat to the trout fisheries of North Arkansas and to the hatcheries that support those fisheries. Trout are the only known susceptible species in Arkansas. There is no harm to human health. Control is possible, but would require eradication of wild and cultured trout.

Koi Herpes Virus (KHV)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Unknown	Yes	No	Yes	Unknown	Possible on farms only



Photo by John Lumsden

KHV causes severe losses in koi and common carp when introduced into previously unexposed populations. It took only 5 years to attain global distribution. The virus is present in Arkansas, but has only been detected in private pools, not on farms or in the wild. It is an OIE reportable disease (see earlier discussion of OIE reportable diseases in Rapid Response Plans of Action section). Introduction of KHV onto koi farms would result in serious fish losses. A perception in the market that Arkansas was KHV-infected would limit commercial koi sales. KHV may result in major kills in wild common carp, but not in other species. There is no risk to human health. KHV can be eradicated from farms, but introductions in the wild would likely produce sporadic fish kills forever.

Muscle microsporean (*Heterosporous sp.*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Unknown	Yes	No	Yes	unknown	Very difficult

The muscle microsporean (*Heterosporous sp.*) is a microsporean parasite that has been spreading in Wisconsin and Michigan. It has also been found in Lake Ontario. The origin of the parasite is unknown, but its geographic distribution is increasing. It renders affected fishes unsuitable for consumption. It has had significant impacts on yellow perch fisheries in Wisconsin. It infects many fish species, including some that are important in Arkansas aquaculture. Its presence in the state would cause severe marketing problems. Temperature limitations of the microsporean are not known. There is no risk to human health. *Heterosporous sp.* is very difficult to eradicate from farms and is likely nearly impossible to eradicate from the wild because of a resistant spore stage.

Salamander iridovirus

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	No	Yes	None

The salamander iridovirus has triggered the deaths of amphibians from North and Central America and Australia. Viruses in the iridovirus group typically infect insects and other invertebrates, as well as fish and frogs. It was initially identified in a massive tiger salamander die-off in Arizona’s San Rafael Valley in 1995. Since then it has been held accountable for the die-offs of tiger salamanders (including an endangered subspecies) at two other locations in the state. It is hypothesized that the virus spreads from one place to another on the feet and feathers of migratory birds as well as by boots, fishing gear, and bait. Salamanders used for bait imported into Arizona from Midwest ranches and farms may be spreading the virus (Herman 2004), so the use of salamanders as bait in this southern portion of Arizona has been banned.

This virus could be a threat to several salamander species endemic to the Ozark and Ouachita mountains in Arkansas. The Caddo Mountain salamander (*Plethodon caddoensis*), Fourche Mountain salamander (*Plethodon fourchensis*), Kiamichi slimy salamander (*Plethodon kiamichi*), and Sequoyah slimy salamander (*Plethodon sequoyah*) are very rare and possibly threatened with extinction/extirpation. The Caddo and the Fourche mountain salamanders are two that occur only in Arkansas. This virus poses no threat to human health. It does pose an ecological threat to salamander biodiversity. No effective control methods have been established.

Spring Viremia of Carp (SVCV)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Unknown	Yes	No	Yes	unknown	On farm only – destroy fish & fallow pond

SVCV is a viral disease not native to North America. It has been discovered outside of Arkansas on farms and in the wild in other parts of the U.S.. Outbreaks in the wild have occurred in Wisconsin and in Lake Ontario. While it is a serious problem in common carp raised in lakes in Europe, U.S. introductions have not led to major fish losses. It is an OIE reportable disease (see earlier discussion of OIE reportable diseases in Rapid Response Plans of Action section), so any occurrence in aquaculture would trigger eradication efforts on the affected farm. This would result in an immediate and severe impact on the ability of Arkansas farmers to ship fish. It may also produce significant losses in cultured cyprinids. The primary species affected are common carp and the Asian carps. However, the virus infects a wide variety of fish species and has the potential to harm endangered cyprinids. The high summer temperatures that occur in Arkansas may restrict the distribution of the virus and may prevent permanent establishment in the state. There is no risk to human health. There is little potential to manage SVCV feasibly if it becomes established in the wild. Destruction of infected fish and fallowing of ponds is effective on hatcheries.

Taura Syndrome Virus (TSV)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Unknown	Yes	No	Yes	Unknown	Very difficult

TSV is an economically important disease of wild and cultured penaeid shrimp. Outbreaks have occurred in farmed shrimp in the Americas, Indonesia, and China since first being described in the Taura region of Ecuador in 1992 (APHIS Impact Worksheet 2004, Lightner et al. 1995). Hawaii reported the first occurrence of TSV in the United States in May of 2004 when an outbreak killed more than 95% of the white shrimp *Penaeus vannamei* at an aquaculture farm in Kahuku (CTSA Publication No. 121 1996). The first outbreak in Texas occurred in 1995 along the southern and central Texas Gulf Coast (APHIS Impact Worksheet 2004). The second outbreak of TSV in farmed Pacific white shrimp occurred in 2004 in Cameron and Willacy counties, Texas. Shrimp mortality for the second outbreak ranged from 80-90 percent but usually varies from 5-95 percent.

TSV is primarily an illness of the outer exoskeleton in shrimp (CTSA Publication No. 121 1996). Shrimp infected with TSV have scattered, black-spot lesions along their outer skin or shell, in the cuticular epithelium, and subcuticular connective tissues of the gills, mouth, esophagus, stomach, hindgut, and general body (Lightner et al. 1995). The lesions have a buckshot or peppered appearance that is characteristic of TSV. Shrimp also display expansion of red chromatophores in the appendages and will have an empty gut. Shrimp displaying the above-mentioned signs usually die during the molting process.

TSV has been found in the feces of seagulls feeding on infected shrimp in Texas (Garza et al. 1997). It remained infectious after passing through the intestinal tract of the seagulls. The gulls could provide a mechanism for the rapid spread of TSV within a single farm and between nearby farms.

Viral Hemorrhagic Septicemia (VHS)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	Unknown	Ponds & hatcheries only



Photo by Photo Mohamed Faisal, Michigan State University

No strains of VHS have been detected in Arkansas and it is an OIE reportable disease (see earlier discussion of OIE reportable diseases in Rapid Response Plans of Action section). Type-I is not present in the U.S., but is an important pathogen of rainbow trout. VHS, Type-IVa, has long been present in the Pacific Northwest and is not an important pathogen. However, Type-IVb has recently been introduced into the Great Lakes where it is now spreading to inland lakes and is producing significant losses in many fish species. Type-IVb produces heavy losses in wild sport-fish. It has had a severe impact on capture fisheries in the Great Lakes region. If introduced into Arkansas, it would have a devastating effect on the ability of Arkansas farmers to ship out of state. The high summer temperatures that occur in Arkansas may restrict the distribution of the virus and may prevent permanent establishment in the state. Type-I may be expected to produce severe effects in the put and take rainbow trout fisheries in Arkansas. Ecological damage would occur primarily to wild fish living in trout streams. However, winter outbreaks in other waters cannot be ruled out. There is no risk to human health. VHS could be eradicated from farms and hatcheries, but introductions of VHS into the wild would be limited only by temperature.

Whirling Disease (*Myxobolus cerebralis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	No	Ponds & hatcheries only



Map from http://www.protectyourwaters.net/hitchhikers/others_whirling_disease.php.

Whirling disease is a myxosporean parasite of salmonids, especially trout. It has spread throughout the U.S. and it is now found in most trout-producing states, but has not been reported in Arkansas. Whirling disease produces deformities and heavy losses in cultured trout, especially in earthen ponds. It has been shown to affect important sport fisheries. There is potential for whirling disease to impact trout fisheries in Arkansas, but is not likely to harm native species. There is no risk to human health. Whirling disease can be controlled on farms, but there has been no feasible control in the wild due to a resistant spore stage.

White Spot Syndrome Virus (WSSV)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	Unknown	None

WSSV is a viral disease of crustaceans, most notably shrimp and crayfish. It is caused by a double-stranded DNA virus of the genus *Whispovirus* (APHIS Veterinary Services 2007). At first, the shrimp stop feeding and then a few days later white spots begin to appear on the carapace and gills (McClenen 2004). The disease is transmitted through the water and feed in shrimp farms and from infected females to their offspring in hatcheries (APHIS Veterinary Services 2007). Once the disease is established, mortality rates increase rapidly and in many cases the entire pond is wiped out (McClenen 2004). WSSV can be found worldwide. Its geographic range includes East, Southeast, and South Asia as well as North, Central, and South America. The disease was first reported in farmed shrimp in Thailand, then China in 1992-93 (Louisiana State University Ag Center 2007). In 1995 WSSV was reported in shrimp farms in southern Texas. From 1992-2002 WSSV was detected in wild shrimp and crabs offshore in the Gulf of Mexico and near shore in Texas, Mississippi, Georgia and South Carolina. It is believed that the disease was introduced into the U.S. from the import of frozen shrimp from Asia (McClenen 2004).

Importing frozen shrimp has been identified as one of the pathways by which WSSV can be transmitted to U.S. farm-raised shrimp, crayfish, and crabs (APHIS 1999). Many of the frozen imported shrimp are processed at U.S. packing plants. Birds that come in contact with effluent or wastes from these plants may unintentionally spread the disease to aquaculture facilities. Effluent discharge and using WSSV-infected shrimp as bait are two direct pathways for virus transmission to wild stock and increase the risk to farmed shrimp.

WSSV was found for the first time in Louisiana crayfish in 2007 (APHIS Veterinary Services 2007). The National Veterinary Services Laboratory (NVSL) confirmed the presence of the virus in samples of freshwater-farmed red swamp crayfish from St. Martin Parish, LA. The source of the infection has still not been determined; however broodstock are collected regularly from wild populations of unknown health. As of June 2007, 13 out of 18 Parishes have found ponds with crayfish that tested positive for WSSV (Louisiana State University Ag Center 2007). WSSV is not known to infect humans. Eating infected shrimp is not considered to be a human health risk. There are no effective treatments for WSSV. Management efforts must focus on prevention.

Plants/Algae

Already present in Arkansas as of 2008

Alligatorweed (*Alternanthera philoxeroides*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Likely	Likely	Costly

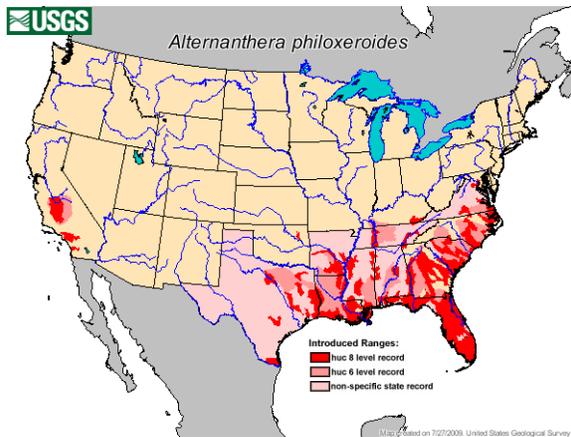


Photo by Chris Evans, River to River CWMA, Bugwood.org

Alligatorweed is an invasive non-native aquatic plant species originally from South America. It rapidly through vegetative reproduction and can grow in terrestrial as well as aquatic settings. The spreading stems are hollow and increase the buoyancy of the weed. Stems can reach lengths of 3 feet or more and root extensively at the nodes (Aulbach-Smith and de Kozlowski 1996). It has leaves in opposite pairs along the stem and small, silvery white flowers. Alligatorweed can produce seeds; however seeds produced are usually not viable. Only vegetative reproduction has been reported in Arkansas. When the plant grows on land, the stems are shorter and not as hollow (CRC 2003).

In the aquatic environment the roots are embedded in the bank or float, allowing the plant to form independent free-floating mats (Julien et al. 1995). These mats can become quite large and dense. Mats can block drainage canals and create flooding during periods of heavy water flow and also serve as habitat and breeding grounds for mosquitoes (Penfound 1940). The dense mats deplete the water of oxygen and block sunlight, causing serious harm to native plant and animal populations. Many human uses of rivers, lakes and reservoirs are adversely affected by these plants, including recreation, angling, irrigation, aquaculture, drinking water treatment, and hydropower generation.

It is thought that alligatorweed arrived in the United States by shipping through the Mississippi and Ohio Rivers (Penfound 1940). Alligatorweed has been found in 12 states throughout much of the southeastern portion of the country and in Puerto Rico (USDA 2007). In Arkansas, alligatorweed is established in ten counties (USGS 2005). The plant's relatively high tolerance of herbicides and high reproductive capacity make it extremely difficult to control (Maddox et al. 1971).

ASPB has listed Alligatorweed as a noxious weed (Circular 11 March 2007). Control of alligatorweed has been primarily through the use of the alligatorweed flea beetle, *Agasicles hygrophila*. Water level drawdown is not an effective means of controlling alligatorweed in southern states because the temperatures do not become cold enough to damage the roots (Hoyer and Canfield 1997). Herbicides such as triclopyr can be used for control in Florida ponds and partial control can be achieved with 2,4-D and glyphosate (Thayer et al. 1986). Use of the alligatorweed flea beetle has been effective in controlling growth in many areas of the United States (Julien et al. 1995). The beetle is native to Argentina and was released in 1964 in California, Arkansas, Alabama, Florida, Georgia, Louisiana, Mississippi, and South Carolina (USACE 2001). Populations did not become established in Arkansas or California (Buckingham 2002). Larvae and adult beetles feed primarily on the leaves but also feed on the plant stems, producing small holes in the weed (USACE 2001). The beetle destroys the plant's stored food and interferes with its ability to produce new food. The beetle may not survive winter temperatures in Arkansas.

Brazilian waterweed (*Egeria densa*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Unknown	Unknown	Chemical & Biological

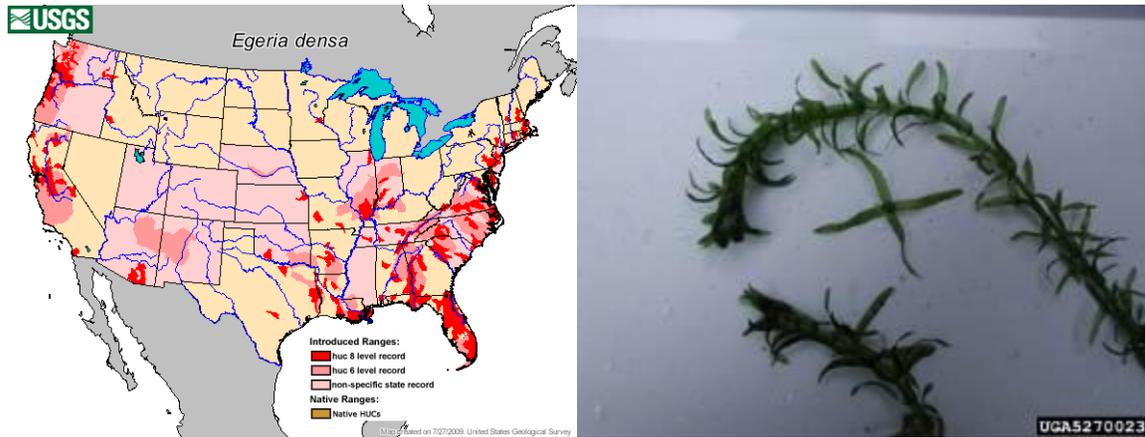


Photo by Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Brazilian waterweed is a submersed aquatic plant native to South America that arrived in the United States in 1893 (USDA-NRCS 2008). In South America it is found growing in slow moving lakes, ponds, streams, rivers, and lagoons (Countryman 1970). It can be either rooted in the substrate or free-floating in the water with stems reaching over 6 feet in length (Aulbach-Smith and de Kozlowski 1996). Leaves have very fine-toothed edges that are barely visible without the use of a microscope (Cook and Urmi-König 1984). Although very similar in appearance to hydrilla and native elodeas, it can be distinguished mainly by its smooth texture and larger overall size. Rapid growth occurs in the spring and summer, forming dense populations that can impair recreational activity as well as suppress the growth of other aquatic plants (Aulbach-Smith and de Kozlowski 1996). Other aquatic plants such as alligatorweed and waterprimrose can grow on top of mats of Brazilian waterweed. Reproduction by fragmentation is most likely the usual way that this species spreads (Countryman 1970). Brazilian waterweed is a popular aquarium plant and its introduction to the United States has been thought to be through the aquarium trade. It was sold in the state of Washington in pet stores under the name “anacharis” until 1996 as well as in plant nurseries as an “oxygenator” plant in aquaria (Weatherby 1932). Anacharis is a term used by commercial aquatic plant suppliers for a variety of oxygen plants including the true elodeas and Brazilian waterweed (South Carolina Department of Natural Resources, no date). It is considered an invasive species in Maine and South Carolina, and also as a noxious weed in Alabama, Vermont, and Washington (USDA-NRCS 2008).

Populations are established in Pulaski, Hot Springs, and Conway Counties of Arkansas (USDA-NRCS 2008, USGS Nonindigenous Aquatic Species Database). Excellent chemical control has been gained through the use of diquat as well as good control with copper-containing chemicals (USACE No date(a)). Biological control methods include using triploid grass carp, which have been observed to consume it in laboratory trials (Pine and Anderson 1991).

Common reed (*Phragmites australis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	No	Yes	Possible, but perpetual



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

Common reed is a perennial grass that develops from thick, white, hollow rhizomes deep in the soil (Aulbach-Smith and deKozlowski 1996). Stems reach 9-10 feet or more in height and are leafy up to the inflorescence. The leafy stem is topped by a large tawny, brown, purplish or silvery panicle of flowers that grow over 1 foot long. It is often found in brackish wetland areas (Marks et al. 1993). Growth is greater in fresh water but it may also survive in acidic wetlands. Once established, large colonies of this grass can occur and spread rapidly by rhizomes (Aulbach-Smith and deKozlowski 1996). It is commonly regarded as an aggressive, unwanted invader in the East, Upper Midwest, and most recently in southern Louisiana (Marks et al. 1993).

During the 1970s, botanists became alarmed at how rapidly the species pushed into new territory and formed dense patches that crowded out other plants (Milius 2002). A 2002 study compared modern samples of this reed collected across the continent with historical specimens collected prior to 1910 (Saltonstall 2002). Pre-1910 samples showed a wide distribution across the continent of 11 haplotypes of this reed considered native to North America. One haplotype was found to be more similar to populations in Europe and across Asia. Today, this haplotype is the most common and has the most widespread distribution of any in North America. Three native haplotypes from the pre-1910 samples have disappeared from the New England area, indicating that the extinction of reed lineages may have occurred over the past century as well. Results indicate that an introduction of a non-native strain has occurred, and the introduced type has displaced native types as well as expand the range of the species in the North America. At present, this non-native reed occurs throughout the whole of the continental United States, however the problems caused are most severe along the Atlantic coast (Blossey et al. 2002).

Direct economic damage has not been assessed or reported because it is largely a weed of natural wetland areas (Blossey et al. 2002). Vegetation structure of brackish tidal marsh is altered when tall, dense, monotypic strands of reed replace relatively diverse shortgrass communities (Windham and Lathrop 1999). In Massachusetts, it is threatening the state rare plant

Myriophyllum pinnatum by reducing the open water and shading aquatic vegetation (Marks et al. 1993). Reed populations alter the structure and function of diverse marsh ecosystems by changing species composition, nutrient cycles, and hydrological regimes (Blossey 2003). The reed decreases soil surface salinity, marsh water levels, and flattens the marsh surface, all of which would alter ecosystem processes in tidal brackish marshes (Windham and Lathrop 1999). Dense stands in North America can decrease native biodiversity and quality of wetland habitat especially for migrating waterfowl species (Blossey 2003).

Cutting, burning, application of herbicides (particularly Rodeo), or water management schemes are possible control measures (Marks et al. 1993). Areas that have been invaded by reed can be restored through these management techniques, allowing natural vegetation to return.

Monitoring is imperative as reed tends to reinvade. Control techniques may need to be applied numerous times or in perpetuity.

Curly pondweed (*Potamogeton crispus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Unknown	No	No	No	Unknown	Chemical & biological

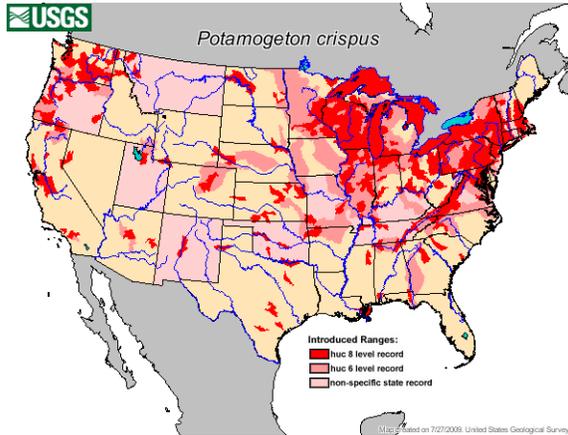


Photo by USGS GLSC

Curly pondweed is a submersed aquatic plant native to Eurasia that is highly branched with flattened stems and reddish upper leaves (Aulbach-Smith and de Kozlowski 1996, Stuckey 1979). It was introduced into the United States and occurs throughout most of the continent in ponds, lakes, and streams (Westerdahl and Getsinger 1988). It has also been found in Africa and Australia (Stuckey 1979). It grows in brackish and fresh water systems. The plant can grow in water as deep as 15 feet and gets its name from the unique appearance of its wavy leaves. The upper portions of the plant grow just under the surface of the water.

Established populations have been documented in Benton County, Arkansas (USDA-NRCS 2008). Reproduction is mostly through tubers produced in large numbers in the springtime, although curly pondweed growing in shallow water has been observed to produce seeds (Hunt and Lutz 1959). Early spring applications of *endothall* or *diquat* have been shown to reduce shoot and root biomass as well as turion formation (Poovey et al. 2002).

Didymo (*Didymosphenia geminata*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Maybe	Maybe	Unlikely to be feasible



Photo by epa.gov

In late spring/early summer of 2005, several area residents and business owners along the White River, directly below the Bull Shoals dam, contacted ADEQ with concerns about a whitish-brown paper-like substance hanging from trees and docks after a typical release of reservoir water. Samples of this material collected by biologists were determined to be Didymo.

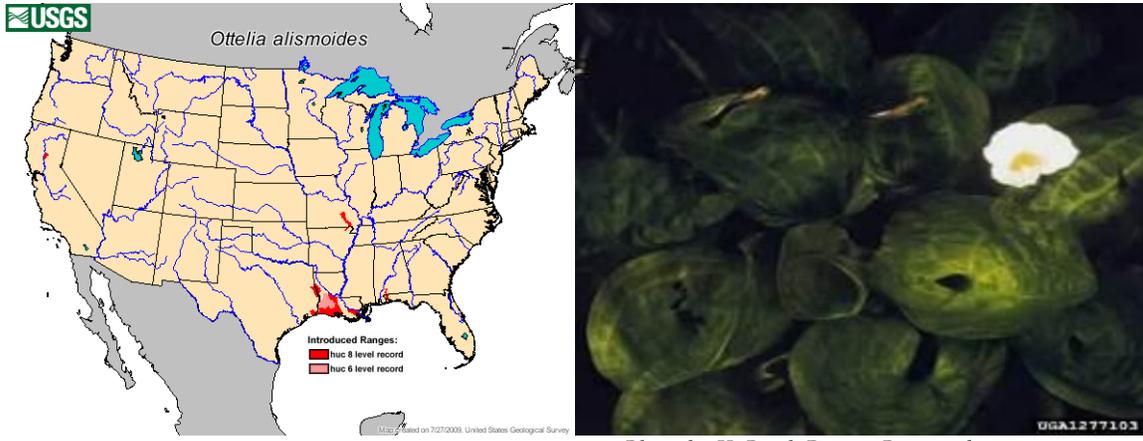
Didymo is a freshwater diatom alga that attaches itself to stones or vegetation by a copious mucopolysaccharide stalk (Kilroy 2004). The stalk attaches strongly to substrate and can become quite thick. During high flows, the long fibrous masses can become dislodged, swept downstream, and accumulated on available debris or fixtures (Spaulding et al. 2005). The result is a whitish brown fibrous material that looks like wet “toilet” paper. The *D. geminata* stalks can be problematic due to its resistance to grazing by invertebrates and resistance to decomposition. The stalks, which persist even after cell death, are large mucopolysaccharide masses that trap fine sediment. Didymo prefers a habitat with cool water and high exposure to UV-B radiation. A stable flow regime and small to medium cobble substrate are preferred. These ideal conditions are commonly located in lake-fed rivers, or in regulated rivers below reservoir impoundments (Kilroy 2004).

This particular alga is known to be an invasive and nuisance species in many regions around the world, including New Zealand and the western United States. Didymo is thought to be the cause of a decline in western U.S. trout fisheries. A study completed in 2006 showed that the number of taxa and total macroinvertebrates found in a heavily infested pool below Bull Shoals dam on the White River decreased as the didymo density increased (Shelby 2006). Both brown and rainbow trout consume macroinvertebrates as juveniles and fish, such as sculpins, that feed on macroinvertebrates, as adults (Shelby 2006). Therefore, it is important to understand the impact of didymo on the macroinvertebrate population in the White River, a world-famous trout fishery.

Currently there are no practical methods for eliminating or controlling Didymo in Arkansas rivers where it is now present. High volume releases from hydroelectric dams located on the White River tend to keep Didymo biomass in check, although it continues to be present and can bloom heavily again during years of lower releases. Thus far efforts aimed at Didymo have focused on awareness and education to prevent or slow the spread of this invasive to other waters. Specifically, the Arkansas Game and Fish Commission (AGFC) has posted signs at all angler access points on infected waters warning anglers of the presence of Didymo and encouraging them to check, clean, and dry their equipment. This information has also been placed on the AGFC website and in the annual trout fishing guidebook. Specific cleaning steps provided to anglers include the use of a solution of 2% bleach or 5% saltwater or detergent. Hard items should be scrubbed and soft items soaked for at least 30 minutes. Cleaned gear should be allowed to dry for 48 hours before using again.

Duck lettuce (*Ottelia alismoides*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Maybe	Maybe	No	unknown	unknown	uncertain



Duck lettuce is a submersed macrophyte that thrives in lake shoreline areas, marsh ponds, irrigation ditches, and stream margins in water ranging from .05 to 1 m deep. It reproduces solely by seeds, is slow to spread, requires constant water levels, and its foliage does not tolerate drying out. This species is native to the tropical areas of Asia and Australia. Duck lettuce is generally not considered a top invasive plant in the United States. It is, however, a Federally Listed Noxious Weed.

Duck lettuce was first discovered in the United States in 1969 in rice field ditches of Cameron Parish, Louisiana. It expanded east by 1986 to the Bayou Teche drainage and other coastal zones of Louisiana. A single population discovered in Butte County, California, (the Lower Butte drainage) in 1977 was quickly eradicated and no plants have been observed since. It was not recorded again until 2000 when several flowering populations were found in Missouri at newly created marsh ponds in the Black River drainage. Due to the location, biologists suspected introduction by waterfowl. Duck lettuce was collected most recently in Florida in 2003 in Thompson Bayou, a tributary of the Escambia River adjacent to the University of West Florida. Populations in Louisiana are believed to remain localized.

In Arkansas, a long established colony in Lake Chicot is still only about 18 m² in size. Where introduced to rice fields and agricultural irrigation ditches outside of the United States, it is not considered a serious weed.

Eurasian watermilfoil (*Myriophyllum spicatum*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	Likely	Unlikely to be feasible

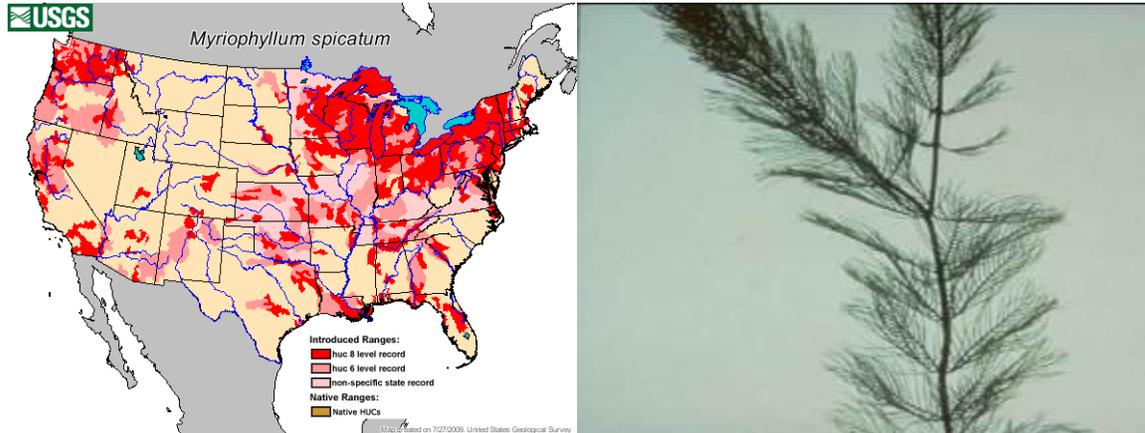


Photo by USGS GLSC

Eurasian watermilfoil is a submersed aquatic plant that has become a major nuisance species throughout much of North America (Johnson and Blossey 2002). There is general agreement that Eurasian watermilfoil was introduced to North America, but the exact timing and location of its introduction(s) are disputed (Reed 1977, Couch and Nelson 1985). It was first collected in the Chesapeake Bay area in 1902 (Steenis 1967). It now occurs in every state in the nation except Wyoming (Jacono and Richerson 2008). Large infestations of this plant are found throughout the eastern United States with extensive populations reported in and near Chesapeake Bay, Tennessee Valley Authority Lakes, and Chatahoochee and Homosassa, FL (Weldon and Blackburn 1973). Eurasian watermilfoil has been sold as an aquarium plant and was likely introduced into the TVA reservoirs in Tennessee via the aquarium trade (Reed 1977).

This aggressive weed is native to Europe, Asia, and North Africa. A number of milfoil species exist in the United States and many of these species are similar to each other in appearance. It closely resembles the native northern watermilfoil *Myriophyllum sibiricum*. The similarity of the species has led to much confusion about species identity which has led to debate over when the species was actually introduced.

It is a perennial plant that is rooted in the lake bottom (Johnson and Blossey 2002). It occurs in a wide variety of habitats and typically grows in water depths of 3-12 ft. In Lake George, NY, the optimal depth was at 10 ft. while at 16 ft. only occasional scattered plants were found (Madsen et al. 1988). The plant thrives in flowing and standing water and tolerates a wide range of temperatures (Mullin et al. 2000). It also tolerates a broad range of environmental conditions, except for acidic waters (Reed 1977). Once established in a new site it can grow very rapidly, creating dense canopies on the water surface - summer growth can be as much as 5-7 cm per day (Reed 1977). As stems near the surface, they branch profusely and reduce the light availability for deeper-growing plants. It is able to shade out and out-compete desirable native species and form colonies over large areas of some water bodies. Rapid domination of littoral zones and

suppression of native plants has been noted in several localities (Madsen et al. 1991). It also forms dense root mats that may play a role in competitively excluding some species (Madsen et al. 1991) as the plant will more readily take up nutrients from the soil.

It spreads very rapidly by both vegetative reproduction and by seeds (Weldon and Blackburn 1973, Reed 1977, Smith and Barko 1990). Seeds have been able to germinate under laboratory conditions and may have potential to germinate under the right conditions in nature (Madsen and Boylen 1989). Stem fragments are important for the spread and colonization of new habitats while local colony expansion is achieved mainly by stolons (Madsen and Smith 1997). Stolon growth may be more successful than spreading by fragmentation but it is more restricted spatially. Forty-six percent of the fragments that settled onto the substrate successfully established growth and provided for a more rapid rate of population expansion. Continued spread is primarily related to boating activities (Mullin et al. 2000).

Dense mats of Eurasian watermilfoil can interfere with recreational activities such as swimming, boating, fishing and waterskiing. In Washington State, private and government sources spend about \$1,000,000 per year on Eurasian watermilfoil control. Other states and provinces (Minnesota, Wisconsin, Vermont, New York, and British Columbia) spend similar amounts, with several million dollars spent annually in northern tier states (Mullin et al. 2000). In New York State alone annual costs are estimated at \$500,000 (Johnson and Blossey 2002).

Eurasian watermilfoil is found in lakes Ouachita and Hamilton in Arkansas (Jacono and Richerson 2008).

Giant Lyngbya (*Lyngbya wollei*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	Yes	Yes	Likely	Unknown



Photo by Aga Pinowska, benthos.org

Lyngbya is a filamentous Cyanobacterium composed of a single series of cells surrounded by a tough covering or sheath (Bayne 2005). The filaments vary in size and length and may be crowded together in thick, tangled mats. There are over 60 different types of Lyngbya that live on bottom substrates in fresh, brackish and marine waters. Most of the freshwater forms are not troublesome. However, in the mid to late 1970s a new, noxious form of Lyngbya began to appear in southeastern ponds and lakes. Giant Lyngbya has filaments 6-10 times the diameter of most other freshwater forms and exhibits extremely aggressive growth, resulting in tons of plant material per surface acre of water.

Lyngbya thrives in warm, slightly alkaline waters with abundant nutrients (Bayne 2005). Growth begins on the pond bottom down to depths of about 6 feet in late winter and early spring. As the water warms, the thick bottom mats trap gas produced during photosynthesis and float to the pond surface. The mats block sunlight penetration and may last for several years. This degrades water quality and threatens fish health. It also hoards nutrients from the other occupants of the water and interferes with recreational uses of ponds such as fishing, boating and swimming. It produces volatile organic compounds that cause musty odors around the pond and off-flavor in water and fish. It is known to produce toxins (*aplysiatoxin*, *debromoaplysiatoxin*, *lyngbyatoxin-a*, *saxitoxin*) that can cause human illness upon contact and has been shown to produce the potent, acutely lethal neurotoxin *saxitoxin*, when tested in mouse bioassay (Carmichael et al. 1997). Giant lyngbya samples that appear healthy (greenish blue-black color of filaments) were found to be toxic while those that appear unhealthy (brownish yellow in color) were not toxic. It is very likely the third cyanobacterial genus to produce paralytic shellfish poisons or PSPs. In various Florida springs, such as Ichetucknee Springs State Park, Alexander Springs, and Crystal River, people that have come in contact with mats of lyngbya have experienced skin reactions, respiratory distress and have required emergency ambulance assistance (PBS&J no date).

Once established it is almost impossible to control with current physical, chemical and biological tools that are approved for use in waters where fish grow for human consumption (Bayne 2005).

Copper compounds and *diquat* have been used with limited success. A relatively new algaecide, *peroxyhydrate*, has also been used with some success. It is difficult to kill because it forms a thick sheath around the cells in the filament, preventing penetration of herbicides. Grass carp do eat giant lyngbya but only if there is little else in the pond for them to eat. Mechanical harvesting is expensive, may spread the plant by fragmentation, and does not affect the lyngbya growing on the bottom. Giant lyngbya has been found in the United States in locations including the lower Rio Grande River (Owens et al. 2005), throughout Florida, in western Lake Erie (Henry 2007) and has been identified in Lake Dardanelle (Nathan Stone, personal communication 2006). The population in Lake Erie survived the winter and has been growing on top of the old growth (Henry 2007).

Hydrilla (*Hydrilla verticillata*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	Likely	Unlikely to be feasible

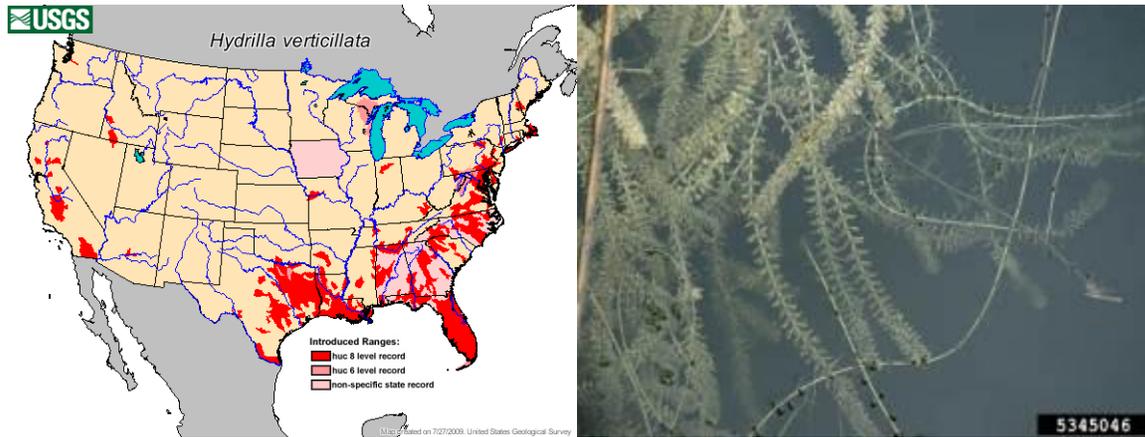


Photo by David J. Moorhead, University of Georgia, Bugwood.org

Hydrilla is a problematic invasive aquatic plant species in the United States and is considered a major aquatic weed problem throughout the southeastern part of the country (Van Driesche et al. 2002). It is a submersed macrophyte distributed throughout Asia, Australia, New Zealand, South America, North America, and many of the Pacific Islands (Madeira et al. 2004; Langeland 1996). There are also localized populations found in Europe and Africa (Madeira et al. 2004).

The dioecious form of hydrilla was first discovered in the United States in 1960 in two locations in Florida: Crystal River and a canal near Miami (Langeland 1996). In the early 1950s a Tampa Bay farmer started deliberately planting and marketing it for aquarium use. Hydrilla and several other members of the family *Hydrocharitaceae* are popular with the aquarium industry because they are hardy, tolerant plants. The farmer received the hydrilla from a Missouri tropical plant and fish farmer who had originally imported the species from Sri Lanka. By the early 1970s, it was established in major water bodies of all drainage basins in the state, and by 1988 the Florida Department of Natural Resources estimated over 20,000 ha of water in Florida contained it (Langeland 1996). This dioecious type female has spread throughout the south and as far west as Texas, with separate distributions in California (Madeira et al. 1978). Before the early 1980s, separate aquarium plant growers in the Washington D.C. area imported the species from Korea and began to market it for aquarium use as well, resulting in the second type (monoecious) establishing itself in the northeastern part of the county. The monoecious plant has spread through the Atlantic states as far south as Georgia, with northern populations reported in Pennsylvania, Connecticut, Massachusetts, and Maine (Langeland 1996). Separate distributions also occur in California and Washington State. Today, it can be found in a wide variety of freshwater habitats including canals, springs, streams, ponds, lakes, rivers, and reservoirs (Balciunas et al. 2002). It is present in several Arkansas lakes (Lakes Ouachita, Hamilton, DeGray) (Jacono et al. 2008).

It forms large, dense stands that restrict water flow. It can reproduce by fragmentation, tubers, turions, and seed. Tubers in soil can remain viable for several years and allow the plant to survive cold temperatures and drought. It has a high rate of growth and lower light requirements than most other submersed plants, allowing it to grow at greater depths and compete well against other plants. It forms dense canopies at the water surface, successfully choking out competition.

It was first listed on the Federal Noxious Weed list in 1979 and is also currently identified in the noxious weed laws of Florida, Louisiana, Texas, California, South Carolina, North Carolina, Oregon, Washington, and Arizona.

Hydrilla infestations can cause multiple types of economic and ecologic damage. In drainage canals, mats of hydrilla can greatly reduce flow, which can result in flooding and damage to canal banks (Langeland 1996). Thick mats of hydrilla can hinder the flow rate of irrigation operations by as much as 90% and can impede the operation of irrigation structures (Balciunas et al. 2002). Fragmented plant material builds up on and clogs intakes for hydroelectric power generation. In South Carolina, the St. Stephen powerhouse operations had to be shut down for 7 weeks due to severe hydrilla infestation on Lake Moultrie, resulting in an estimated loss in power generation for the plant of \$2,000,000. Expenses due to repairs, dredging, and fish loss were roughly \$2,650,000. It can also affect recreational activities such as boating, fishing and swimming. Economic loss from drops in tourism can be substantial. For example, the economic activity contributed to Orange Lake in North Central Florida was almost \$11.0 million. During the years that hydrilla completely covered the lake this amount was virtually lost (Langeland 1996). Mullin et al. (2000) reported that costs for hydrilla control in the United States had approached \$25 million annually. California spends nearly \$1.8 million annually to eradicate hydrilla infestations (Balciunas et al. 2002). Ecologically speaking, it has the ability to displace native aquatic plants and whole communities wherever introduced. Massive amounts of hydrilla can alter dissolved oxygen, pH, and other water chemistry parameters.

Control by harvesting is uneconomical. Seasonal drawdowns are sometimes effective. Like harvesting, herbicidal control is only intended to reduce but not eliminate hydrilla. Biological control with grass carp generally provides adequate control, at a fraction of the cost of other methods. The USACE is field-testing the "Pakistani fly" (*Hydrellia pakistanae*) whose larvae feed exclusively on hydrilla in Arkansas lakes.

Purple loosestrife (*Lythrum salicaria*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	No	Possible	Feasible

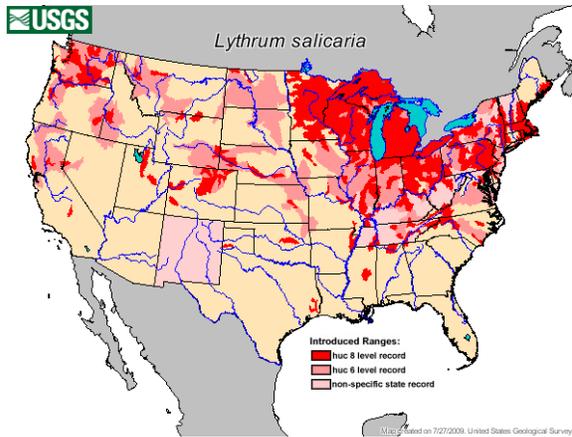


Photo by Steve Dewey, Utah State University, Bugwood.org

Purple loosestrife is a perennial plant that grows in the shallow margins and banks of wetlands, lakes, and streams. It has spikes of purple to pink mauve flowers all summer long and forms large clumps. Other plants often confused with it include gayfeather and blue vervain. It can be distinguished by the square stem and opposite or whorled lanceolate leaves, which hug the stems.

It is native to European wetlands and arrived in North America accidentally in ship ballast and was imported as a bee plant. It is often planted as an ornamental flower, or “pass along” plant due to its rapid spread. Several cultivars of this plant can be found commercially and are usually listed as “sterile”. This appears to be a misnomer as the sterile plants often produce an abundance of viable seeds. The ASPB, as well as many other states, lists the plant as a Prohibited Noxious Weed. This designation prohibits the sale, possession, propagation, and trading of all *Lythrum* species, including “sterile” cultivars.

It reproduces by seed and division of the plants. One plant can produce hundreds of thousands of seeds every year. These seeds may be viable for several years, waiting for the optimum conditions for germination. Seedlings can germinate in muddy depths of a wetland and float up to the water surface to be carried by the current to infest new areas. Once introduced into new areas, the plant has flourished and spread rapidly. Currently, it is a serious pest in the Great Lakes region, where it has overtaken most wetlands. Arkansas currently has isolated patches, which are being monitored and sprayed. Environmental effects include the loss of biodiversity as native vegetation is replaced by this plant. Wildlife suffers due to the loss of food sources.

It is managed by chemical and biological means. Intensive spraying is effective if initiated before the plant has a chance to seed. This must be repeated annually as new plants appear from seed or rootstock. Mechanical removal is not effective because all of the roots must be removed and the tiny seeds scatter widely during the disruption. Non-native beetles and weevils have been introduced into areas with dense populations with some success. These pests appear to prey only on the target plant and hold promise for controlling this plant.

Uruguayan waterprimrose (*Ludwigia hexapetala*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	No	No	unknown

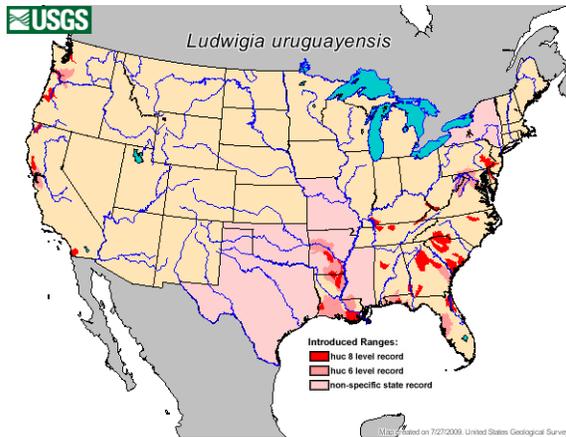


Photo by US Army COE

Uruguayan waterprimrose is native to South America, including Uruguay (Zardini *et al.* 1991), and questionably to portions of the southeastern United States. If native to portions of the southeastern United States, the species has been introduced and established far outside of its native range and is currently widespread from New York south to Florida, west to Oklahoma and Texas and north to Missouri and Kentucky. Populations are also established in California, Oregon, and Washington.

This plant has been found in neighboring Tennessee. It is also listed as a species to watch in Oklahoma, Arkansas' western neighbor. It is currently documented from four counties in Tennessee, three of which are along the Cumberland drainage (including populations along Lake Barkley and the Land Between the Lakes) in the northwestern portion of central Tennessee. It also occurs along the Holston River, where it was observed in the early 1970s, and along Ft. Loudoun Reservoir (Tennessee River), where it was observed in the early 1980s (Webb and Bates 1989).

It can spread by seed, vegetative fragments, and floating mats distributed by downstream flow. It seems likely that the seed of Uruguayan waterprimrose also may be carried to other water bodies and drainages by waterfowl. Because of its large, showy, yellow flowers, it is sometimes sold as an ornamental for water gardens. It is also locally dispersed via boating, human activity, and waterways. However, the original introduction pathway is unknown, but is suspected to have been through wetland nurseries and garden centers.

It is a mat-forming, perennial that is rooted in mud or shallow water and has long, decumbent stems that float on or just below the surface of the water. Leaves of early season growth are compacted to form floating rosettes; each leaf is sub-orbicular to spatulate in shape, shiny, glabrous, and grows from the nodes of the horizontal floating stem. Later season growth has upright stems (up to 1 m tall) from the nodes. Leaves of upright stems are obviously alternate, lanceolate to oblanceolate in shape, and 3 to 6 cm long and 2 cm or so in width. The ascending stems are sparsely to densely pubescent, becoming reddish and woody with age. Flowers are

solitary on stalks from the upper leaf axils and have 5 or occasionally 6, large, yellow petals that are up to 3 cm long. The fruit is a cylindrical capsule up to about 2 cm long, containing numerous seeds.

It typically roots along the shoreline and sends out horizontal stems that branch and form mats. These mats may extend 30 feet or more from the shoreline and completely cover narrow pockets and sloughs. It frequently forms monospecific colonies and in the TVA reservoirs is often mixed with alligatorweed, which has a similar growth form. During periods of high flow or wind, vegetative fragments and large mats may be dislodged and moved to open water areas where flow and/or prevailing winds then move them to new areas. It can also reproduce from seed that can be dispersed by flow and presumably by waterfowl and aquatic mammals.

It colonizes a variety of habitats including swamps, ditches, open-water areas of marshes, shoreline areas of lakes and ponds, and stream margins. Dense mats can restrict flow in streams and drainage ditches and hinder access to shoreline areas and the upstream ends of shallow sloughs.

Water hyacinth (*Eichhornia crassipes*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	Likely	Unlikely to be feasible

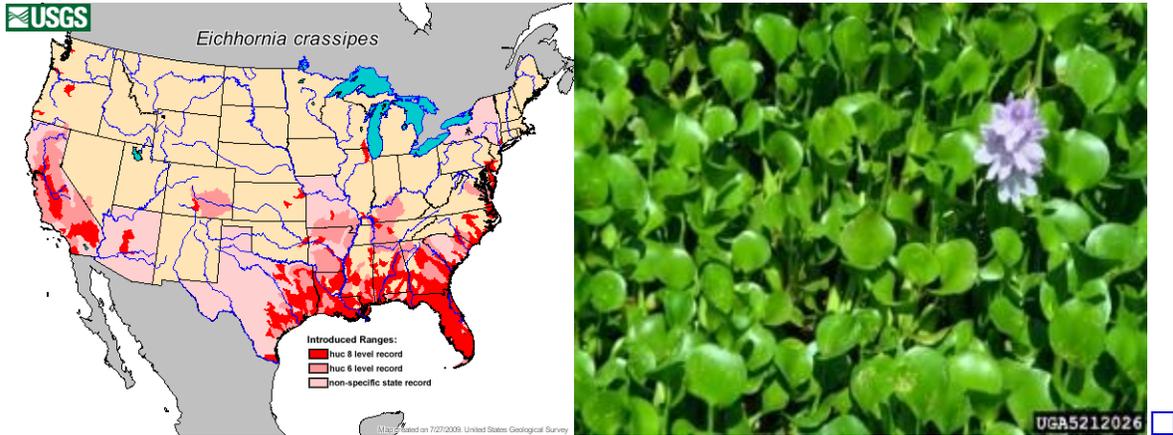


Photo by Katherine Parys, LSU, Bugwood.org

Water hyacinth is a member of the Pickerelweed family. It is native to South America but has been naturalized in most of the southern United States and many of the world’s subtropical and tropical climates (Center et al. 2002). Populations have been reported from more temperate states including New Jersey, Kentucky, Tennessee, Missouri, and Arkansas, where plants grow as annuals but do not persist vegetatively through the winter (Jacono and Richerson 2006). The plant is currently thriving throughout the Southeastern United states. It was first introduced into the United States in 1884 at the Cotton Centennial Exposition in New Orleans and has rapidly become a pest throughout the southeastern states (Weldon and Blackburn 1973; Penfound and Earle 1948).

It is a free-floating plant distinguished by its bright green, polished looking leaves (Weldon and Blackburn 1973). The roots are fibrous, unbranched, with a conspicuous root cap (Penfound and Earle 1948). The plant has spongy bulbous stems that allow for buoyancy. Flowers are light blue to lavender and their beauty has helped to distribute this plant as an ornamental throughout the United States. It is popular with water garden enthusiasts for its decorative properties as well as its ability to consume excess nutrients and shade the water surface. It usually grows in dense mats with new plantlets attached on floating green stolons (Langeland and Burks, no date). When plants are deposited on an open lawn they are able to survive for 6 days in sunny weather and up to 12 days in cloudy weather. Plants cannot survive water temperatures less than 23°C or higher than 34°C (Penfound and Earle 1948). During winter studies of water hyacinth, the portion of the plant above the surface of the water would be destroyed by freezing temperatures while the protected stem bases would survive to regrow (Owens and Madsen 1995). However, the plants are not able to survive extended periods of below zero temperatures.

Plants produce abundant seeds, but it is the speed at which this plant produces daughter plants through vegetative production that plays a more important role in the colonization of a water body by this species (Penfound and Earle 1948, Owens and Madsen 1995).

Dense growth can clog canals and water intakes as well as restrict navigation along rivers and lakes (USACE No date(b)). It often becomes so abundant in natural streams that it impedes runoff and increases flooding conditions in many areas (Penfound and Earle 1948). Fish populations and associated tourism can be adversely affected as well.

In 2006, ASPB named water hyacinth a Prohibited Noxious Weed. It is now illegal to buy, sell, trade, possess, or propagate this plant. Perennial populations have been established in Southeastern Arkansas near the Arkansas River and associated backwaters and oxbow lakes. There are also known colonies near Camden, Lake Dardanelle, and the Little Maumelle River near Little Rock. These appear to be unaffected by winter temperatures. The northern limit for this plant is unknown.

In field studies the number of plants doubled every 12.5 days. At this rate, an acre of plants (roughly 544,360) would be produced in 8 months (Penfound and Earle 1948). It can be easily spread by natural wind and water currents, as its leaves act like sails and move where the wind blows (Holm et al. 1977). Navigation can become almost impossible due to the size and weight of its mats. Annual costs of management programs range from \$500,000 in California to nearly \$3 million in Florida (Mullin et al. 2000).

It is known as one of the world's worst weeds (Holm et al. 1977). A solid mat can shade out and replace native aquatic plants.

Water lettuce (*Pistia stratiotes*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	Yes	Feasible – mechanical & chemical

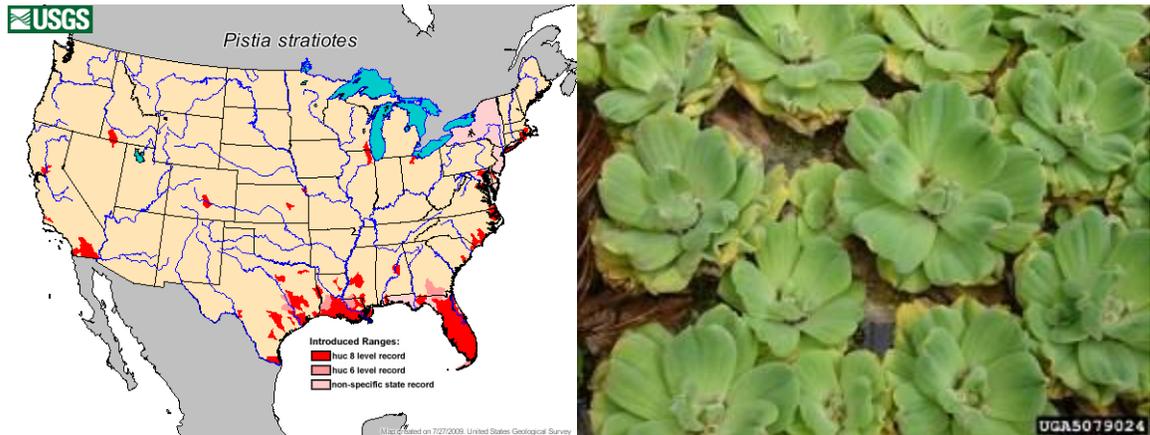


Photo by Troy Evans, Eastern Kentucky University, Bugwood.org

Water lettuce may have been introduced to North America by natural means or by humans via boat ballasts (Stoddard 1989). It was seen as early as 1774 in the St. Johns River (Van Doren 1928), where trade may have provided an early avenue for introduction (Stuckey and Les 1984). It is now considered one of the most widely distributed hydrophytes in the tropics (Holm *et al.* 1977). In North America, it occurs in peninsular Florida and locally westward to Texas (Godfrey and Wooten 1979). It has also been known to persist in coastal South Carolina (Nelson 1993). It occurred in 68 public water bodies in Florida by 1982 and in 128 water bodies by 1989, but total abundance was reduced by half over the same time period as a result of a statewide management program (Schardt and Schmitz 1990). In some states, it continues to be sold through aquarium supply dealers. While it is not on the U.S. Federal Noxious Weed List, it is listed as a noxious weed in Texas, Alabama, and California.

It is a free-floating plant that resembles a head of lettuce with thick green leaves. The leaves are covered with very fine hairs and are arranged in a spiral pattern. It is an aggressive invader that can form thick floating mats that disrupt submersed plant and animal communities and interfere with water movement and navigation (Bruner 1982, Attionu 1976, Sharma 1984, Holm *et al.* 1977); and also serves as host for at least 2 genera of mosquitoes (Holm *et al.* 1977). These mats degrade water quality by blocking the air-water interface and reduce oxygen levels in the water. This may reduce or eliminate native submersed plants, fish, and other animal communities. It reproduces vegetatively and sexually; new daughter plants are formed on stolons that grow from the mother plants; seedlings are produced in mild climates (Penfound & Earle 1948).

It is found globally in the tropics and subtropics and can survive for extended periods of time on moist soil, sandbars, and banks (Holm *et al.* 1977). It is not cold tolerant (Holm *et al.* 1977) which limits the growth and potential for spread (Holm *et al.* 1977), but its leaves regrow after moderate freezes. It is considered one of the world's worst weeds (Holm *et al.* 1977).

Several methods have been developed to manage it. Mechanical harvesters and chopping machines are used to remove it and transport it for disposal on shore. Chopping machines grind the plant into bits and the slurry is sprayed across the water. Excellent control has been achieved using chemicals that contain diquat. Two insects are believed to be useful to keep it under control – *Neohydronomus affinis* and *N. pulchellus* (Chikwenhere 1994, Harley et al. 1984). Fish that are able to control submersed plants are ineffective against it.

Not present in Arkansas as of 2008

Giant Salvinia (*Salvinia molesta*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Likely	Yes	Feasible

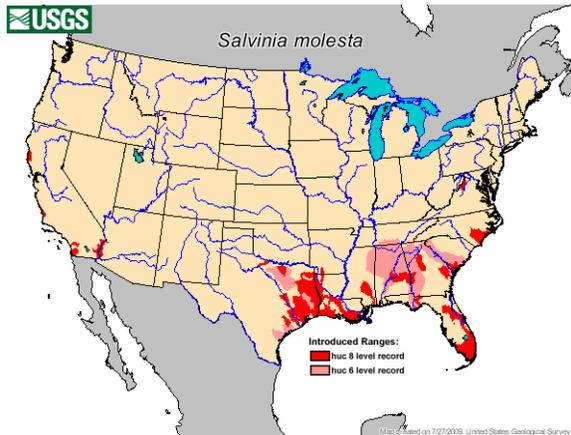


Photo by Troy Evans, Eastern Kentucky University, Bugwood.org

Giant salvinia is a highly invasive floating fern from South America. Currently, it is present in Alabama, Arizona, California, Florida, Georgia, Hawaii, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Texas, and Virginia (Howard 2008). There have been no sightings in Arkansas, but it has great potential to spread to lakes and streams in the southern part of the state. It is limited by cold weather, but its northernmost range is unknown. Lake Caddo, a 35,000-acre natural lake about 1 hour south of the Arkansas on the Texas-Louisiana border, was recently found to have an infestation.

The green to golden leaves lie flat on the water surface when young. As the plant matures the oval leaves can grow up to 1½ inches long and extend out from the water surface. Populations can double in size every 2 weeks resulting in thick mats of vegetation. Under the water surface are root-like structures and spore cases - not known to produce new plants in temperate regions.

It can be spread by a number of means. Floating plants can be carried by currents and wind to connected waterways. It can become entangled in boat motors and trailers to contaminate other water bodies. It is occasionally sold as a water garden ornamental, or can be a “hitchhiker” along with other water plants for sale. It is listed as a Federal Noxious Weed as well as a Prohibited Plant in Arkansas. It is illegal to buy, sell, trade, or possess this plant in the state.

As it spreads over the water surface it can quickly choke out native aquatic plants. The surface can become entirely shaded, disrupting the ecology of the waterway as light and oxygen are blocked. The surface can become so dense that boats cannot navigate through the tangled mats. It, along with other members of the Salvinia family, is regarded as one of the world’s worst weeds as it has caused irrigation, navigation, and agricultural problems in over 22 countries (Holm et al. 1977).

It can be controlled by chemical and biological methods. Herbicides can be effective with repeated applications to catch untreated plants. Weevils have been used in tropical locations with some success. Research is currently underway to study the effectiveness of this weevil in the United States.

Golden algae (*Prymnesium parvum*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Maybe	Yes	No	Yes	Yes	Feasible



Photo by Matt Wargo, 1998, wfsc.tamu.edu

Golden algae is a naturally occurring microscopic flagellated alga that typically occurs in brackish waters. Under certain environmental stresses, it can produce toxins that can cause massive fish and mussel kills. There is no evidence of harm to other wildlife, livestock, or humans. Research is under way to better understand, detect, and manage this alga. It was first found in inland waters in the Middle East, where it caused fish mortalities in aquaculture facilities. It is widely distributed, reported from at least 14 countries and on every continent except Antarctica. It is most often associated with estuarine or marine waters, but can exist in inland waters.

Fish kills from this alga have been documented in inland waters in Texas since 1985. It was first identified in the U.S. in water samples from a 1985 fish kill in the Pecos River (Rio Grande basin). Since then, it has caused fish kills in four other river basins in Texas (Brazos, Canadian, Colorado, and Red River basins). To date, 15 states have reported it. This species is found worldwide in estuarine waters and in some freshwaters that have relatively high salt content. Texas biologists were the first to note its occurrence in freshwater in the Western Hemisphere. Subsequently, other states have reported its occurrence or possible occurrence. Fish kills caused by the algae can be significant, resulting in ecological and economic harm to the affected water bodies.

The toxins released by golden algae are called prymnesins and affect gill-breathing organisms by causing hemorrhaging and interruption of the selective permeability of cells in the gills and also damaging cells of other exposed tissues. All species of fish, bivalves, crayfish, gilled amphibians, and certain plankton species are susceptible to the toxins. Most aquatic insects appear unaffected and adverse impacts to higher vertebrates have not been documented.

Fish kill investigations in Texas indicate a general progression of mortality during a toxic event. Small forage fishes, especially planktivorous species such as threadfin shad (*Dorosoma petenense*), gizzard shad (*D. cepedianum*) and freshwater drum (*Aplodinotus grunniens*) are affected relatively early. Shallow water fishes such as juvenile and young adult sunfish,

minnows, and cichlids are affected next, followed by larger and more mobile fishes such as striped bass (*Morone* sp.), and catfish (*Ictalurus* sp.). Common carp (*Cyprinus carpio*), gar (*Lepisosteus* spp.), and buffalo fish (*Ictiobus* spp.) usually are affected last.

Ecological impacts range from minor reductions in forage fish populations to major declines in fisheries. Central Arizona has suffered marked losses of sport fishes in the last three years due to blooms of golden algae. Fish kills in 2001 resulted in losses to the local economy surrounding Possum Kingdom Reservoir (Texas) estimated in the millions of dollars.

Ultraviolet light treatments and ozonation have been successful in treating small quantities of water.

The alga may be spread from site to site via water and equipment that moves from one water body to another, such as boats and trailers. It is a wise strategy to prevent transporting it through equipment cleaning efforts whenever leaving a water body with golden alga present.

Roundleaf toothcup (*Rotala rotundifolia*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Maybe	Maybe	No	No	Unknown	May be possible

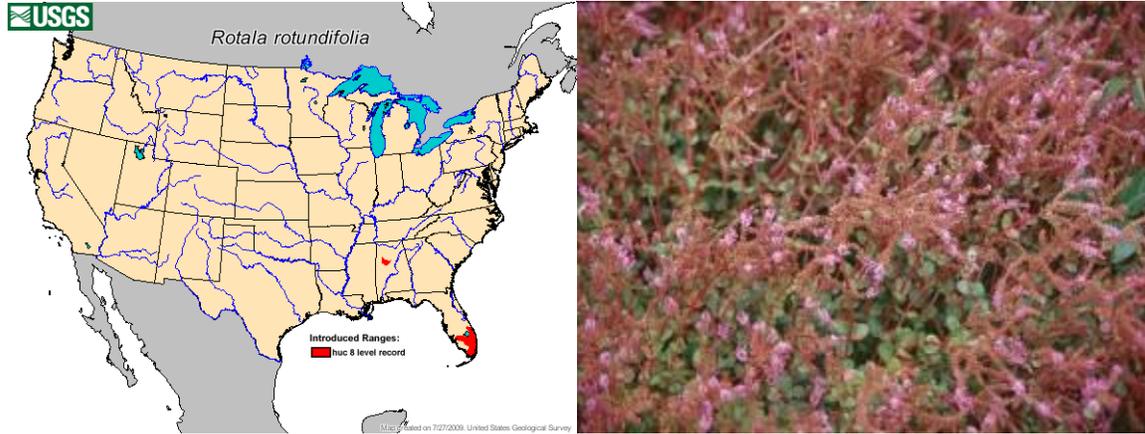


Photo by USGS

Roundleaf toothcup is a nonnative aquatic plant that is popular in the water garden and aquarium trade for its brilliant, rose-colored flowers (Jacono 2008). In water gardens it is an excellent transition plant, growing along the pond edges and onto the surface of the water (Jacono and Vandiver 2007). It is a relative of purple loosestrife, which is an invasive aquatic plant found throughout much of the United States (see section on Purple loosestrife). There is concern that this species will become a similar problem. Lush growth occurs along canal edges in southern Florida (Milius 2003). It is native to higher elevations in India and Southeast Asia but is quickly spreading in southern Florida, most likely due to aquarium release.

In 1996, a population described as a “rapidly expanding infestation” was found in Broward County, Florida (Jacono 2008). The plant has been found since in Lee County, FL (2002) and Tuscaloosa County, AL (2001, 2002, and 2003) (Reese and Haynes 2002, Jacono 2008). The Alabama plants died after the pond was drained and left to dry, whereas the Florida populations have remained even after seasonal fluctuations in water levels (Jacono and Vandiver 2007). This plant has been known to spread by fragmentation as well as by seeds in Florida. Results of growth chamber experiments demonstrated that it can regenerate at a higher capacity than a known successful aquatic invader, alligatorweed (Ervin and White 2007). Plant fragments can be dispersed easily in water bodies. This increases the invasion potential of this plant in wetlands of the United States. Management and/or eradication may be possible through application of 2,4-D (Jacono and Vandiver 2007).

Mollusks

Already present in Arkansas as of 2008

Asian Clam (*Corbicula fluminea*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	Yes	Unlikely to be feasible

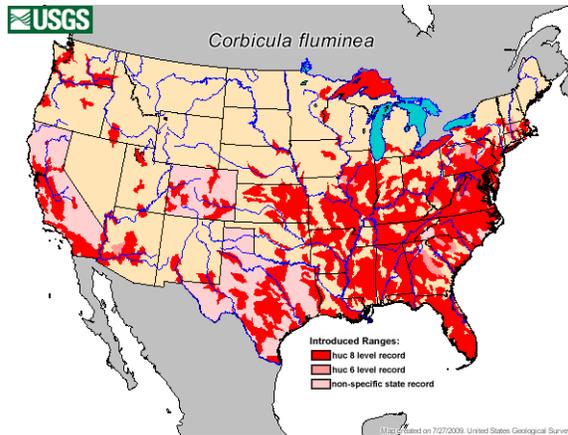


Photo by Noel Burkhead, USGS

The Asian clam was first collected in North America as empty shells in Namaimo, Vancouver Island, British Columbia, in 1924. It was first discovered in the United States in 1938 in the sand and gravel banks of the Columbia River, Washington. Hanna (1966) identified the occurrence of this mollusk with the arrival of immigrant Chinese laborers in the United States.

It has life history traits that allow it to survive in unstable habitats (McMahon 1999). The Asian clam grows rapidly and is characterized by higher filtration and assimilation rates than other bivalves. The spawning season lasts about six months starting in early summer. Fertilization takes place in the inner gills. The first (trochophore) and second (veliger) larval stages develop on the gill. The juvenile is discharged at approximately 1 mm and begins its adult life on the bottom. They reach maturity at a size of 6-10 mm with a life span of about 1-4 years. Their primary source of food is phytoplankton.

This clam causes bio-fouling problems in power plant and industrial water systems, municipal water treatment facilities, and irrigation canals and pipes. It damages centrifugal pumps, clogs straining screens, and contributes to bad taste and odor even after chemical treatment of the water (Sinclair 1964; McMahon 1982, Page et al. 1986).

Ecologically, it can alter benthic substrates and compete with native mussel species for food and space (Foster et al. 2010). Asian clam populations as dense as 131,000/m² have been documented on sand bars in California. Matthews (2007) documented maximum densities of 3,250/m² in the Buffalo River, AR. At these densities, native benthic communities can be stressed from limitations of space and food resources. Some studies suggest that this clam has

little or no effect on native species because if the environment was not already changed by human activities and the native flora and fauna were not already stressed, it could not displace native species. This clam tolerates anthropogenic activities, it has a high reproductive capacity, high growth rate, and short generation time, allowing it to quickly adapt to disturbed environments (McMahon 1982).

Control measures have resulted in additional costs at power plants and industrial water systems. It may compete with native bivalves and other benthic organisms for food and nutrient resources. There has been no documented harm to human health, although there have been periodic large-scale die-offs that create odor and potential pathogen problems. In closed environments, such as power plants, mechanical or chemical control methods can be employed to reduce or eliminate this species where problems occur.

Zebra mussel (*Dreissena polymorpha*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	Yes	Difficult in wild

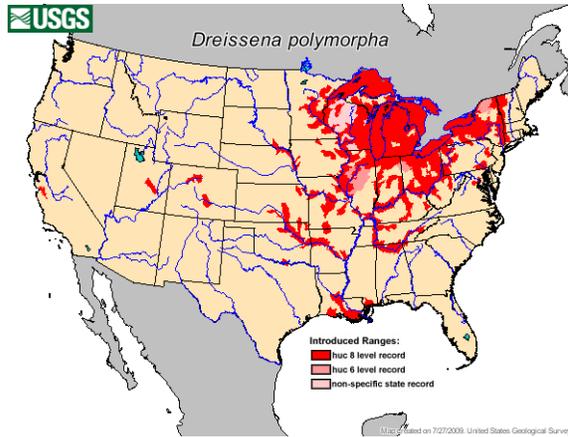


Photo by USGS

The zebra mussel was introduced into the Great Lakes in the ballast water of ships in 1988 (Herbert et al.1989). It has been spread by barge traffic into all major U. S. rivers connected through canals to the Great Lakes. It was first believed to be intolerant of warm water in the southern states, but is now established in the lower Mississippi River. It is also well established in the Tennessee River, where barge traffic can carry it south into the Tombigbee River system. Its effect on native species, especially rare and endangered mollusks, is of particular concern. It filters organic and inorganic particles between 7 and 400 microns, competing with native planktivores for food. The net result is sedimentation of previously suspended organic matter in the form of feces and pseudofeces, shifting energy and nutrient balances from the pelagic to the benthic zone. Increases in water clarity favor increased photosynthesis by rooted aquatic macrophytes, and negatively affect fishes that prefer slightly turbid conditions, such as walleye. Removal of green algae gives cyanobacteria a competitive advantage, as zebra mussels will stop filtering in the presence of cyanobacteria. They settle in high numbers on native mussels (Unionidae), causing suffocation, starvation, and energetic stress leading to death. Loss of native mussel populations has increased dramatically where zebra mussels are present, particularly in the Great Lakes and Hudson and Mississippi rivers. Dense colonization of hard substrates is beneficial to benthic invertebrates, as habitat complexity increases as does availability of organic matter. Spawning reefs of fishes are negatively affected by zebra mussel colonies.

Zebra mussels tolerate salinity to 6 ppt, temperatures to approximately 29° C, and will not settle in currents greater than 7 ft./sec. They filter a wide size range of particles, but select algae and zooplankton between 15-40 microns. Larval stages feed on bacteria.

They are dioecious and fertilize externally. The fertilized egg hatches into a trochophore (40-60 microns, 1-2 days), and there are several stages of free-swimming, planktonic veliger lasting 8-180 days (or longer in cold water). At approximately 350-micron size, the larvae settle as plantigrade mussels, attaching to hard substrates as juveniles. They may mature within the first year of life under optimal conditions; however maturity in the second year is more usual.

Fecundity is estimated at up to 1.5 million eggs per female per year, and survival to adult stage may be less than 1%. They live 3-5 years.

Numerous control methods are available to remove them from substrates or kill them within infested water intakes or on fouled man-made substrates; none of these methods are useful for control in the wild. Controls include mechanical removal (scraping, mechanical scrubbers in pipes), chemical (chlorine, bromine, deoxygenation), thermal, UV light, electric current, and antifouling paints (containing zinc or copper, or slick surfaces such as epoxy that make removal of mussels easier). Natural predators include diving ducks, crayfish, muskrats, and fishes with grinding teeth (carp, freshwater drum, pumpkinseed, round goby, bream, roach, eel, sturgeon, and flounder).

In Arkansas, they have been reported from the Arkansas, Mississippi, St. Francis, and White rivers, Plum Bayou and Bayou Meto. AGFC and USGS jointly conduct monitoring at 12 sites within the state. Adverse impacts to native mussels have been documented in the Arkansas River (Davidson 1997), and they occur at low density on native mussels in the White River near Clarendon. Additional maintenance to water intake structures and lock gates in the Arkansas River drainage has been required due to zebra mussel build up. They were found for the first time in northern Arkansas waters on September 13, 2007 in Bull Shoals Lake. They were also found in Missouri's Lake Taneycomo, which drains into Bull Shoals Lake, at the same time.

Their presence requires vigilance to assure that industrial and domestic water intakes, boat motors, cooling tower intakes, and irrigation systems are not fouled. There likely have been additional economic costs to maintain and clean cooling structures, locks, and water intakes. There have been ecological changes documented in Lake Dardanelle in the vicinity of Arkansas Nuclear One and in the Ozark and Dardanelle pools of the Arkansas River. Managing their introduction to waterways that are not maintained for commercial navigation is feasible. Control through reducing spread requires an aggressive public education effort and diligence among resource agency personnel.

A regional action plan has been approved for this species by ANSTF (Western Regional Panel on ANS 2009). Efforts in Arkansas will draw on the expertise represented by this plan.

Not present in Arkansas as of 2008

All but one of the focal mollusk species not yet present in Arkansas as of 2008 are snails. The concern with introduced snails is that they will compete with native snail species for food and space within the habitat. Many of these species have demonstrated a propensity to attain very high densities in introduced populations. Regionally, snails are a highly imperiled group and their diversity in Arkansas is poorly understood. Disrupting the native snails will most likely have an effect on the native fish, vegetation, and other biota found within the invaded habitat.

Big-ear Radix (*Radix auricularia*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	Yes	No	Possible	Unknown

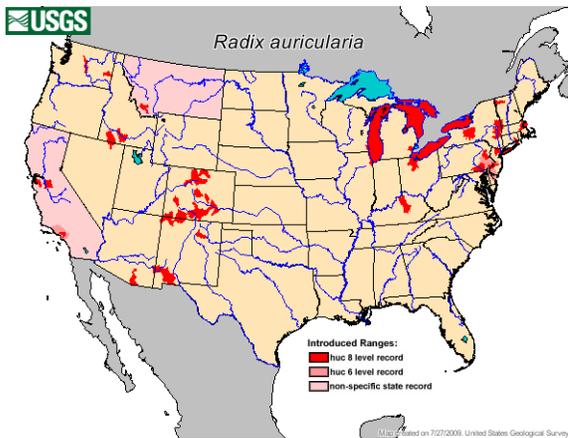


Photo by Chan Sow Yan USGS

These light-to-dark brown, reddish snails are originally from Europe and North Asia. They are 35mm high, 20mm wide, and their bodies are yellow with black spots. In their native range they feed on algae, plants, and carrion in calm waters.

Many snail species are carriers of parasites, especially trematodes. This snail is known to be the first intermediate host of the parasite *Clinostomum complanatum* in Korea (Chung et al. 1998). This Asian parasite can infect humans eating raw fish. The first known human case occurred in Korea in 1995 (Chung et al. 1995). This snail is also a host for the parasite that commonly causes cercarial dermatitis in humans, *Trichobilharzia franki* (Ferté et al. 2004).

Naturalized populations have been found in Southern Idaho, where they live in a diverse range of water temperatures (Kipp and Benson 2011). They are most common in warmer ponds and ditches in the Hagerman Valley but can also be found residing in pool areas of a few cold spring tributaries.

Big-ear radix is invasive and can become a nuisance in Arkansas. Harm to human health has been documented in other countries but not in the United States. Ecological damage has not yet been documented; however the possible threat exists that it could alter the ecosystem.

Channeled Apple Snail (*Pomacea canaliculata*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	unknown	Unlikely to be feasible

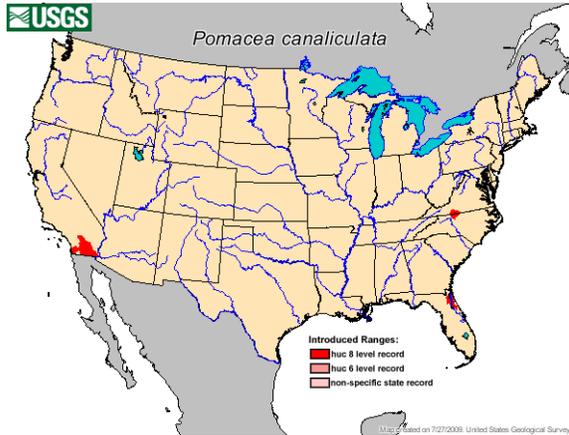


Photo by Amy Benson USGS NAS website

The channeled apple snail, a native of South America, has gained notoriety in North America following its discovery in 2000 in Florida, and more recently in Louisiana, Texas, Indiana and Ohio. They were once sold nationwide by the aquarium pet industry.

Its home range covers much of the Amazon basin in Brazil and Argentina. Natural habitat is lakes and swamps where they feed on a wide variety of plants including algae, azolla, and succulent leafy plants, including rice. They survive dry conditions by burying in moist soil, and become active as much as 6 months later, when flooded conditions return. They have invaded ponds, irrigated fields and shallow waterlogged areas in Florida and Texas, and have been discovered in lakes in Ohio and Indiana.

They are able to tolerate temperatures near freezing. Egg laying starts in the spring when water temperature reaches 65 F. New egg clusters are laid every 2 to 3 weeks, always above water. Clusters have 200 to 300 strawberry-colored eggs. Egg masses turn white as they are about to hatch. When the young snails reach the size of corn seed they begin to feed aggressively. They reach sexual maturity in 2 to 3 months at about the size of a ping-pong ball. The shell is round, thin, and dark-brown to golden brown, with a thin operculum.

This snail poses a serious threat to US rice production and to natural wetland areas in the south (Cowie 2005). Rice production in the Dominican Republic fell by 70% in 3 years following the introduction of this snail (Dr. David Robinson, USDA, 2003 personal communication to Robert G. Howells, Fishery Research Biologist, Texas Parks and Wildlife Department, Ingram, Texas). It was introduced to Taiwan in 1980 with the mistaken belief that it would be a useful supplement for animal and human diets. By 1990 it was the top rice pest in the Philippines, and remains a major pest in rice production throughout southeast Asia.

Several Arkansas pet stores sold channeled apple snail between August 2005 and April 2006 (2008 personal communication to Dr. Hugh Thomforde, Extension Specialist, University of Arkansas at Pine Bluff, Lonoke, AR), including Pine Bluff, Little Rock, and Jacksonville. Arkansas law prohibits the sale, possession and transport of all plant feeding snails. Interstate commerce is not legal, but snails and eggs probably continue to spread by birds or in shipments of ornamental aquatic plants.

Its management or control is not likely to be feasible once an area is infested. There are no chemicals that will selectively eliminate these snails. The best approach is to prevent introductions. Aquarium-kept animals should not be released into natural water bodies.

Chinese mystery snail (*Cipangopaludina chinensis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Possibly	Potential	Unknown	Unknown	Unknown

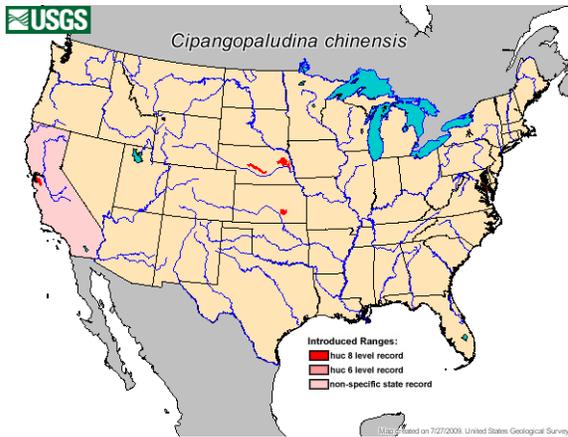


Photo by USGS NAS website

The Chinese mystery snail is of the family *Viviparidae*, which is widely distributed throughout North America (Thompson 2004). It was most likely introduced into western North American Asian markets, where it was imported live from Japan and sold during the 1890's in San Francisco (Abbott 1950, Distler 2003). It has become well established on the east coast (Jokinen 1982). It is found in large lentic as well as lotic systems with sandy or muddy substrates (Distler 2003). Adults give birth to live young and live for about 5 years. It requires at least 5ppm calcium in its habitat and survives well in cool to warm-temperate climates (Jokinen 1982).

It is also a known second intermediate host of the human intestinal fluke *Echinostoma cinetorchis* in Korea (Chung and Jung 1999). The snail, along with other members of the family *Viviparidae*, are widespread in Asian countries and are commonly called rice field snails. In Taiwan, it has been found to be an intermediate host for the parasitic worm *Angiostrongylus cantonensis*, which can infect humans (Chang et al. 1968). An 8-year old child who ate a number of these snails uncooked from a rice field in Taiwan developed symptoms of eosinophilic meningitis.

This snail is invasive and could become a nuisance if introduced into Arkansas. There is the potential for harm to human health by parasites that it has been shown to carry in other countries.

Ghost ramshorn snail (*Biomphalaria havanensis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Possibly	Potential	Unknown	Unknown	Unknown

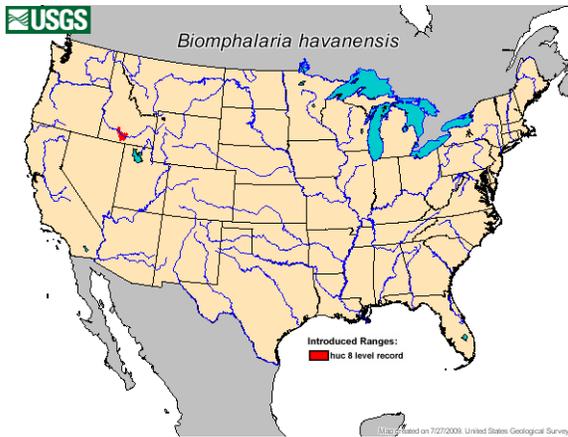


Photo by David Kirsh Jacksonville, Florida www.jaxshells.org

The Ghost ramshorn snail is widely distributed throughout Central America (Thompson 2004). It is naturally found in Florida and Texas, as well as Mexico and Central America (Branson 1970, Covich 1976, Thompson 2004). In Florida it is most commonly found in clear, oligotrophic waters on submersed vegetation but also resides in ponds and roadside ditches (Thompson 2004). Its grayish-white shell is flattened and smooth with about 5 whorls in adults (Covich 1976, Thompson 2004).

Snails of the genus *Biomphalaria* are known to be intermediate hosts for *Schistosoma mansoni*, a trematode that can infect humans, in Africa (Caldeira et al. 2004). This snail was found to carry the parasite in Haiti (Michelson 1976).

This snail is invasive and can cause harm to human health. Since it is found throughout the southern United States, particularly in a state that borders Arkansas, there exists the threat of invasion into the state.

New Zealand mud snail (*Potamopyrgus antipodarum*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Possibly	Unknown	Unknown	Yes	Unknown

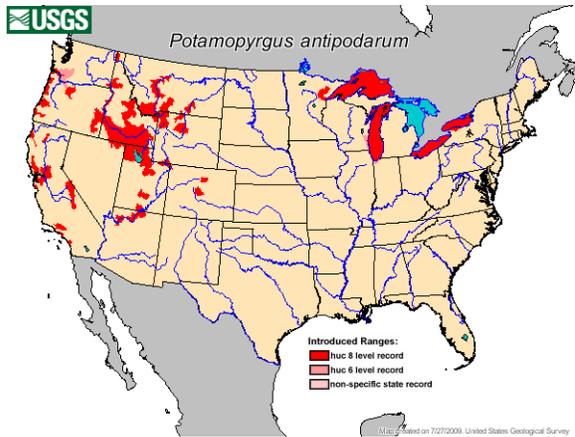


Photo by Mike Gangloff, USGS

The New Zealand mudsnail can range in color from light to dark brown (NZMMCWG 2007). Shells of adults typically have 5-6 whorls. Western populations rarely exceed 0.2 inches in length. They have an operculum, which covers the entrance of the shell when the snail is fully inside. All populations in the U.S. are essentially females, with males only occurring in a population in the Snake River, ID.

Originally native to New Zealand, this snail has become established throughout waters in Europe, Asia, and Australia since the mid 1800s (Richards 2002).

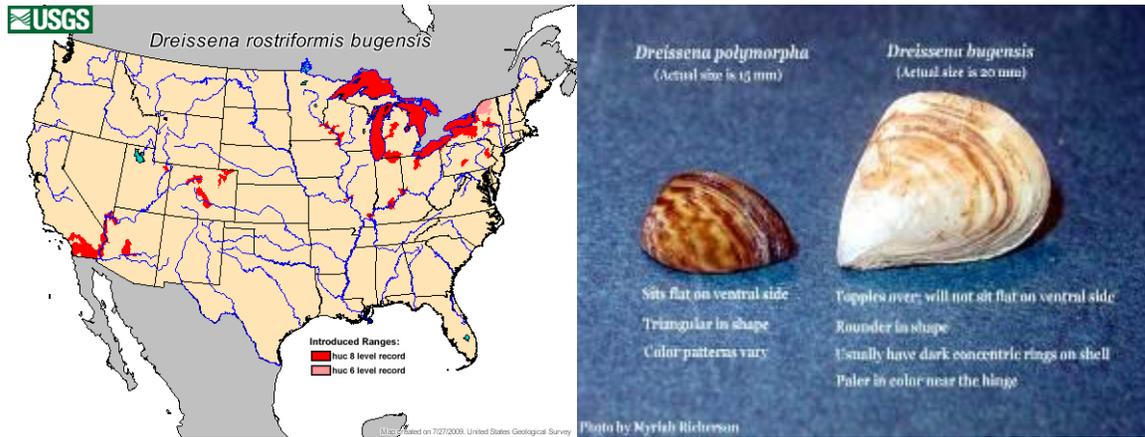
There are currently three different clones of this snail present in the United States (NZMMCWG 2007). Prior to 2005, all western snails had been grouped as a single species introduced from Australia or New Zealand (US 1). A second clone (US 2) appeared in three of the Great Lakes and in parts of the Saint Lawrence River, and a third clone (US 3) is known from a small section of the Snake River. This snail is established in the Western United States (NZMMCWG 2007). Populations currently exist in Arizona, California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

These snails clone themselves and keep the embryos inside their shell until they are large enough to release (Oregon State University 2006). The developing young are kept within a brood pouch inside the first whorl (NZMMCWG 2007). Well-developed embryos can be found usually in the late summer and fall. This reproductive behavior (called parthenogenesis) allows a single snail to rapidly populate a new location. People, other animals, and equipment easily transfer the snails from one location to the next because they are often overlooked due to their small size (<5 mm) and can survive out of water for weeks (Oregon State University 2006). Once established in a new habitat they are extremely difficult to eradicate.

A national management plan has been approved for this species by ANSTF (NZMMCWG 2007). Should threats from this species arise in Arkansas, management efforts will draw on the expertise represented by this plan.

Quagga mussel (*Dreissena bugensis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Unknown	Unknown	Unlikely to be feasible



The introduction of the quagga mussel (*Dreissena bugensis*) into the Great Lakes appears to be the result of discharge of ballast water carrying veligers, juveniles, or adult mussels from transoceanic ships. This mussel was first sighted in the Great Lakes in September 1989, though it was not recognized until August 1991 (Mills *et al.* 1996). It is currently distributed in Lakes Michigan, Huron, Erie, Ontario, St. Clair, and Saginaw Bay, throughout the St. Lawrence River north to Quebec City. There are also a few inland occurrences in New York, Ohio, Michigan, and Pennsylvania. The first sighting of quaggas outside the Great Lakes basin was made in the Mississippi River between St. Louis, Missouri and Alton, IL in 1995. In January 2007, populations were discovered in Lake Mead near Boulder City, Nevada, and in Lakes Havasu and Mohave on the California/Arizona border.

If its native habitat is any indicator, it will most likely take over areas where the zebra mussel is now established to become the dominant dreissenid, and this trend appears to be occurring in the lower Great Lakes (Mills *et al.* 1996). Mean shell size and biomass increased for both species from 1992 and 1995 in southern Lake Ontario, but the increase was sharper in quagga mussels. They now dominate southern Lake Ontario where zebra mussels once did (Mills *et al.* 1999).

The genus *Dreissena* is highly prolific with high potential for rapid adaptation attributing to its rapid expansion and colonization (Mills *et al.* 1996). Other factors aid in the spread of this species across North American waters such as larval drift in river systems or fishing and boating activities that allow for overland transport or movement between water basins. They are prodigious filterers, removing substantial amounts of phytoplankton and suspended particulates from the water. Thus, their impacts are similar to those of the zebra mussel. Impacts associated with the filtration of water include increases in water transparency, decreases in mean chlorophyll a concentrations, and accumulation of pseudofeces. Water clarity increases light penetration causing a proliferation of aquatic plants that can change species dominance and alter the ecosystem. They are able to colonize both hard and soft substrata so their negative impacts

on native freshwater mussels, invertebrates, industries and recreation are unclear. They lack the keeled shape that allows the zebra mussel to attach so tenaciously to hard substrates (Mills *et al.* 1996). They have been found at depths up to 400 ft. in the Great Lakes (Mills *et al.* 1996, Claxton and Mackie 1998).

Biological control so far has proven to be ineffective in controlling *Dreissena* species. Predation by migrating diving ducks, fish species, and crayfish may reduce mussel abundance, though the effects are short-lived. Researchers are continuously studying these species to learn more about their life cycle, and environmental and physiological tolerances, with hopes of developing environmentally safe controls that can be used to control populations.

While not verified in Arkansas at the time of writing of this plan, it is likely that quagga mussels have had access to state waters, especially the Arkansas and Mississippi rivers. They are known to be invasive in other areas. The best approach is to prevent introductions where it does not presently occur.

A regional action plan has been approved for this species by ANSTF (Western Regional Panel on ANS 2009). Should threats from this species arise in Arkansas, management efforts will draw on the expertise represented by this plan.

Quilted melania (*Tarebia granifera*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Unknown	Potential	Unknown	Possible	Unknown

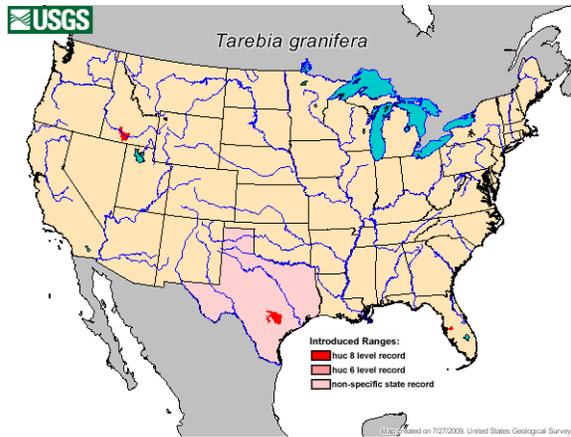


Photo by Jose and Marcos Coltro USGS

Quilted melania is an exotic snail native to southern Asia (Abbott 1952). The shell is a light brown color approximately 1-inch in length for adults, with 7-10 whorls. They have an operculum and females are live-bearers (Chanotis et. al 1980a, Thompson 2004). Developing young are stored in a brood pouch on the back of the mother (Abbott 1950).

They seem to feed only on algae; they have not been shown to harm aquatic plants. The species tend to live in fast-flowing freshwater streams (Abbott 1952). In Puerto Rico, the snail was observed in numerous types of habitats including small and large lakes, domestically polluted water, natural and artificial ponds, cement and earthen ditches, and in slow moving waters (Chanotis et al. 1980a). Abbott (1952) noted that they thrived in water temperatures of both aquaria and Florida springs of 24°C and were totally absent from waters less than 10°C. In laboratory studies, the snails had a much broader water temperature tolerance range of 7°C to 40°C (Chanotis et al. 1980b).

Once found only in the Far East and western Pacific Islands, they are now abundant in small streams and springs in Florida (Abbott 1950, Thompson 2004). They were the dominant taxon found during a water quality study of the San Marcos River, Texas (Fries and Bowles 2002). An aquatic plant and fish dealer in Tampa may have accidentally introduced the species into Lithia Spring, Florida when improperly washed tubs were used to gather native plants (Abbott 1950, Abbott 1952). The dealer had acquired them while visiting in California in 1937 and sold them as “Philippine horn of plenty” snails. In Lithia Spring, as many as 400 snails per square foot have been documented.

They have the ability to burrow deep into muddy shorelines to escape harm. In Puerto Rico, viable snails were found buried for up to 4 weeks after an unusually high tide infiltrated the beach (Chanotis et al. 1980a).

They are an intermediate host of the Oriental lung fluke *Paragonimus westermani* (Abbott 1952). This parasite causes a disease in humans that is similar to tuberculosis or broncho-pneumonia

(Abbott 1950). However, a second intermediate host such as a crayfish is needed to complete the parasite's life cycle, and the crayfish must be eaten raw (Abbott 1952). This is a rare custom in our part of the world, so the threat to human health is negligible. They also carry three other trematodes, two of which have been known to infect humans.

The concern with this species, as with many introduced snails, is that they will proliferate quickly and out-compete native snail species. On Martinique Island, French West Indies, it only took 7 years for the species to spread from its introduction site and colonize 13 river systems (Pointier 2001). In laboratory experiments, 14 mature snails gave birth to 118 young after 7 hours (Chaniotis et al. 1980b). Snails can easily spread by attaching to other animals (particularly birds) and by water currents. They are nonnative and could cause ecological damage if released into Arkansas's natural waters.

Red-rim melania (*Melanoides tuberculatus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	Unknown	Unknown	Possible	Unknown

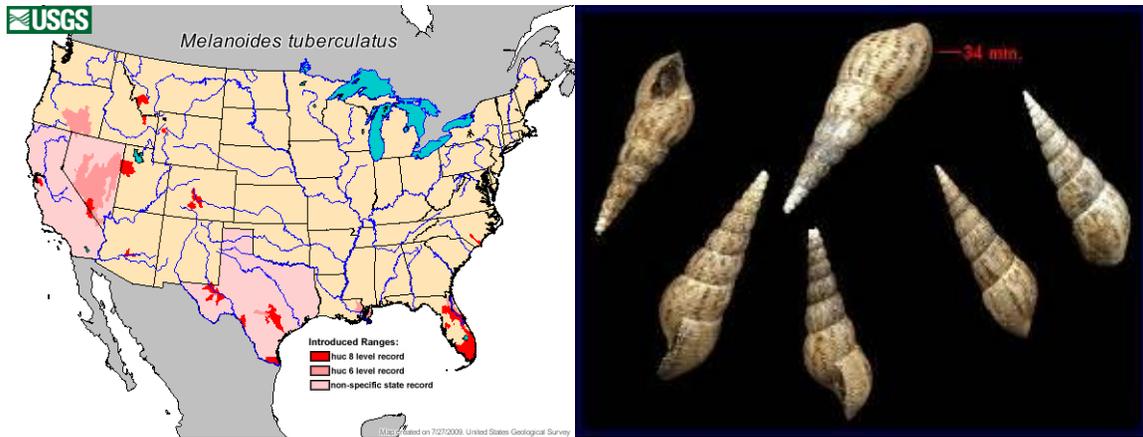


Photo by Bill Frank - Jacksonville, Florida www.jaxshells.org

The red-rimmed melania is an exotic snail with a cone-shaped shell of 5-10 whorls (Thompson 2004). It is in the same family as the quilted melania (Rader et al. 2003). Shells are light brown in color with rusty spots and have an operculum. They can reach 30-36mm in length. They are native to the tropical regions such as Africa, Malaysia, Southeast Asia, eastern Mediterranean, southern China, and northern Australia (Rader et al. 2003). They feed primarily on algae and detritus.

They have been identified as the intermediate host for an exotic gill trematode (*Centrocestus formosanus*) that causes serious losses to tropical fish producers (Mitchell et al. 2005). They are also an intermediate host for the Chinese liver fluke (*Clonorchis sinensis*) (Abbott 1973, Dundee and Paine 1977).

At least 15 southern and western states have red-rim melania populations. Two populations were discovered in 1975 in New Orleans, Louisiana (Dundee and Paine 1977). Prime habitat seems to be along the roots of bank vegetation, where densities of the snails reach up to 2,700 per meter. In the Bonneville Basin, Utah, an average density of 6,452 per meter was documented in 2001 (Rader et al. 2003). Populations exist in Florida, Louisiana, and Texas. In Florida, as many as 37,500 snails per meter were documented in a 1977 study (Roessler et al. 1977). Prime habitat in this study seemed to be around mangrove rootlets that were located below the sediment surface. The red-rimmed melania survived in waters with salinity ranging between 0-30 ppt, indicating that the species can spread throughout coastal mangrove fringes of southern Florida.

In laboratory experiments, red-rim melania survived in water temperatures ranging from 18° C to 32° C (Mitchell and Brandt 2005). In Utah, populations were found thriving primarily in slow flowing waters between 18° C and 30° C (Rader et al. 2003). A five-minute exposure to waters of 50° C or warmer should be enough to kill them on dip nets or other equipment (Mitchell and Brandt 2005). They are hard to find and remove once established because they are nocturnal, spending a good portion of the day buried in mud or sand (Rader et al. 2003).

Crustaceans

Already present in Arkansas as of 2008

Gapped ringed crayfish (*Orconectes neglectus chaenodactylus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	No	Yes	Unlikely to be feasible

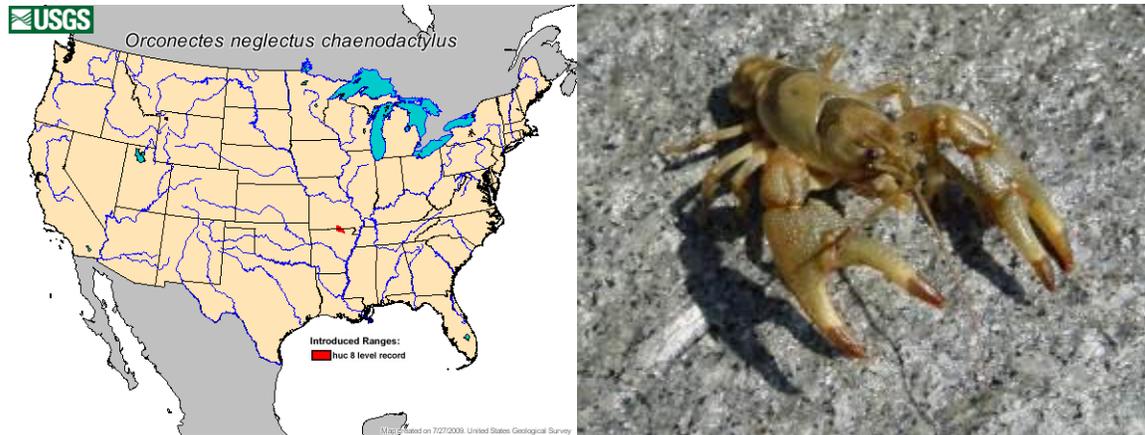


Photo by Brian Wagner, AGFC

The gapped ringed crayfish (*Orconectes neglectus chaenodactylus*) is native to part of Arkansas. However, it has been introduced outside its native range. It is currently recognized as a subspecies of the ringed crayfish. Recent analysis of mitochondrial DNA (cytochrome-oxidase I gene) supports elevation to species status (Dillman et al. 2007). It is a narrowly distributed endemic Ozarkian species that is of conservation concern – crayfish experts consider it to be of special concern (Taylor et al. 1996). The Nature Conservancy currently gives it a rank of S1 (extremely rare) in Arkansas (www.natureserve.org, accessed 6-4-07).

Flinders and Magoulick (2005) documented the presence of this crayfish in the South Fork Spring River, which is outside its native range. It is expanding its distribution in this basin and displacing two native crayfish species. Rabalais and Magoulick (2006) examined the interaction of this crayfish with the native species, and Magoulick and DiStefano (2007) described the threat it poses to the endemic coldwater crayfish, *Orconectes eupunctus*, and Hubbs' crayfish, *Cambarus hubbsi*. In current research, Larson and Magoulick are seeking to determine the mechanism by which it is displacing the native species.

It is possible that the species shift in the crayfish community could alter the food web and have unknown effects on the sport fishery. The Spring River basin has one of the most diverse sport fisheries in the state and is a popular recreational destination for canoeing and fishing.

Not present in Arkansas as of 2008

Australian red claw crayfish (*Cherax quadricarinatus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Maybe	No	No	Unknown	Unlikely to be feasible

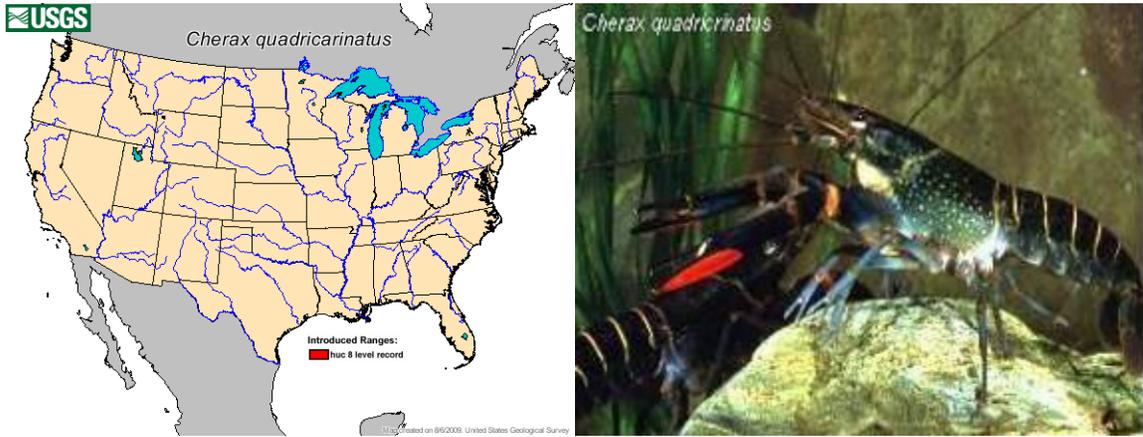


Photo by Keith A. Crandal <http://tolweb.org/>

The red claw crayfish is found in northern Australia, where it is cultured commercially and has also been stocked to establish fisheries (Petr 1998). The tropical climate of its native range indicates a lower likelihood of establishment in the temperate climate of Arkansas. It has been cultured experimentally but there is little commercial production in the U.S. Since establishment of AGFC’s Approved Aquaculture Species List Policy, one now-expired permit has been granted for culture in Arkansas which had limited culture to indoor, recirculating systems to prevent escapes and the possibility of introducing diseases and parasites that might harm native crayfish. Possession is prohibited in Texas. This crayfish has established introduced populations in South Africa, Mexico, Jamaica, Puerto Rico, and Singapore (Ahyong and Yeo 2007).

Chinese mitten crab (*Eriocheir sinensis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	Unknown	Unlikely to be feasible

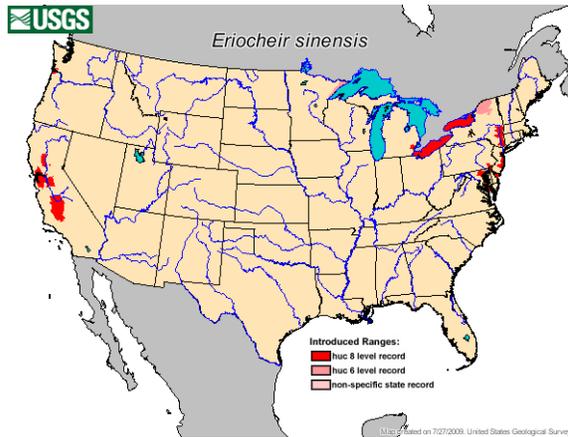


Photo by Lee Mecum, California Game and Fish

The Chinese mitten crab is a brownish-orange to greenish-brown crab native to coastal rivers and estuaries of the Yellow Sea (Hieb 1997). It is characterized by brown setae densely covering the front claws, producing the appearance of “hairy” claws (Veldhuizen 2001). It is catadromous, meaning reproductive adults spawn in brackish or salt-water areas of estuaries and the offspring migrate upstream to fresh or brackish waters. Each female produces from 250,000 to 1 million eggs that hatch in late spring or early summer (Cohen and Carlton 1997).

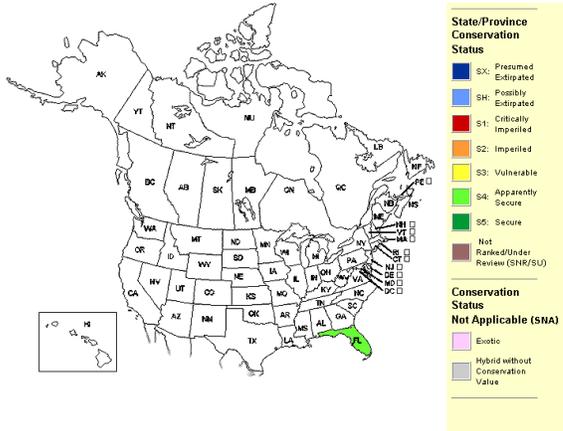
It is established in California. The first specimens were collected from South San Francisco Bay in 1992 by commercial shrimp trawlers (Hieb 1997; Veldhuizen 2001). By 1996 the mitten crab had spread throughout the lower tributaries. The most likely pathway of introduction was ballast water release (Cohen and Carlton 1997). Several specimens have also been collected in Chesapeake Bay and some of the Great Lakes.

This crab has affected commercial and recreational fisheries in California (Veldhuizen 2001). Commercial shrimp trawlers find it time consuming to remove crabs from the nets (one fisherman caught over 200 crabs in a single tow during the fall of 1996) and are concerned that a large catch will damage not only their nets but also the shrimp. At the Tracy Fish Collection Facility, over 750,000 crabs were entrained in 1998 (Siegfried 1999), a large increase over the tens of thousands entrained in 1997. Anglers report difficulty with crabs when attempting to bait fish, especially during the fall and winter months (Chinese Mitten Crab Working Group 2003). Many areas have been reported to be “unfishable” during periods of high mitten crab abundance. Burrows constructed by the crabs have accelerated bank erosion rates and caused reduced levee stability (cited in Veldhuizen 2001). There has not been any documented harm to human health; however the Chinese mitten crab may be a secondary carrier of parasitic lung flukes. Whether or not the mitten crabs cause ecological damage is still undetermined.

The genus *Eriocheir* is listed as injurious under the Lacey Act. The state of California has taken measures to control the introduced crab, including banning the possession and transport of live crabs from the genus *Eriocheir* (Chinese Mitten Crab Working Group 2003). It is legal to catch a mitten crab in the inland waters of California with a valid fishing license but the crab must be killed immediately. There are reports of people catching the crabs for bait and human consumption. Prevention is the best management option. Once the crab is established, control is difficult due to its ability to disperse widely and quickly. A national management plan has been approved for this species by ANSTF (Chinese Mitten Crab Working Group 2003). Should threats from this species arise in Arkansas, management efforts will draw on the expertise represented by this plan.

Everglades crayfish/electric blue crayfish (*Procambarus alleni*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
unknown	unknown	No	No	unknown	Unlikely to be feasible



Map by natureserve.org



Photo by commons.wikimedia.org

The everglades crayfish is native to the everglades in Florida. A blue variant has become popular in the pet trade and is being distributed widely. Little is known about the species’ invasiveness or its potential to become a nuisance.

Rusty crayfish (*Orconectes rusticus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Yes	Yes	Unlikely to be feasible

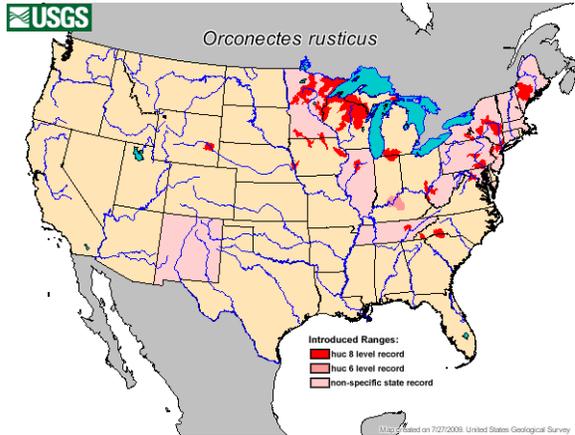


Photo by USGS

The rusty crayfish is an aggressive species (Capelli and Munjal 1982) native to the Ohio River basin of Kentucky, Ohio, and Indiana (www.natureserve.org, accessed 6-5-07). It has been introduced widely outside its range for use as bait. The history of its invasion in Ontario and Lake Superior is chronicled by Momot (1996). It is not currently present in Arkansas.

Introduction is most likely from use as bait, but other possibilities include distribution by biological supply companies, aquarium releases, and intentional introduction in hopes of establishing a commercial fishery. This species has shown the ability to spread widely outside its native range when introduced, with detrimental effect.

They have been observed to displace native crayfish in many instances (e.g. Capelli 1982, Lodge et al. 1986, Olsen et al. 1991). They also reduce aquatic plant abundance and diversity (Lodge and Lorman 1987, Olsen et al. 1991). Due to their higher metabolic rate they consume twice the food resources of the crayfish they displace (Momot 1992). They may impact fish populations by consuming fish eggs (Horns and Magnuson 1981, Momot 1992).

Economic damage is likely due to reduced fisheries and ecological damage has resulted. While many chemical agents will kill crayfish, some even selectively, none are registered for crayfish control (Bills and Marking 1988). The best approach is probably to prevent introductions.

Smooth marron (*Cherax cainii*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
unknown	unknown	No	No	unknown	Unlikely to be feasible



Photo by Greg Craig, bluemarron.com

Formerly considered the same species as the hairy marron (*Cherax tenuimanus*), the two species have recently been split. The hairy marron is an endangered species in Australia, and is restricted to the Margaret River (Australian Department of Environment and Water Resources, 2006). It is experiencing competition from the smooth marron, which has been introduced widely in southwest Australia to develop fisheries (RFAC Recreational Freshwater Fisheries Stakeholder Sub-Committee 2005, Beatty et al. 2005). It is one of the most southerly (cooler climate) distributed crayfish in Australia. Beatty et al. (2004) also recognized a great degree of ecological plasticity in this species when encountering new species. The Missouri Department of Conservation has banned import of Australian crayfish due to potential parasite issues (Bob DiStefano, MDC Crayfish Biologist, pers. comm.).

Yabby (*Cherax albidus*, *Cherax destructor*, *Cherax preissii*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Some	Likely	Unlikely to be feasible



Photo by wikipedia.org

The common name “yabby” is derived from an aboriginal word applied to many *Cherax* crayfishes (Lawrence and Jones 2002), which leads to confusion about which species is under discussion. *Cherax destructor* has been introduced along with the smooth marron in some places in southwestern Australia (Beatty et al. 2005), where they are described to have “...life history characteristics ... typical of many other invasive crayfish species...” (Beatty et al. 2005). Information presented by Lawrence and Jones (2002) reflects that *Cherax destructor* and *Cherax albidus* (if a distinct species) occur in the most temperate part of Australia, and over a broad range of climatic conditions, hinting at adaptability to local conditions.

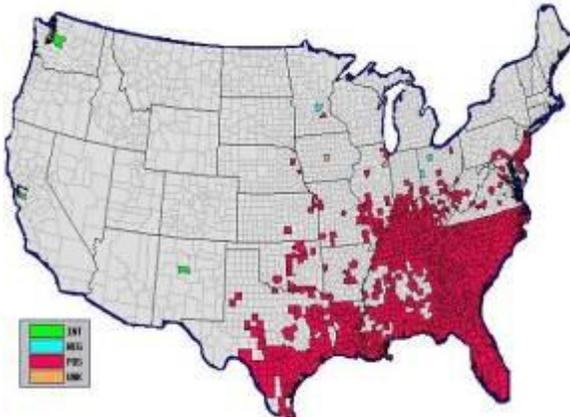
The only economic damage reported is impacts to the marron fishery.

Insects

Already present in Arkansas as of 2008

Asian tiger mosquito (*Aedes albopictus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	Yes	Yes	unknown	Unlikely to be feasible



Map by cdc.gov



Photo by Susan Ellis, Bugwood.org

The Asian tiger mosquito is a known carrier of the West Nile Virus and Dengue Fever. Dengue Fever has occurred as far north as the Rio Grande Valley on the Mexico-Texas border but the potential exists for it to spread to Arkansas. The mosquito has a distinctive marking allowing researchers to easily recognize the species under the microscope. The back is black with a distinguishing white stripe down the center beginning at the dorsal surface of the head and extending along the thorax (Walker 2007). The abdomen also has white stripes that stand out against the black shiny scales of the mosquito.

This mosquito was first discovered in the United States in 1985 in Houston, Texas (Moore et al. 1988). Since its arrival in Texas, it has spread rapidly and can be found in many large cities throughout the Southeastern and Midwestern United States. The interstate shipment of automobile tires is thought to be responsible for its rapid dispersion (Jamieson and Olson 1995). In southeastern Asia, it commonly selects tree holes for its larval habitat. The species has now adapted to using artificial containers such as automobile tires that may periodically fill with rainfall. Larvae have also been collected from house gutters, flowerpots, birdbaths, barbecue grills, and a Christmas tree stand (Jamieson and Olson 1995).

On August 10, 1993, three biting females were collected within the city limits of Batesville, Arkansas (Jamieson and Olson 1995). Until then, the only published collections in the state were from Grant County in central Arkansas, Jefferson County in southeastern Arkansas, and Craighead County in northeastern Arkansas. A 2000 distribution map from the Center for Disease Control shows that it has also been identified in Pulaski, Miller, White, and Sebastian Counties (Center for Disease Control 2000).

Please note that while the Asian tiger mosquito is considered a nuisance species in Arkansas, it does not meet the definition of an aquatic species according to Aquatic Nuisance Species Program documents and USFWS State Plan funding via NANPCA will not be used to fund activities related to this species.

Fish

Already present in Arkansas as of 2008

Bighead carp (*Hypophthalmichthys nobilis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	unknown	unknown	unknown

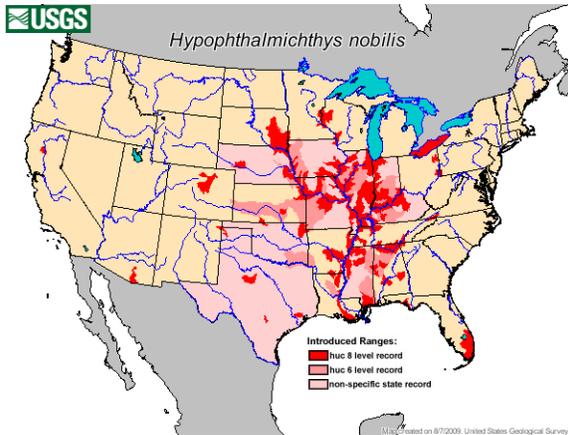


Photo by David Riecks UIUC IL-IN Sea Grant

Bighead carp likely escaped from one or more of the sites where stocked (See section on Additional Background Information for more information on introductions). Escapees were found in Yates Reservoir, Alabama in 1984, and at Mississippi River mile 364, Illinois, in 1986 (Kolar et al. 2005). They have been recorded from within or along the borders of at least 23 states and are self-sustaining within the Mississippi, Missouri, Ohio, and Tennessee river basins (Kolar et al. 2005; Nico and Fuller 2010; Schofield et al. 2005). After having increased for a number of years, the catch rates in the Mississippi and Illinois rivers between 1993 and 2004 by the Long-Term Resources Monitoring Program (USACE), peaked between 2000 and 2002 (Nico and Fuller 2010). 2004 was the last year of recorded data and showed lower catch rates than in previous years.

The rapid population increases prior to 2000 caused concern over the potential impact on native fish populations. Sampson (2005) found dietary overlap with gizzard shad (*Dorosoma cepedianum*) and, to a lesser degree, with bigmouth buffalo (*Ictiobus cyprinellus*) in the Illinois and Mississippi rivers. Dietary overlap can result in competition for food in nutrient-limited ecosystems. It is unclear what affect these populations may have on native species. Fishermen have been catching more bighead carp, but Brozovic et al. (2006) found that this increase has not affected the buffalo fish harvest. While some limited markets have developed for dead bighead carp caught from these rivers, fishermen have voiced frustration with handling large volumes of a mostly undesirable species.

Bighead carp are regulated in Arkansas as a Restricted Species. They are established in the Mississippi River Basin and are considered a nuisance species. However, there has been no documentation of economic or ecological damage to date. There has been no harm to human

health. The feasibility of management or control is unknown, but alternatives for control have been included in the Asian Carp Management and Control Plan (Conover et al. 2007), which has been approved by ANSTF. Efforts in Arkansas will draw on the expertise represented by this plan.

Black carp (*Mylopharyngodon piceus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Unknown	Unknown	No	No	Unknown	Unknown

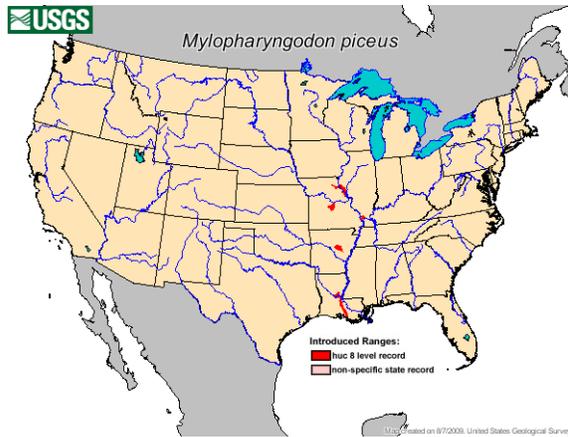


Photo by Leo G. Nico USGS

Black carp feed primarily on mussels and snails. Mollusk populations in the U.S. have been reduced by poor water quality, pollution, habitat degradation, and commercial harvest. Black carp is listed as a focal species in this plan because wild populations of black carp might increase to levels that would add additional pressure to mollusk populations. Arkansas has a diverse mussel fauna and a number of species that are threatened or endangered; thus protection of those species is important to the state.

Six black carp have been collected by commercial fishers from the Mississippi River Basin (Nico 2010). Of these the first was collected in Illinois in 2003, three in Louisiana in 2004, one in the Mississippi river near Lock and Dam 24, and one in the White River in Arkansas in 2005. Schramm and Basler (2005) sampled waterways during 2003 and 2004 “in proximity to open-pond aquaculture facilities known or expected to use black carp” in Arkansas, Louisiana, and Mississippi with AC electrofishing gear. They did not find any black carp in their sampling efforts. Two triploid black carp were collected in the Piney Creek drainage near Brinkley, Arkansas, during snakehead eradication efforts in 2009 (AGFC pers. comm.).

They are listed as an injurious species under the Lacey Act; thus, their importation from another country and their transport across state lines is prohibited. While much concern has been expressed over their use, there has been no documented economic or ecological damage yet. There has been no harm to human health; black carp are used to prevent schistosomiasis in a number of countries around the world. The feasibility of its management or control is unknown, but alternatives for its control have been included in the Asian Carp Management and Control Plan (Conover et al. 2007), which has been approved by ANSTF. Efforts in Arkansas will draw on the expertise represented by this plan.

Northern Snakehead (*Channa argus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Maybe	Maybe	Difficult

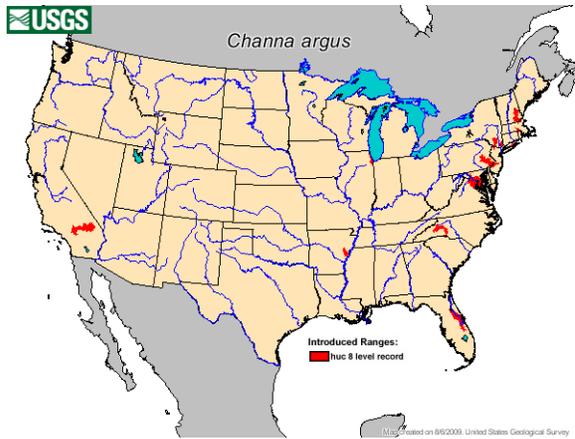


Photo by Lee Holt, AGFC

The northern snakehead (NSH) is a piscivorous fish native to China and some areas of Siberia (Lazur et al. 2006, Odenkirk and Owens 2005). They are obligate air-breathers and some species have been reported to move overland for short distances (Orrell and Weigt 2005), but the northern snakehead is not thought to do so (Courtney and Williams 2004). Young are more capable of doing so than adults, but only when some water is present or when there are flood conditions. They are a top predator known for their voracious feeding (Courtney and Williams 2004). A popular food fish in the live market trade, they were imported into the U.S. prior to 2002. In 2002 importation and interstate trade was banned under the Lacey Act (Northern Snakehead Working Group 2006). That same year possession of all snakeheads was banned in Arkansas. They play a small role in the aquarium trade as well, although they are not as popular as other species within the family (Courtney and Williams 2004).

They have been reported in the U.S. since a 1997 capture in California (Courtney and Williams 2004). The first reported breeding population in the U.S. was found in MacQuilliam Pond in Crofton, Maryland in 2002 (Orrell and Weigt 2005). The fish were eradicated from the pond by rotenone. In 2004, an angler caught the first of twenty northern snakeheads in Virginia and Maryland Potomac River tributaries. It was initially believed that the source of these fish was the retention pond in Crofton, however it has since been determined through DNA testing that the Potomac population was genetically different from the Crofton population (Orrell and Weigt 2005). Single specimens were found in a pond in Wheaton, Maryland and in Chicago's Burnham Harbor, Lake Michigan in 2004. Three were also captured in Meadow Lake, FDR Park, Philadelphia, Pennsylvania in 2004.

Those caught in the Potomac River preferred areas that had slow-moving, shallow water and multiple vegetation types (Odenkirk and Owens 2005). Vegetated boat slips near a channel with submersed weeds and a floating or emergent plant were the second most important habitat.

The concern is that they will disrupt the native fish communities, causing economic and ecological damage to valuable fisheries. They are a top predator and can consume a number of

fish species as well as crayfish, insects, and frogs (Courtney and Williams 2004). Stomach contents were examined from 20 Potomac River northern snakeheads. Only gizzard shad and white perch were found - two of the most abundant fish species found in the system (Odenkirk and Owens 2005). The abundance of northern snakehead in the Potomac River has increased from 2004-2006 based on increases in CPUE (catch-per-unit-effort) from electrofishing and angling (Odenkirk and Owens 2007).

Northern snakeheads can reproduce rapidly in their native range when favorable conditions exist. Females are reported to release 1,300 -15,000 eggs with an average of 7,300 (Courtney and Williams 2004). Larvae remain in the nest of aquatic vegetation built and maintained by the parents until their yolk sac is fully absorbed. The adult northern snakehead will fiercely protect the nest; this behavior was observed in the MacQuilliam Pond in Crofton, Maryland.

Northern snakeheads have been successfully caught by electrofishing and are susceptible to standard doses of rotenone in laboratory experiments (Odenkirk and Owens 2005, Lazur et al. 2006).

In 2000, prior to the 2002 bans, some northern snakeheads were brought to Arkansas fish farmers to be raised for the live food-fish market. The farmers were informed of the potential threat that snakeheads posed to native fish species and were advised that the specimens should be destroyed, which they reportedly attempted.

A wild population was confirmed in Lee County, Arkansas, on April 28, 2008. A local farmer found a peculiar fish on a gravel farm road, which was later identified as a northern snakehead by an AGFC fisheries biologist. After the confirmation, fisheries biologists worked to determine how far the population had spread and over 100 adult snakeheads (55 of which were retained for additional studies) and several hundred young were killed. Results of this work suggested that the population was confined to the Piney Creek watershed and a large-scale effort was made to eradicate the population using the fish toxicant rotenone in March 2009. This effort involved the application of 17,000 pounds of powdered rotenone and 3,000 gallons of liquid rotenone to 500 miles of irrigation ditches, creeks, and backwaters and 4,000 acres of ponds, reservoirs, and sloughs. Over 700 snakeheads were collected. Monitoring of the effectiveness of the eradication is in progress, so far one snakehead has been caught in a nearby drainage post-eradication.

Of concern are the unknown impacts that the northern snakehead may have on valued black bass, crappie, bream, and catfish populations in southeast Arkansas (AGFC and USFWS 2008). From stomach content samples, fisheries biologists can see that the fish's diet includes crayfish and bream species. Northern snakeheads are invasive and could potentially cause ecological damage. It is too soon to determine the effects of northern snakeheads in Eastern Arkansas, but an analysis is underway.

Silver carp (*Hypophthalmichthys molitrix*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	Yes	Unknown	Unknown	Difficult

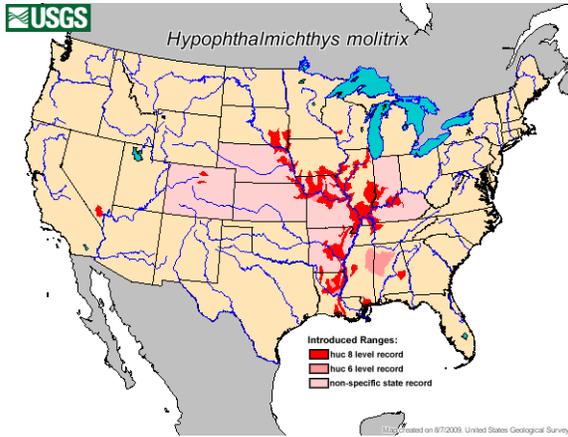


Photo by David Riecks UIUC/IL-IN Sea Grant

The earliest report of silver carp in the U.S. is from Urban Lake, Chandler, Arizona in 1972 (Kolar et al. 2005). Private fish farmers in Arkansas legally imported them into the U.S. in 1973 with the assistance of a variety of state and federal agencies. While originally introduced by a commercial grower, all were transferred to AGFC in 1974 and subsequently spawned by AGFC with help from Dr. Lin of Taiwan.

Research programs on spawning and rearing were developed by a variety of state and federal agencies, along with universities (Kelly et al. 2011), but there was no commercial production before 1977 (D. Mitchell, personal communication). However, they were found in Arkansas County (Bayou Meto and the White River) in 1975 (Kolar et al. 2005). The likeliest pathway was through a state hatchery that had begun to spawn them or from the various sites stocked for plankton control. They were found in the Mississippi River at Cape Girardeau, IL in 1983 and in Alabama’s Yates Reservoir in 1984. The original source of these fish is not known; they could have escaped from any of a number of sites where they had been stocked. The species’ use was promoted by state and federal agencies in the 1970s and early 1980s (Dupree and Huner 1984).

The principal interest in their use was to control phytoplankton, primarily in sewage treatment lagoons (Freeze and Henderson 1982). EPA published several publications in the 1970s and 1980s related to the use of aquaculture for wastewater treatment (Environmental Protection Agency 1976, 1980a, 1980b, 1982, 1983). Henderson (1979) reported results from a project funded by EPA that involved stocking six treatment lagoons of the Benton Services Center treatment plant in Benton, Arkansas. The Arkansas State Pollution Control and Ecology Commission also promoted the use of silver carp for small towns struggling to come into compliance with EPA regulations. Twelve municipalities in Arkansas received silver carp for this use; Clarendon had to restock its lagoon when the silver carp were reported to have escaped. The National Marine Fisheries Service and the Tennessee Valley Authority also funded silver carp sewage studies (Maddox et al. 1979).

A study funded by the State of Illinois, from the Institute of Natural Resources, reported stocking silver, bighead, grass, and common carp into ponds of the Sam A. Parr Fisheries Research Center, a joint facility of the Illinois Natural History Survey and the Illinois Department of Conservation near Kinmundy, Illinois (Buck et al. 1981) that followed previous studies with bighead and silver carp at the same pond facility (Buck et al. 1978a; 1978b). Henebry et al. (1988) reported additional silver carp studies in tanks at the Illinois Natural History Survey designed to further evaluate their potential as filter feeders in polyculture and in manure treatment systems. In Hawaii, Laws and Weisburd (1990) stocked them into 24 commercial freshwater aquaculture ponds in 1984 to study the effects on algal biomass. Cremer and Smitherman (1980) stocked silver and bighead carp in cages and ponds at Auburn University to compare growth, food habits, and filtering capability. Auburn University also conducted studies with bighead and silver carp in polyculture in earthen ponds (Pretto 1976; Dunseth 1977; Burke and Bayne 1990). Wilson et al. (1984) reported stocking silver carp in eutrophic dairy farm impoundments in South Carolina to control phytoplankton. Silver and bighead carp were stocked into a small shallow pond in Arvada, Colorado in 1992 for control of nuisance algal problems with funding by the U.S. Bureau of Reclamation and the National Biological Service (Lieberman 1996). McBride (1997) reported stocking 750 bighead and 1,500 silver carp into the Pantex plant's wastewater treatment lagoon. "If the plan works, state officials may approve similar projects for other wastewater projects across Texas."

A few catfish farms in Arkansas and Mississippi stocked silver carp in the late 1970s or early 1980s in an effort to manage phytoplankton blooms. However, the practice did not continue for long and silver carp have not been raised commercially in Arkansas for several decades. Their leaping abilities make them difficult to handle and transport, and they are a nuisance when seining catfish ponds.

AGFC was known to have stocked silver or bighead carp in four sites by 1982 (Freeze and Henderson 1982). These included a sewage plant at a correctional facility (Benton Correction Facility Sewage plant), a lake stocked for recreational and commercial fisheries (Hill's Lake in eastern Pulaski County/western Lonoke County) and a four-sided manmade lake owned by AGFC (Mallard Lake in Northeast Arkansas) (Mike Freeze, personal communication). The fourth location was possibly another city sewage facility, perhaps the City of Lonoke. Mallard Lake was rotenoned and then drained into the St. Francis River after the silver carp failed to control the algae for which they had been stocked.

Silver carp have been recorded from within or along the borders of at least 16 states and are self-sustaining within the Mississippi, Missouri and Ohio river drainages (Kolar et al. 2005; Schofield et al. 2005). Data from the Long Term Resources Monitoring Program of the U.S. Army Corps of Engineers (USGS 2007) show continuous increases in catch rates between 1993 and 2004, the last year of recorded data (USGS 2007). The rapid population increases have caused concern over the potential impact on native fish populations. Sampson (2005) found dietary overlap with gizzard shad and, to a lesser extent, with bigmouth buffalo in the Illinois and Mississippi rivers. Dietary overlap can result in competition for food sources in nutrient-limited ecosystems.

Of greater immediate concern is the threat to human safety caused by their jumping behavior when startled. Jumping silver carp have caused personal injury and property damage to recreational boaters and fishers.

Silver carp are listed as an injurious species under the Lacey Act; thus, their importation from another country and their transport across state lines is prohibited. Some economic damage has resulted from loss of recreational fishing and boating opportunities in areas with large populations of silver carp. In spite of high population numbers, no ecological damage has been documented. Some people have been hurt by jumping silver carp. The feasibility of management or control of silver carp is unknown, but alternatives for its control have been included in the Asian Carp Management and Control Plan (Conover et al. 2007), which has been approved by ANSTF. Efforts in Arkansas will draw on the expertise represented by this plan.

White Perch (*Morone americana*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	unknown	Yes	unknown

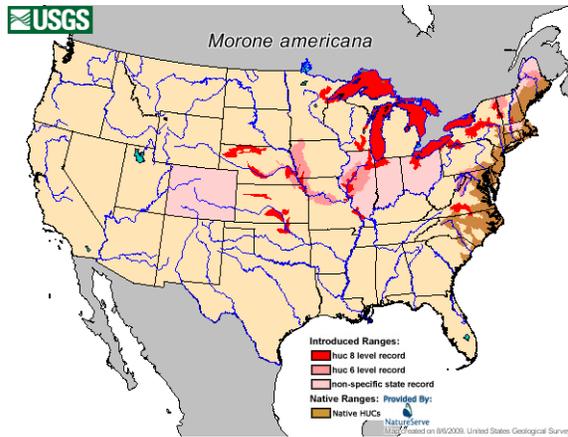


Photo by Douglas Facey

White perch are native to freshwater coastal drainages and estuaries of the Atlantic Coast of North America from Quebec to the Pee Dee River of South Carolina (Buchanan et al. 2007). This species was first found in the Great Lakes region in 1950, presumably gaining access to the area via the Erie Barge Canal (Johnson and Evans 1990). USGS records indicate that they had spread to all five Great Lakes by 1988. (Fuller et al. 2006). They were brought from New Jersey to Nebraska in 1964, and fry produced in a hatchery that year were introduced into a reservoir that provided access to the Missouri River (Hergenrader and Bliss 1971). The species was not recorded from the Missouri River, Missouri until the 1990’s (Pflieger 1997). White perch inadvertently included in a shipment of striped bass (*Morone saxatilis*) from Virginia were unintentionally stocked in Cheney and Wilson reservoirs in Kansas. They moved downstream from Cheney reservoir into the Arkansas River and were first discovered in Oklahoma in 2000 (Buchanan et al. 2007). They were first discovered in Arkansas in the Lake Dardanelle Pool of the Arkansas River in early 2006, presumably arriving as the result of downstream movement from Oklahoma (Buchanan et al. 2007).

In Maryland, native white perch spawn from April through June in fresh to low salinity waters of large rivers over fine gravel or sand (Maryland DNR Fact Sheet). Females produce from 50,000 – 150,000 eggs and do not release them all at once; ovulation may occur over a period of 10 – 21 days. Eggs are generally demersal and attached in still water, but are pelagic in free flowing streams and tidal waters. Eggs usually hatch from 1 to 6 days after fertilization (Maryland DNR Fact Sheet: <http://www.dnr.state.md.us/fisheries/fishfacts/whiteperch.asp>).

In their native environment, juveniles use inshore areas of estuaries and creeks near spawning areas their first summer and fall, and feed on aquatic insects and small crustaceans (Maryland DNR Fact Sheet). Adults inhabit open waters close to shore and are bottom-orientated predators whose diet consists of crabs, shrimp, and small fishes (Maryland DNR Fact Sheet).

Based on past establishment in areas where introduced, it is probable that they will establish breeding populations in the Arkansas River, Arkansas. (Buchanan et al. 2007). The effects of

their establishment on native fish species in Arkansas are uncertain, but the biological effects of recent invasions into other states have been documented by several researchers.

The establishment of white perch in Lake Erie has been linked to a reduction in recruitment of native white bass (*Morone chrysops*) populations, presumably because white perch reduced the survival of white bass through heavy egg predation (Madenjian et al. 2000). The collapse of the walleye (*Stizostedion vitreum*) fishery in the Bay of Quinte (Lake Ontario) following the invasion of white perch may have been a result of egg predation and subsequent lack of recruitment (Shaeffer and Margraf 1987; Fuller et al. 2006). They have been found to compete for food with yellow perch (*Perca flavescens*), emerald shiners (*Notropis atherinoides*), and spottail shiners (*Notropis hudsonius*) in Lake Erie, leading to reduced growth and declines of these three species (Parrish and Margraf 1990; Parrish and Margraf 1994; Fuller et al. 2006). Within three years of being introduced into a reservoir in Nebraska, they replaced the native black bullhead (*Ictalurus melas*) as the dominant species in the reservoir (Hergenrader and Bliss 1971).

Hybridization of non-native white perch with native *Morone* species has also been documented. Irons et al. (2002) described hybridization between white perch and yellow bass (*Morone mississippiensis*) in the middle Illinois River (Fuller et al. 2006). Todd (1986) described hybridization between white perch and white bass in Lake Erie (Fuller et al. 2006). With two native species of *Morone* present in the Arkansas River (white bass and yellow bass), hybridization with non-native white perch is possible.

Yellow bass (*Morone mississippiensis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	No	Possible	Unknown

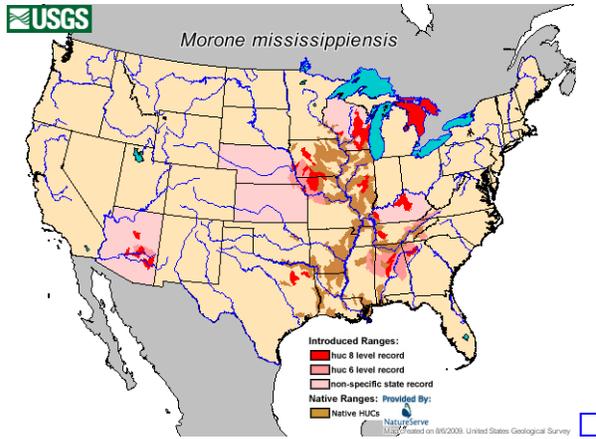


Photo by USGS

Yellow bass are a native schooling fish found primarily in the natural lakes and large warm-water rivers of Arkansas' eastern and southern lowlands. The yellow bass most closely resembles the white bass, but there are no teeth on the tongue, and the golden-yellow sides have dark stripes sharply broken and offset above the front of the anal fin. They are a popular sportfish in some states, but most Arkansas anglers consider them a nuisance, because of their aggressive nature and small size.

Until the late 1990s this species was found only in the streams and lakes of the Coastal Plain and Delta ecoregions associated with the Mississippi, White, Arkansas, St. Francis, Ouachita, and Red Rivers. In recent years this species has advanced up the Arkansas River and is now found in high densities within the Arkansas River Valley upstream of Dardanelle Dam. They have also been stocked incidentally into the Ouachita River reservoirs during shad stockings. Their range has likely been expanded through stockings of fish taken from inhabited systems. The current range expansion is not certain, but may have expanded up the Ouachita River into Lake Ouachita and up the Arkansas River as far as Kerr Lake in Oklahoma. At this time it is not certain whether they have been introduced into the reservoirs of the White River system.

Yellow bass are a highly prolific species. Over-abundant populations may stunt their growth or that of other closely associated species such as white bass, hybrid striped bass, and striped bass. They often school with these species and directly compete for forage. They may reduce prey available for other species and reduce or substantially impact the densities of prey and competitors when introduced to these new systems. They can be controlled by prohibiting interbasin stocking of shad or other species that have not been sorted carefully. Their prolific and invasive nature warrants action to prevent their further spread.

Yellow perch (*Perca flavescens*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	No	Unknown	Unknown

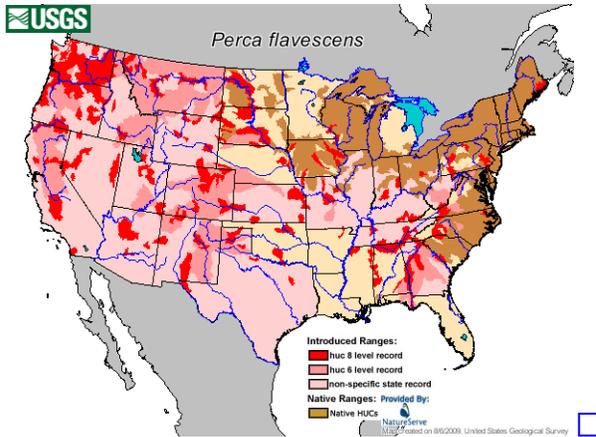


Photo by Noel M. Burkhead

Yellow perch are native to the northern U.S., Atlantic coastal plain and Canada. In these areas the species can be either an important sport and commercial fish or a nuisance. Whether it is a beneficial species or nuisance depends on its abundance. Like the bluegill and crappie of the south, it is prone to overpopulation, resulting in slow growth and even stunting at a size well below that desired by anglers. Stunting occurs when the population of predators is too low or otherwise unable to keep the perch population under control.

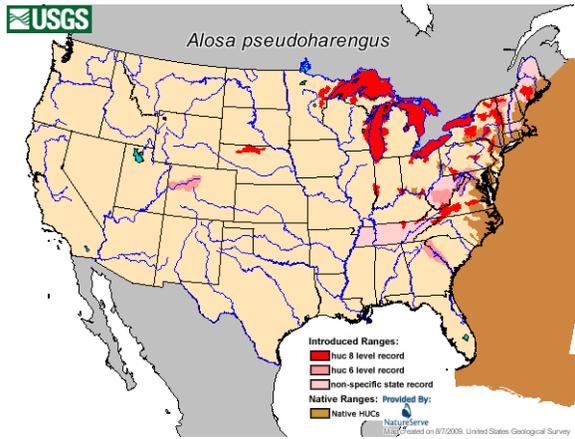
They are easily caught and make excellent table fare. In northern waters they are often caught from the shoreline, being an ideal fish for children and other beginners. For that reason, many people who have moved to Arkansas from northern states have requested that AGFC stock yellow perch into the large Ozark reservoirs which do suffer from an absence of edible-sized game fish that can be caught easily from the shoreline during the summer vacation season. These requests have been denied consistently because of the perch's tendency to stunt, possible competition with native species such as bluegill and crappie, and the belief that the species would not produce the desired summer shoreline fishery. The species prefers cool water and would likely be found in water at or below the thermocline (25-40 feet deep) during the summer.

It appears that private individuals took matters into their own hands and stocked yellow perch into Bull Shoals Reservoir without permission from either AGFC or the Missouri Department of Conservation (MDC). An angler first reported yellow perch from the Missouri portion of Bull Shoals in 1998. Identification of the fish was confirmed by MDC biologists (Bob Legler, personal communications) but the species was not reported again until 1999 when another was shown to AGFC biologists Mark Oliver and Ken Shirley. Reproduction was documented for the first time when a single fingerling yellow perch was collected in AGFC rotenone samples. In 2001, nine individuals from two-year classes were collected by rotenone indicating that the species had established a population in the lake. Since then, the species has been caught regularly by anglers with perch over one pound taken occasionally. Reproduction has been very stable since 2002, constituting less than 1% of the fingerling fish in rotenone samples.

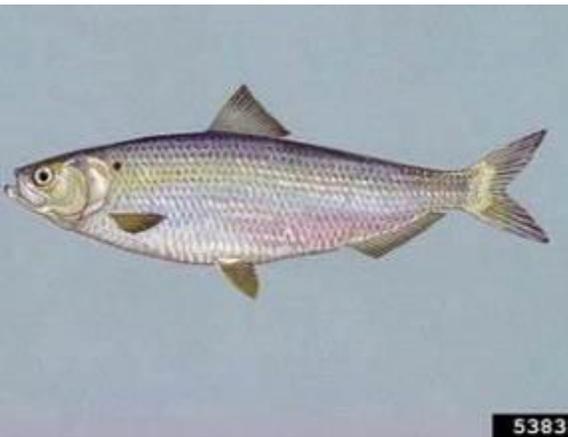
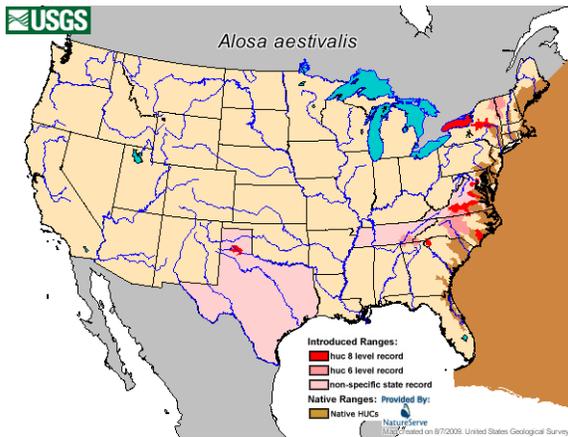
The species has shown neither a tendency to overpopulate nor has it developed into a substantial fishery in Bull Shoals reservoir. It has caused no economic or ecological harm to date. There is concern over the possibility of its dispersal downstream. A single adult yellow perch was caught at the confluence of Crooked Creek and the White River, 27 miles below Bull Shoals dam in 2006. Extensive electrofishing on both Crooked Creek and the White River by AGFC biologists and University of Arkansas fisheries students has yet to collect other specimens. Eradication attempts would likely harm important recreational fisheries in Bull Shoals Reservoir or rivers downstream. Current management is to allow unlimited harvest of yellow perch. Low creel and length limits on black bass (15") and walleye (18") and massive walleye stockings support predator populations to increase predation on forage species, hopefully including yellow perch.

Alewife and Blueback herring (*Alosa pseudoharengus*, *Alosa aestivalis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	No	Likely	Feasible but costly



Illus. by Duane Raver, U.S. Fish and Wildlife Service, Bugwood.org



Illus. by Duane Raver, U.S. Fish and Wildlife Service, Bugwood.org

The alewife is a member of the herring family (Rodger 2006). This small herring is an anadromous species that has a single dark spot behind the gills at eye level and a grayish-green dark dorsal side shading to silver on the sides. Alewives are similar in appearance to the blueback herring; the only difference between the two can be seen internally (Shiffer 1990). The body cavity lining of the alewife is silver, while that of the blueback herring is black. The term alewife usually includes both species (Rodger 2006). Both fish are important prey for popular game fish such as salmon (Kraft et al. 2006). Alewives are considered an important fishery in Canada. They are used as food fish, and bait (lobster and crab industries), as well as in fertilizer and pet food (Rodger 2006). Freshwater landing of alewives in 2003 accounted for 1,559 tons in Canada that were valued at \$469,000. They are extremely abundant in the Great Lakes. The species is native to the Atlantic coast of the United States (from South Carolina to Newfoundland) and has been introduced to other waters outside of its range (Indiana DNR 2006,

Rodger 2006). Natural landlocked populations occur in New York and they have been introduced into the upper Great Lakes (Robins et al. 1986).

They live for about 6 to 7 years and begin to reproduce at age 2 (Indiana DNR 2006). Females can release from 60,000-200,000 eggs per spawning season and usually spawn 2-3 times during their lifetime (Rodger 2006). The young feed primarily on zooplankton while adults also will feed on aquatic insects and small fish (Indiana DNR 2006). They can compete with native species for zooplankton. Their predation on zooplankton has been responsible for altering the zooplankton community from larger to smaller individuals in Virginia (Kohler and Ney 1981) and in New York (Hutchinson 1971). They have also been found to consume the larvae of yellow perch in Lake Ontario (Brandt et al. 1987) and larval walleyes in the laboratory (Brooking et al. 1998). Bauer (2002) found that white bass populations had poor recruitment in Nebraska reservoirs where alewives were the most abundant prey. This was attributed to competition for food and predation on small white bass by the alewives.

During periods of high alewife abundance, mass die-offs have occurred. Beaches become littered with dead and dying alewives, causing aesthetic and hygienic problems, reducing recreational use, and hampering local industries that withdraw water. High abundance has occurred in Lake Michigan due to the elimination of large predator fish by the sea lamprey (University of Wisconsin Sea Grant 2002). They can also cause disease in popular sport fish. They have been found to carry bacteria that cause thiamine deficiency in salmonid species in the Great Lakes (Honeyfield et al. 2002).

Approximately \$13,400 is spent annually on alewife management in Lake St. Catherine, Vermont (Good and Cargnelli 2004).

Eurasian ruffe (*Gymnocephalus cernuus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	Maybe	Yes	Maybe

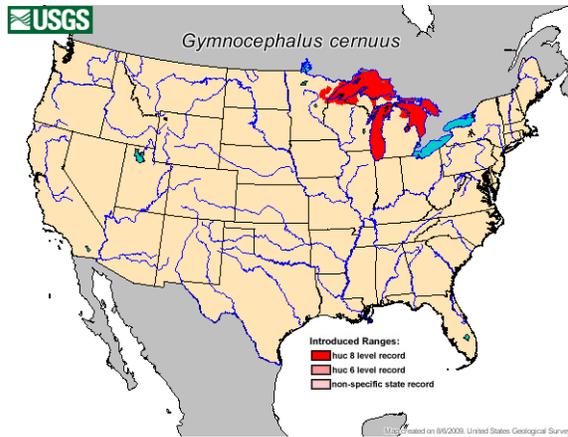


Photo by Steffen Zienert

The Eurasian ruffe resembles a yellow perch with walleye markings. The mouth is slightly turned down. They are found in Lakes Superior, Ontario, Huron and Michigan, but are expected to spread throughout the Great Lakes and possibly into the Mississippi River Basin. They were first found in western Lake Superior in 1986, in the St. Louis River, and then in Duluth/Superior harbor area of Lake Superior. It is thought that ruffe were first introduced around 1985, probably in ballast water.

The ruffe is a small (typically 4-6") fish with a continuous dorsal fin, with no notch between the spiny and soft dorsal fins. A bottom dwelling species, it is an opportunistic feeder, generally eating small insects and insect larvae on the bottom (especially Chironomidae), but it will also consume large zooplankton. It is considered to have poor eyesight, although it is equipped with a tapetum lucidum (like walleye) for improved low-light vision. It also has a well-developed and sensitive lateral line, and is generally considered to be a nocturnal species, moving into shallow water to feed at night. However, this is not always the case; in Lake Mildevatn, Norway, it was found to be mainly active during the day. Spawning takes place in mid-April to July, and ruffe reach sexual maturity in one year in warmer climates (Ogle 1998). Intermittent spawners, ruffe lay two or more batches of eggs per season. Considered to be a temperature mesotherm, ruffe tolerate a wide range in temperatures (from near freezing to 30-34° C), but prefer 25° to 30° C. They are found in both fresh and brackish water and tolerate nutrient-enriched waters. Numbers generally increase with increasing eutrophication until hypereutrophy is reached, when ruffe abundance typically declines. They are consumed by predatory fish, although native species without spines are preferred.

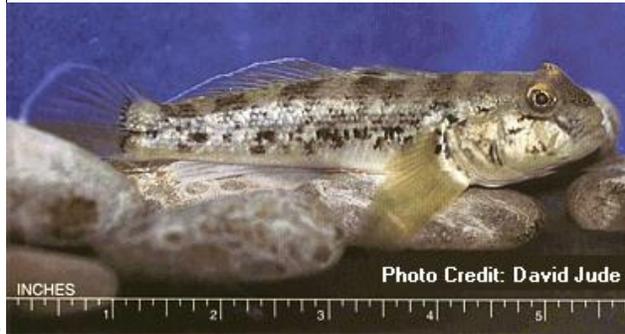
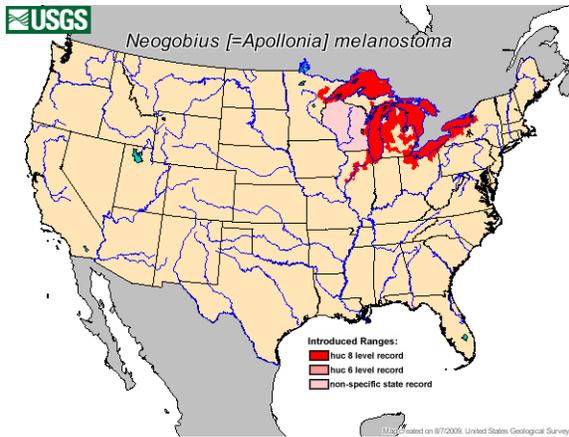
The ruffe is considered an invasive, nuisance species, posing a serious threat to commercial and sport fisheries and with the potential to affect native fish populations. Because of its rapid growth, high reproductive potential, and ability to tolerate a wide range of habitats, ruffe are thought to pose a threat to native species such as yellow perch, emerald shiners, and trout-perch. Ruffe do not pose a particular hazard to human health.

Attempts have been made to delay its spread through activities such as population reduction, ballast water management, and education. A Ruffe Control Program has been prepared for the Aquatic Nuisance Species Task Force, outlining measures that can and are being taken to slow the spread of ruffe, and possibly prevent its introduction into the Mississippi River. Control measures such as low levels of TFM (lampricide) have been tested, as ruffe are more sensitive to the chemical than brown trout or yellow perch. However, TFM is not labeled for ruffe control and would require a special permit.

A national management plan has been approved for this species by ANSTF (Ruffe Control Committee 1996). Should threats from this species arise in Arkansas, management efforts will draw on the expertise represented by this plan.

Round Goby (*Neogobius melanostomus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	unknown	Yes	Unlikely



The round goby *Neogobius melanostomus* is a small, soft-bodied, bottom-dwelling fish, typically 3 to 6 inches length, with of maximum size of about 10 inches. It resembles a native sculpin but has the pelvic fins fused together, forming a suction disk (Crossman et al. 1992). Young gobies are gray, while larger fish develop black and brown blotches. Breeding males are black in color. They are prolific and spawn multiple times during the season (in one study, five to six times at 18 to 20-day intervals). Males aggressively defend their nests. Their primary food is mollusks, including zebra mussels, which they crush with their upper and lower pharyngeal teeth. They also eat fish eggs, small fish, and various other food items such as aquatic invertebrates. Round gobies are a temperate water fish and can tolerate a wide range in temperature, from -1 to 30 C. They are also euryhaline, preferring brackish water, but capable of living and reproducing in fresh water. Gobies can tolerate low levels of dissolved oxygen (down to 0.3 – 0.9 mg/L, depending on fish weight) but will leave areas with less than 50 – 60% saturation (information compiled by Charlebois et al. 1997).

Ballast water is thought to be the pathway for the introduction of the round goby to the United States around 1988 to 1989. They were first discovered in the U.S. in 1990 (Jude et al. 1992), and are now found in all of the Great Lakes, extending into some streams in Pennsylvania and New York (Fuller et al. 2011). They have been found on the Mississippi River side of the electric barrier installed to prevent fish movement between the river and Lake Michigan.

They are considered to be an invasive species and a nuisance, and have been called an example of the ‘perfect’ invader (Manz 1998). They cause ecologic harm by eating the eggs of native fish species and by apparently out-competing native sculpins (Jude et al. 1995; Corkum et al. 2004). The impact of this mollusk-feeder on native mussel species is unknown; while the mouth gape is small, these fish are able to crush zebra mussels (Ray and Corkum 1997), which is apparently difficult for native molluskivores.

They also may be a link in the botulism poisoning of thousands of Great Lakes birds. Zebra mussels apparently filter out botulism from water, and in turn are eaten by round gobies. Birds

such as mergansers, gulls and loons then feed on the round gobies, and succumb to Type E botulism (Yule et al. 2006).

The gobies are consumed by native predatory fishes (Dietrich et al. 2006) and ironically, now constitute more than 90% of the diet of the once-endangered Lake Eric Water Snake *Nerodia sipedon insularum* (King et al. 2006). They are easily caught on bait, and impact sportfishers by taking baits intended for sportfish (Marsden and Jude 1995). They are also caught in large numbers by commercial fisheries, although they have no market value. There is concern that round gobies will be caught as bait from the wild and transported to new waters.

To date, there do not appear to be any feasible methods for control or management of round gobies. The potential for spreading down the Mississippi River is unknown but it is possible that round gobies will be successful at invading much of the river basin.

Snakehead (Family Channidae) – other than Northern Snakehead

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	unknown	unknown	Feasible but costly

Fishes in the family *Channidae* are commonly referred to as snakeheads; derived from their elongated, cylindrical bodies and the presence of large scales on the head (for most species), reminiscent of the cephalic scales on the heads of snakes. Their eyes are located in a dorsolateral position on the anterior part of the head. They also have tubular anterior nostrils. Their mouth is terminal and large with a protruding lower jaw, which contains canine-like teeth. Several species resemble the native bowfin (*Amia calva*) but can be distinguished by the anal fin (anal fins in snakeheads are elongate) and the lack of enlarged scales on the top of the head (Courtenay and Williams 2004). They are obligate air-breathers - some snakehead species have been reported to move overland for short distances by using snake-like wriggling motions (Orrell and Weigt 2005).

Five species of snakeheads have been reported from open waters of the United States. A single giant snakehead specimen (*Channa micropeltes*) was taken by an angler from open water in Tennessee (Bobby Wilson TWRA, personal communication, 2006). In most instances, the pathways of introduction are unknown, but are presumed to be either accidental pet release by aquarists or by purposeful introductions to establish a food and/or sport fishing resource. Snakeheads can be purchased on-line from exporters in India and Asia (Courtney and Williams 2004). The fish can quickly outgrow aquariums and subsequently are often released into the environment.

Although the northern snakehead has been found in Arkansas (see the section on Northern Snakehead above) there are at least 11 other species (Graham 1997) with the potential for illegal introduction into the state.

Current regulations restricting the possession of live specimens, along with continued monitoring, will limit the likelihood of additional snakehead species becoming established in Arkansas. However, angler education and awareness is needed to help ensure that any observation of a snakehead is reported immediately.

Sticklebacks (Family Gasterosteidae)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Unknown	Unknown	No	No	unknown	unknown

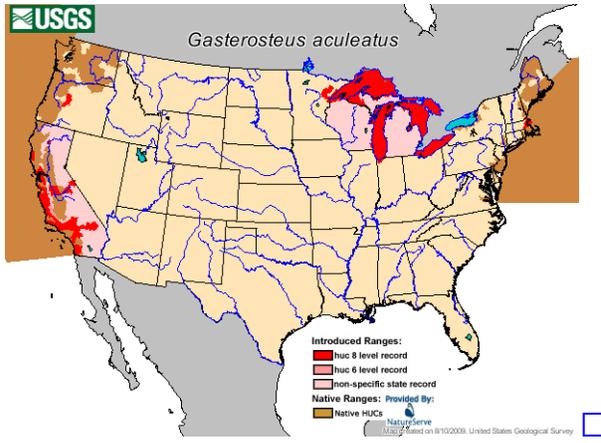


Photo by Noel M. Burkhead

Sticklebacks are small fish, typically 2 to 4", easily recognized by the presence of two or more stout dorsal spines that are not attached to the fin (free spines). Their body is elongate with a narrow caudal peduncle (area between body and tail). The ventral fins are spines with only a few rays. Scaleless fish, several species have bony plates on their sides. Species found in the Great Lakes region include the ninespine stickleback *Pungitius pungitius*, brook stickleback *Culaea inconstans*, fourspine stickleback *Apeltes quadracus*, threespine stickleback *Gasterosteus aculeatus*, and the blackspotted stickleback *Gasterosteus wheatlandi*. Threespine, fourspine and ninespine sticklebacks are found in both salt and freshwaters. Sticklebacks typically are bottom fish, feeding on aquatic insects and zooplankton.

The threespine stickleback is not native to the Great lakes, but has been found in areas of Lakes Michigan, Superior, Erie and Huron as well as Lake St. Clair. It is considered a nuisance species in the Great Lakes, as its native range is along the east and west coasts. Suspected pathways of introduction include natural movement through a canal, ballast water and bait release. The fourspine stickleback is native to the east coast and is mostly a nearshore marine species, but it has been found in Thunder Bay, Lake Superior, Canada, where it is apparently displacing native species.

Shipments of wild fathead minnows from the north central region sometimes contain sticklebacks, typically the brook stickleback (usually five spines). Brook sticklebacks have been reported in non-native locations, including Alabama, where the introduction was thought to be from a bait dealer holding fish from Wisconsin. The brook stickleback is a cool water fish that prefers clear water, although in southwestern Wisconsin, it can be found in highly turbid waters. The upper temperature tolerance (LC-50) for brook stickleback acclimated to 77°-79° F was found to be 87° F.

While sticklebacks are not considered to be particularly invasive, the concern is that they compete with native fish species. Sticklebacks are not native to Arkansas and are prohibited in the state.

Birds

Already present in Arkansas as of 2008

American white pelican (*Pelecanus erythrorhynchos*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
No	Yes	No	Yes	No	Feasible

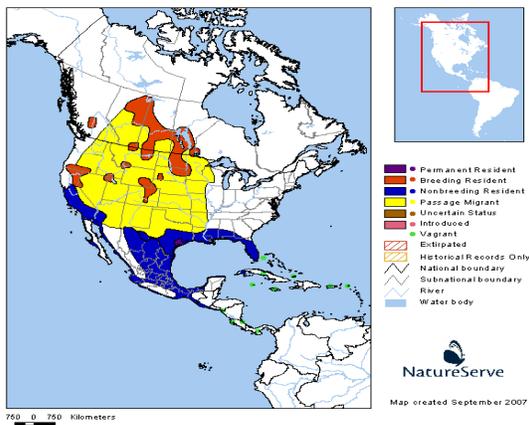


Photo by Mike Baird

The American white pelican is a large, white bird with a long orange-to-yellow bill and throat pouch, weighing 10 to 13 lbs with the second greatest wingspan of any bird in North America at 9-9 ½ feet (National Park Service 1997, Barras 2007). In North America they are grouped into two metapopulations using the North American Continental Divide as the delineation between the Eastern and Western populations (King and Anderson 2005). Populations mainly occur in the Western and Southern portion of North America, breeding inland and wintering along the warmer southern coasts (Knopf and Evans 2004). There are approximately 134,000 breeding pelicans found in North America and their numbers are increasing (King and Anderson 2005). Nests have more than doubled since 1979-1981 surveys of 20 selected colonies in both the eastern and western locations. The coastal waters of Louisiana have been shown to be a highly important wintering area for pelicans east of the Rocky Mountains, with nearly 35,000 birds observed from 1997-1999 (King and Michot 2002). In Mississippi, numbers peaked during the months of February and March in 1996, corresponding with the timing of their spring migration (King and Werner 2001). In Arkansas, peak numbers usually occur in April (James and Neal 1986).

In Arkansas and the Delta region of Mississippi, pelicans will loaf in groups numbering from under 100 to several thousand in flooded agricultural fields when the Mississippi River is high and there are no exposed mud flats or sand bars (King 1997). They will move on to catfish ponds while wintering in the Delta region of Mississippi (King and Michot 2002). Unlike other pelican species that swoop down and collect fish from the water, white pelicans scoop up fish while swimming (Peterson and Peterson 2002). They can also feed in coordinated groups, with flocks driving fish into shallow waters or encircling fish to concentrate numbers so they are more easily caught through synchronized bill dipping (Knopf and Evans 2004).

Animal Damage Control offices in Arkansas, Louisiana, and Mississippi began receiving complaints of pelicans foraging in catfish ponds in 1990 (King 1997). The relative shallowness of the ponds and high fish stocking rates used by most commercial farmers provide a perfect foraging environment. They were found most often on catfish ponds during the month of April in Mississippi (King and Michot 2002). Birds foraging at catfish ponds will spend about 4% of their time actually foraging and 96% of their time loafing (King and Werner 2001). Flocks are becoming harder to disperse on catfish farms because they are now foraging in smaller flocks spread out over the entire catfish complex rather than in one large group at a time (King 1997). As many as 1,000 pelicans have been observed foraging in a single 5 ha Mississippi catfish pond. Catfish up to 34 cm long were found in the stomachs of pelicans collected from the Delta region of Mississippi (King 1997). This could translate into a loss of \$2,900 from a single day of an average size flock of 250 pelicans consuming 2 lbs of catfish each, valued at \$1.54/kg (\$0.70/lb) (Glahn and King 2004). Mississippi, Alabama, Arkansas, and Louisiana are the top four catfish producing states in an industry that had sales of \$445 million during 2007 (NASS 2008). Pelicans have been cited as the third greatest cause of loss to catfish producers due to wildlife (Wywiałowski 1999). Aside from causing direct losses to the catfish farmers from predation, the pelicans are also the final host of the digenetic trematode (*Bolbophorus* spp.), which causes high mortality rates and decreases in production on catfish farms in Arkansas, Louisiana, and Mississippi (Terhune et al. 2003).

Current recommendations to farmers with pelican problems include harassment patrols, pyrotechnics, electronic noise devices, and issuance of USFWS depredation permits (King 1997). USDA/APHIS/Wildlife Services is authorized to eradicate up to 500 American White pelicans in Arkansas when deemed necessary (Federal Fish and Wildlife Permit number MB715040-0).

Please note that while the American white pelican is a native species that is considered a nuisance species in Arkansas, it does not meet the definition of an aquatic nuisance species according to the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA as amended by NISA, 1996) and USFWS State Plan funding via NANPCA will not be used to fund activities related to this species.

Double-crested cormorant (*Phalacrocorax auritus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
No	Yes	No	Yes	No	Feasible

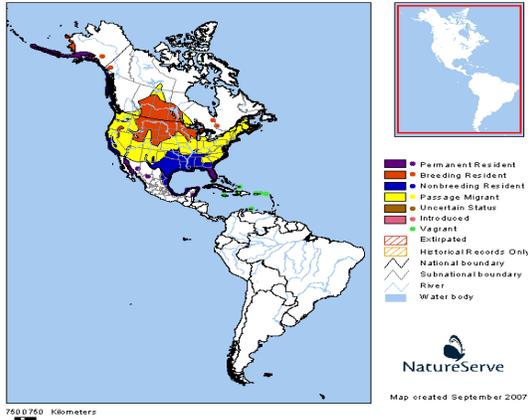


Photo by wikipedia.org

Double-crested cormorants are piscivorous birds that have been known to cause problems for aquaculture farms throughout the southern states. It is the widest ranging of six species of cormorants with nesting numbers in the interior as well as coastal areas of the country (Hatch 1995). They are native to North America and remains have been found in Arkansas dating back to 600-800 AD (James and Neal 1986). The interior and Atlantic populations of cormorants have been experiencing an explosion in numbers since 1972, suggesting that the cormorants have recovered from effects of harmful pesticides used during the 1960's (James and Neal 1986; Hatch 1995).

Cormorants overwinter in Arkansas from December to March, with at least 16,000 cormorants documented in catfish-producing areas of Arkansas (Wooten 2001). They are remarkably fast swimmers when pursuing prey, both along the surface of water as well as beneath (Baerg 1951). In a survey of catfish producers regarding losses caused by wildlife to their production operations in fifteen states, birds were the most frequent cause of losses with double-crested cormorants being cited most often (Wywialowski 1999). Cormorants catch an average of five catfish (averaging 12 cm in length)/cormorant/hour on catfish farms in Mississippi (Stickley et al. 1992). Fingerling catfish were taken at rates as high as 28 fingerlings/cormorant/hour. A typical flock of 30 cormorants in Mississippi have been estimated to consume \$13.45 of catfish per hour of foraging. In terms of economic losses, enterprise budgets simulating 30 cormorants feeding at a 15-acre catfish pond for 100 days resulted in a 111% loss of profits (Glahn et al. 2002). Glahn and Brugger (1995) constructed a bioenergetics model to predict the food demand and impact on the catfish industry in the Delta region of the Mississippi. An average predicted food demand of 504 g/bird/day led to a loss of approximately 4% of the estimated standing crop at a replacement cost of \$2 million annually. Glahn et al. (2000) subsequently revised this damage estimate to \$5 million annually.

Cormorants breed locally in small numbers in Arkansas but can be found throughout the state in larger numbers during the winter (Scheiman 2007). In 1999, two crappie fishermen at Millwood Lake in the southwest corner of Arkansas found a large cormorant rookery of over 100 active

nests (Thurman Booth, USDA/APHIS/WS, personal communication, 2007). Subsequently, the double-crested cormorant was designated by AGFC as an invasive aquatic species on November 18, 2004 (Minute Order 04-082). A management goal of zero nesting cormorants in Arkansas has been set to prevent unacceptable economic and aesthetic losses to fishery resources that have resulted in other states where cormorant nesting has been allowed to continue unchecked. The USFWS authorizes the use of depredation permits on fish farms for addressing cormorant problems and damages. Two depredation orders have been issued by USFWS that allow for the unlimited killing of cormorants (50 CFR 21.47 and 50 CFR 21.48). APHIS/WS currently provides assistance to those applying for depredation permits in the state.

Please note that while the double-crested cormorant is a native species that is considered a nuisance species in Arkansas, it does not meet the definition of an aquatic nuisance species according to the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA as amended by NISA, 1996) and USFWS State Plan funding via NANPCA will not be used to fund activities related to this species.

Mammals

Already present in Arkansas as of 2008

Beaver (*Castor canadensis*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
No	Yes	No	Yes	Possible	Feasible

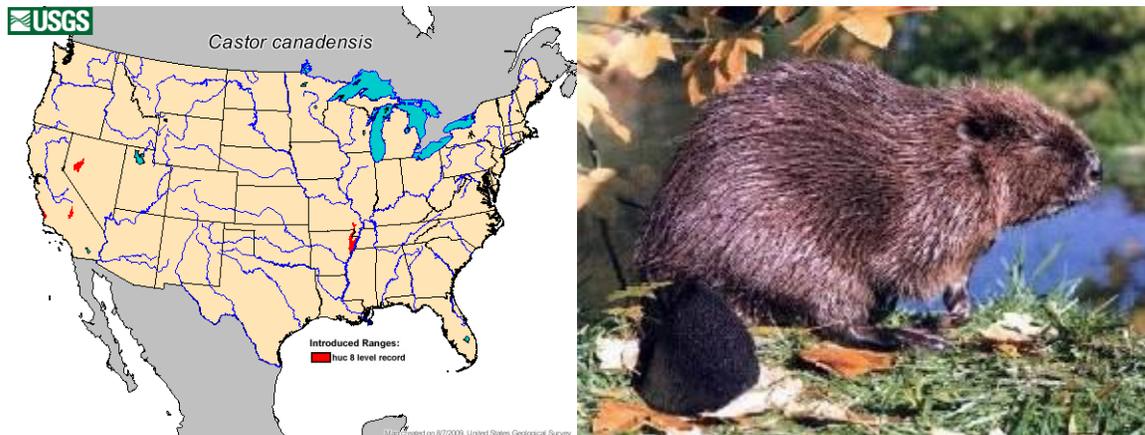


Photo by turtletrack.org

The beaver is a large rodent with a broad, flat tail, short ears, large incisors, brownish fur, and webbed hind feet. They generally weigh 35 to 40 pounds at maturity but weights in excess of 60 pounds have been reported. Life expectancy is 10 to 12 years in the wild. They are primarily nocturnal, feeding and working mainly at night. Their diet consists primarily of bark, twigs, and leaves of various trees and shrubs. Breeding occurs during the winter with the gestation period lasting four months. Young usually appear as early as April and as late as June (Whitaker et al. 1991).

Beaver were historically found throughout Arkansas. However, populations experienced a drastic decline in the late 1800s due to trapping. Restocking efforts in the early- to mid- 1900s and the decline in pelt prices helped re-establish populations (McPeake and Pledger no date). They can be found throughout most of the U.S. except for parts of California, Florida, and Nevada.

They can become a nuisance and pose problems to agriculture operations, personal property, and threaten the integrity of constructed pond levees. Surveys have estimated damages state-wide totaling from \$3,000,000-\$35,000,000 annually (McPeake and Pledger no date).

While they can be beneficial from a wildlife standpoint, an overpopulation of beavers can become problematic. By constructing unwanted dams, they can damage agriculture crops, standing timber, and other personal property. Most damage is associated with flooded timber and agricultural land and the girdling or cutting of valuable trees.

Trapping bounties have been offered for pelts and for tails. Other methods of control include the destruction of dams and lodges (beaver homes), habitat manipulation, exclusion fencing, and the use of toxicants.

Please note that while the beaver is a native species that is considered a nuisance species in Arkansas, it does not meet the definition of an aquatic nuisance species according to the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA as amended by NISA, 1996) and USFWS State Plan funding via NANPCA will not be used to fund activities related to this species.

Nutria (*Myocastor coypus*)

<u>Invasive</u>	<u>Nuisance</u>	<u>Human Health Threat</u>	<u>Economic Threat</u>	<u>Ecological Threat</u>	<u>Control Feasibility</u>
Yes	Yes	No	No	Possible	Feasible

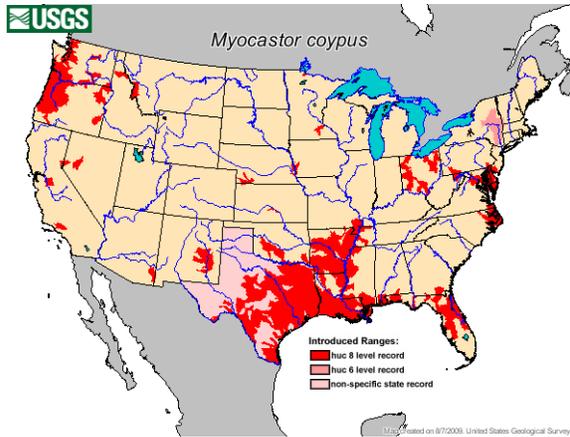


Photo by USGS

Nutria are semi-aquatic rodents that can be found in marshes, lake edges, bayous, freshwater impoundments, drainage canals, and various other types of wetlands. They are native to southern Brazil, Bolivia, Paraguay, Uruguay, Argentina and Chile (Carter and Leonard 2002).

They construct platforms from vegetation that are used for feeding and grooming and will either inhabit the burrow of another animal or construct their own burrow. The burrows vary from a single tunnel to a complex system with chambers and may extend 50 feet or more. They also create runways throughout the vegetation surrounding the den, which can extend to a radius of 600 ft. Much of their time is spent browsing aquatic vegetation. Diet is strictly vegetative matter.

Their head and body length is 430-635mm while the tail length ranges from 255-425mm. Nutria usually weigh 10-20 lbs. but can reach 37 lb. Their incisors are brilliant orange. The fur of the upper parts is made up of many long coarse yellowish brown or reddish brown guard hairs. The guard hairs conceal soft, thick dark gray underfur. Pale yellow fur covers the belly and is not as coarse as the fur covering the upper parts. The tail is cylindrical, thinly haired and scaled. Front limbs are relatively short. The hind foot is webbed and much longer than forefoot (Nowak 1999).

The first recorded attempt to establish a population was in Elizabeth Lake, California in 1899. These animals did not breed and failed to establish a viable population. The first successful reproduction of nutria in North America occurred in Quebec in 1927. Nutria ranches were established in Louisiana, New Mexico, Ohio, Oregon, Utah, and Washington during the 1930s. When these ranches failed due to low pelt prices, nutria were sometimes released into the wild. Additionally, state agencies, including Arkansas, purposely released nutria to promote the fur trade and control aquatic vegetation (Carter and Leonard 2002).

A viable population must have not resulted from the 1940 state release because they were not noted again until the 1960s. Today's population is thought to have resulted from range expansion from Louisiana. Nutria can be found throughout Arkansas (Bailey and Heidt 1978).

Twenty nutria were introduced into Louisiana in 1938 and within 20 years the population reached 20 million. In 1962, the nutria replaced the native muskrat as the leading fur bearer in Louisiana. Nutria may breed all year long. Reproduction peaks in late winter, early summer and mid-autumn. Nutria reach sexual maturity at four to six months. Males can breed throughout the year. Females are pregnant from 128 to 130 days and are ready to breed 48 hours after giving birth. Litters average 4 to 5 young but can be as many as 13. Females may have three litters a year (Nowak 1999).

Grazing activities destroy marsh vegetation, burrows undermine water control structures, and agricultural crops can also be affected by nutria (Carter and Leonard 2002). Louisiana coastal wetlands are particularly affected by nutria grazing. A bounty of \$5 per nutria tail is paid by the state to help reduce the impacts to Louisiana's wetland habitats (Louisiana Department of Wildlife and Fisheries 2003).

JURISDICTIONS

Many state and federal agencies are involved in various aspects of regulation affecting the possession or introduction of ANS. This section describes the jurisdictions relevant to ANS. Descriptions are grouped into categories of federal agencies, state agencies, affected organizations without regulatory jurisdictions, and a description of several relevant national and state programs. Additionally, when jurisdictions are absent, or are not readily apparent, concessions need to be made to address these shortcomings in a timely manner.

Federal Agencies

Current federal management efforts are comprised of numerous laws, regulations, policies and programs. The majority of these efforts are aimed at promoting coordination and cooperation among federal agencies to prevent ANS introduction and spread. No single federal agency has clear authority over ANS management.

The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, P.L. 101-646) established the National Aquatic Nuisance Species Task Force (ANSTF). The ANSTF provides national leadership and calls for coordination among federal agencies to help prevent, control, and detect ANS in the United States. While it mainly focuses on zebra mussels, NANPCA also calls for preventing the introduction and dispersal of any nonindigenous species into the waters of the United States.

The National Invasive Species Act of 1996 (NISA, P.L. 104-332) reauthorizes and amends NANPCA to include all pathways of invasion and authorizes the formation of regional panels to promote coordination. NISA requires the development of voluntary national guidelines to prevent the introduction and spread of nonindigenous species into U.S. waters via ballast water of commercial vessels. Also under NISA, individual states may submit their own comprehensive management plan to the National ANSTF for approval.

President Clinton signed Executive Order 13112 (Invasive Species) into law on February 3, 1999. This Order requires that all federal agencies seek to prevent the introduction of invasive species, respond rapidly to control invasive species when detected, monitor invasive species populations, provide for restoration of native species and habitat conditions in ecosystems that have been invaded, research technologies to prevent future introductions, and promote public education on invasive species and the means to address them. President Bush continued the Order under his two administrations.

Under the Lacey Act (16 WSC 3371-3378) it is unlawful to import, export, transport, buy or sell fish, wildlife, and plants taken or possessed in violation of federal, state or tribal law whether in interstate or foreign commerce. The term "fish or wildlife" means any wild animal, whether alive or dead, including without limitation any wild mammal, bird, reptile, amphibian, fish, mollusk, crustacean, arthropod, coelenterate, or other invertebrate, whether or not bred, hatched, or born in captivity, and includes any part, product, egg, or offspring thereof.

Department of Interior (DOI)

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation.

National Park Service (NPS)

The National Park Service mission is to preserve and protect the cultural and natural resources entrusted to it while providing the public and future generations an opportunity to enjoy these resources (National Park Service Organic Act, 16 U.S.C.1). In Arkansas, the NPS manages six diverse sites. Of the six, Arkansas Post National Memorial and Buffalo National River are the only two with significant aquatic resources. As a federal agency, NPS is subject to the above-mentioned regulations that outline the responsibilities of the federal government in respect to invasive species. NPS also has Management Policies that address exotic species and their impact. Park superintendents, planners, and other NPS employees use management policies as a reference when making decisions that will affect units of the national park system. All exotic plant and animal species that are not maintained to meet an identified park purpose will be managed- up to and including eradication- if control is prudent and feasible and if it is determined that the exotic interferes with natural processes of native species (including disrupting genetic integrity), disrupts the presentation of a cultural landscape, damages cultural resources, significantly hampers the management of the park or adjacent lands, poses a public health hazard, and/or creates a hazard to public safety (NPS Management Policies 4.4.4.2). Where an exotic species cannot be successfully eliminated, managers will seek to contain the species to prevent further spread or resource damage. Where management appears to be feasible and effective, superintendents should consult, as appropriate, with federal, tribal, local, and state agencies as well as other interested groups.

Fish and Wildlife Service (USFWS)

The mission of the U.S. Fish and Wildlife Service is to work with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. Because of their responsibilities, the Service is very concerned about the impacts that invasive species are having across the Nation. The U.S. Fish and Wildlife Service addresses invasive species issues through a variety of programs and partnerships. The Service's Invasive Species efforts take proactive approaches to address intentional and unintentional introductions, combat the spread of existing invaders on and off Service lands, and maintain the Service as a leader in invasive species prevention and control.

Fisheries and Aquatic Resource Conservation

The U.S. Fish and Wildlife Service's **Aquatic Invasive Species Program** is housed within the Fisheries and Habitat Conservation Program's Division of Fisheries and Aquatic Resource Conservation. The Branch of Aquatic Invasive Species essentially houses three functions:

- **The FWS Aquatic Invasive Species Program**

The AIS Program seeks to prevent the introduction and spread of AIS, rapidly respond to new invasions, monitor the distribution of and control established invaders, and foster responsible conservation behaviors through its national public awareness campaigns (Stop Aquatic Hitchhikers and Habitattitude).

- **Administration of Aquatic Nuisance Species Task Force**

The Branch of AIS builds capacity, coordinates, and implements AIS prevention and control activities authorized under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, as amended by the National Invasive Species Act (NISA) of 1996), including: co-chairing and administering the ANSTF, supporting Regional Panels, providing grants for State/Interstate ANS Management Plans, and implementing a National AIS program.

- **Injurious Wildlife Evaluations and Listings**

The AIS Program supports the Injurious Wildlife Provisions of the Lacey Act through an ongoing process of evaluating species and possibly listing them as injurious through the rulemaking process.

The AIS Program has worked to prevent populations of invasive species from entering or spreading into the United States. Priority containment (boat inspection and decontamination), early detection and rapid response (snakehead eradication and Chicago Sanitary Shipping Canal), interjurisdictional coordination and planning (Quagga/Zebra Mussel Action Plan and 100th Meridian), and regulatory (injurious wildlife listing of black and silver Asian carp) and non-regulatory actions (Stop Aquatic Hitchhikers!) have occurred across many jurisdictions. Through the actions of the AIS program, a national AIS network has been built – including 39 states, 6 Regional panels, over 1,000 participants in two national public awareness campaigns and many other partners – that has planned, directed and accomplished significant regional and landscape level invasive species prevention and management resource outcomes. The AIS Program serves as the nation’s front line for prevention of new aquatic invasive species by regulating imports of injurious wildlife, facilitating behavioral change and managing pathways to limit the introduction and spread of invasives (awareness campaigns and ballast water), and developing monitoring programs for invasion hotspots to facilitate early detection and rapid response.

The Fisheries and Habitat Conservation Program also manages three national fish hatcheries in Arkansas: Greers Ferry, Mammoth Spring, and Norfolk National Fish Hatcheries.

National Wildlife Refuge System

The Fish and Wildlife Service also manages more than 550 refuges, encompassing more than 150 million acres of wildlife habitat, within its **National Wildlife Refuge System** (NWRS). In 2010, more than 2.5 million acres of the Refuge System are impacted by invasive plants. In addition, there are approximately 3,800 invasive animal populations

residing on refuge lands. There are 10 National Wildlife Refuges in Arkansas: Bald Knob, Big Lake, Cache River, Felsenthal, Holla Bend, Logan Cave, Overflow, Pond Creek, Wapanocca and the White River National Refuges.

Endangered Species

The ultimate goal of the Endangered Species Act (ESA - (16 U.S.C. § 1531 et seq.)) is the recovery (and long-term sustainability) of endangered and threatened species and the ecosystems on which they depend. Recovery is the process by which the decline of an endangered or threatened species is arrested or reversed, and threats removed or reduced so that the species' survival in the wild can be ensured. The goal of the ESA is the recovery of listed species to levels where protection under the ESA is no longer necessary.

In many instances these threats may be caused by invasive species. They may either directly harm the species by causing mortality or may threaten a species by modifying or destroying the habitat or food source on which that species depends. A variety of methods and procedures are used to recover listed species, such as reduction of threats (including invasive species), protective measures to prevent extinction or further decline, consultation to avoid adverse impacts of Federal activities, habitat acquisition and restoration, and other on-the-ground activities for managing and monitoring endangered and threatened species.

United States Geological Survey (USGS)

The mission of USGS is to provide natural resources information for use by other entities and the public. USGS has created and maintains a “Nonindigenous Aquatic Species” website that provides information on species including descriptions, pictures, maps of distribution, and collection sites within all 50 states. The website allows for new findings to be documented as well.

Department of Defense (DOD)

United States Army Corps of Engineers (USACE)

The United States Army Corps of Engineers has regulated activities in the nation’s navigable waterways since 1890.

Specific authority for USACE includes Sections 401 and 404 of the Clean Water Act. Section 401 requires a permit to conduct any activity that may result in discharge of a pollutant into the water. Section 404 requires a permit for discharging dredge or fill material at specified disposal sites.

The USACE is also home to the Aquatic Plant Control Research Program (APCRP) which is the nation’s only federally authorized research program dedicated to developing technology for the management of non-indigenous aquatic plant species. In 1993, USACE established the Invasive Species Center (ISC) assigned to the Environmental Laboratory, US Army Engineer Research and Development Center (ERDC), in

Vicksburg, MS. The ISC provides a single point of contact with the ERDC for the coordination and facilitation of all invasive species research and technology transfer to various Federal, State, private industry, and academic organizations.

United States Department of Agriculture (USDA)

The United States Department of Agriculture provides leadership on food, agriculture, natural resources, and related issues based on sound public policy, the best available science, and efficient management. The USDA has Under Secretaries for each of the following programmatic areas: 1) Natural Resources and Environment (includes the Forest Service, the Natural Resources Conservation Service, and the National Invasive Species Information Center); 2) Farm and Foreign Agricultural Services; 3) Rural Development; 4) Food, Nutrition, and Consumer Services; 5) Food Safety; 6) Research, Education, and Economics (includes the CSREES federal-state partnerships of research and extension with land-grant universities and the National Agricultural Library); and 7) Marketing and Regulatory Programs (includes Animal and Plant Health Inspection Service).

United States Forest Service (USFS)

The U.S. Forest Service was established in 1905 and is an agency of the U.S. Department of Agriculture. The USFS manages public lands in national forests (National Forest System) and grasslands, which encompass 193 million acres. It is also the largest forestry research organization in the world, and provides technical and financial assistance to state and private forestry agencies.

The Chief of USFS has identified invasive species as one of the “Four Threats” to conservation on national forests across the country (Ozark-St. Francis National Forest Plan 2005). One of the top priorities of the Forest Service is to protect forest and rangeland ecosystems from the impacts of invasives by preventing the release of and controlling or eradicating the spread of non-native species.

Within Arkansas are the Ouachita National Forest and the Ozark - St. Francis National Forests. USFS does not have exclusive jurisdiction over fish and wildlife within National Forest System lands, but they do have jurisdiction over plants and therefore aquatic invasive/nuisance species of plants within their lands. Treatments to eradicate aquatic nuisance fish species within the National Forests would be done through a cooperative arrangement with AGFC as covered by the Memorandum of Understanding of 7/13/06. It states that USFS has sole approval authority over herbicide applications on National Forest System lands and AGFC has joint approval authority with USFS over the use of piscicides on National Forest System lands. All three National Forests have specific language as to procedures for treatment protocols and approval processes. In response to Executive Order 13112 the Forest Service has developed programs and lists of invasive species, including terrestrial and aquatic, animal and plant, and has concentrated a great deal of time and money on eradication/management of invasive plants on National Forests, mostly due to the jurisdictional issues of not being in the lead for eradication of non-plant species.

The original Wilderness Act of 1964 (PL 88-577) and the subsequent legislation enacting the various Wildernesses on National Forest System lands within Arkansas (Eastern Wilderness Area Act of 1976, PL 93-622 and Arkansas Wilderness Act of 1984, PL 98-508) dictate actions that can occur within these tracts of lands within the National Forest (see 36 CFR 261 and 293). Since ANS are not native to the areas, there is great importance in eradicating them from Wilderness Areas but the means to do so must meet the letter and intent of the law. The Regional Forester must approve actions if they are a “non-conforming activity”. Direction for these activities can be found within the Forest Service Manual:

Chemical Treatment: Chemical treatment may be used to prepare waters for reestablishment of indigenous, threatened or endangered, or native species, or to correct undesirable conditions caused by human influence. The Regional Forester approves all proposed uses of chemicals in wilderness (FSM 2150).

Wildlife and Fish Habitat: Achieve a balance of wildlife and fish with their habitat through cooperation with state agencies in management of public hunting, fishing, and trapping. Objectives for the management of wildlife and fish habitat are normally compatible with the objectives for maintaining wilderness values. Where incompatible, the requirements for maintenance of wilderness values take precedence.

Manipulation of Wildlife Habitat: The objective of all projects must be to perpetuate the wilderness resource; projects must be necessary to sustain a primary value of a given wilderness or to perpetuate a federally listed threatened or endangered species. First priority is given to locating habitat improvement projects outside wilderness for the benefit of wildlife that spend only part of the year in wilderness. To qualify for approval by the Chief, habitat manipulation projects must satisfy the following criteria:

1. The condition needing change is a result of abnormal human influence.
2. The project can be accomplished with assurance that there will be no serious or lasting damage to wilderness values.
3. There is reasonable assurance that the project will accomplish the desired objectives.
4. Test major projects through a pilot study. The pilot study should take place in a comparable area outside of wilderness if possible.

In a similar vein, but considerably less restrictive, is the Wild and Scenic Rivers Act of 1968 (PL 90-542: USC 1271-1287). Arkansas Rivers were added to the system in 1992 with PL 102-275. Basically this series of laws are to preserve the various rivers or river segments in their free-flowing conditions (36 CFR 297). Discovery of an ANS within the Arkansas National Forests’ Wild and Scenic Rivers or their corridors would not reduce the emphasis to eliminate or manage the species but might impact how the treatment/management would be conducted. The individual management plans for each river/segment would need to be reviewed on a case-by-case basis to determine if there are any constraints to ANS management.

The Ouachita National Forest has specific guidelines in their Revised Forest Plan (September, 2005) for the use of pesticides within streamside management areas (Management Area 9). This standard was specifically designed to deal with ANS issues whereas the earlier plan did not allow the use of herbicides in MA 9. The Forest Supervisor, following site-specific analysis and a monitoring plan, can approve pesticide use within MA 9 on a case-by-case basis. Terrestrial vegetation control may only be conducted on dams or for control of invasive and/or exotic species. Aquatic application of herbicide for control of invasive or nuisance aquatic vegetation/algae may occur if biological controls have failed, are not available, and/or other means of control are not suitable or practicable.

The Ozark - St. Francis National Forests also have specific guidelines in their Revised Forest Plan (September 2005) for the use of pesticides within streamside management zones (SMZs). Aquatic pesticides for use as a sampling tool or for removal of exotic species is permitted on lakes and ponds except for areas used as public or domestic water sources. Herbicides cannot be used within the appropriate SMZs or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a "Finding of No Significant Impact" (FONSI).

Their Plan also lists as a priority to develop protocols for survey, detection, evaluation, suppression, and prevention of infestations of non-native invasive species. It includes coordinating with ANHC and other state and federal agencies on prevention, suppression, and eradication efforts. A target was set to treat at least 200 acres per year for reduction or elimination of non-native, invasive species.

Agricultural Research Service- National Agricultural Library

The National Agricultural Library maintains an online National Invasive Species Information Center (NISIC): gateway to invasive species information; covering Federal, State, local, and international sources.

Animal and Plant Health Inspection Service (APHIS)

The Animal and Plant Health Inspection Service is charged with the protection of the health and value of U.S. agriculture and natural resources. The APHIS system safeguards the health of animals, plants and ecosystems in the U.S. and fosters safe agricultural trade worldwide. Mission priorities include the protection of plant and animal health through domestic surveillance and detection systems, regulations, emergency preparedness, animal welfare, wildlife damage management, import and export programs, and international safeguarding.

The APHIS Federal Noxious Weed Program is designed to prevent the introduction and spread of nonindigenous invasive plants into the United States. This authority was given to APHIS mainly through the Plant Protection Act of 2000 and the Federal Seed Act.

The Plant Protection Act of 2000 (PPA) (7 U.S.C. 7701) consolidates all or part of 10 existing USDA plant health laws into one law that regulates plants, plant products,

certain biological control agents, noxious weeds, and plant pests. The Federal Noxious Weed Act of 1974 (FNWA)(7 USC §§2801-2814) was superseded by the PPA and was the original Act that provided for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. No person was allowed to import or move any noxious weed identified by regulations of the Secretary into or through the U.S. except in compliance with regulations and/or permits. A Federal Noxious Weed List was created under FNWA listing the prohibited noxious weeds and is the only part of the original Act that is still included under the PPA today (7 CFR 360). The current Noxious Weed List (as of June 30, 2006) includes hydrilla and giant salvinia. APHIS (through delegated authority from the Secretary of Agriculture) prohibits or restricts the importation, exportation, and interstate movement of plants, plant products, certain biological control agents, noxious weeds, and plant pests in the United States. APHIS was also given the authority to declare an extraordinary emergency when a newly introduced or not widely prevalent noxious weed poses a significant threat. This allows APHIS the ability to hold, seize, quarantine, treat, or destroy any plant or plant product being moved within a state that is believed to be infested with a plant pest or a noxious weed. The PPA reaffirms APHIS authority to regulate biological control to prevent the introduction of plant pests or noxious weeds and encourages the USDA, other Federal agencies, and states to use biological control whenever feasible. The PPA provides APHIS with guidance on how to regulate the movement of biological control organisms and authorizes APHIS' participation in activities that enable the effective transfer of biological control techniques. The Noxious Weed Control and Eradication Act of 2004 (7 U.S.C. 7781) amends the PPA to require the Secretary of Agriculture to establish a program to provide assistance to weed management agencies to control or eradicate noxious weeds on public and private lands.

The Federal Seed Act (7 U.S.C. 1551-1611) regulates the interstate shipment of agricultural and vegetable seeds. Seeds shipped in interstate commerce must be labeled with information that allows seed buyers to make informed choices. The importation of any agricultural or vegetable seed that contains noxious weed seeds is prohibited under this Act.

Plant Health, Protection, and Quarantine (PPQ)

The Plant Health, Protection, and Quarantine sector of APHIS safeguards agriculture and natural resources from the risks associated with the entry, establishment, or spread of animal and plant pests and noxious weeds to ensure an abundant, high-quality, and varied food supply. The PPQ regulates the importation of plant and plant products under the authority of the Plant Protection Act. The PPQ manages the import permit process that is required to import specific plants, plant products, and organisms into the U.S. and across state lines. Federal regulations also require that most imported plants and seeds enter the U.S. through one of seventeen PPQ operated Plant Inspection Stations.

Wildlife Services (WS)

APHIS Wildlife Services has no regulatory authority. Its mission is to provide federal leadership in managing problems caused by wildlife. The WS program carries out the federal responsibility for helping to solve problems that occur when human activity and wildlife are in conflict with one another.

WS (formally APHIS Animal Damage Control) is authorized by Congress to conduct activities relating to most wildlife damage situations. Additionally, field activities are conducted under authorizations received from cooperating federal and state regulatory agencies. The primary statutory authority for the program is the Animal Damage and Control Act of March 1931, as amended (7 U.S.C. 426-426c; 46 Stat. 1468). This act authorizes and directs the Secretary of Agriculture to spread the best methods of eradication, suppression, or bringing under control on national forests and other areas of the public domain as well as on State, Territory or privately owned lands of certain animals that are injurious to agriculture, horticulture, forestry, animal husbandry, wild game animals, fur-bearing animals, and birds. Injurious animals include but are not limited to brown tree snakes, wolves, and more recently, double-crested cormorants. The WS program addresses both prevention and correction of wildlife damage problems and, in consideration of contemporary values, seeks acceptable balances between human interests and wildlife needs. WS, under authorization from the U.S. Fish and Wildlife Service, assists aquaculture producers in resolving double-crested cormorant depredation problems under Depredation Order 50 (CFR 21.47). Double-crested cormorants can be taken by employees of WS at roost sites in the vicinity of aquaculture facilities, at any time, day or night, during the months of October through April. WS may also designate agents to carry out control programs. This same depredation order provides for the take of double-crested cormorants to protect public resources. When cormorants are found committing or about to commit depredations on the public resources of fish, including hatchery stock at federal, state, and tribal facilities, they can be taken without a permit.

A WS representative will go to the depredation site to assess the extent of the cormorant problem. The aquaculture producer must have a non-lethal harassment program established before the recommendation for removal under the depredation order is given.

United States Environmental Protection Agency (EPA)

EPA regulates three areas that may be critical to ANS management and rapid response programs in Arkansas. These are 1) point source discharges, 2) dredge or fill material discharge, and 3) the manufacture, distribution, sale, and use of pesticides in the U.S. Rapid response actions must occur quickly in order to be effective against newly introduced ANS and this may require the help of EPA.

The Clean Water Act (USC 36 Chapter 26) is the primary statute protecting surface waters in the U.S.. The act's goal is to restore and maintain the chemical, physical, and biological integrity of the nation's waters so that they can support the protection and propagation of fish, shellfish, and wildlife (USEPA 2005). Section 404 of the Clean Water Act regulates the discharge of dredged or fill material. The responsibility for enforcing Section 404 is shared by the EPA and USACE. Natural resource managers should consult the appropriate USACE District office to determine whether a Section 404 permit is needed if control methods include mechanized clearing of riparian areas to remove ANS or dumping of fill material to smother ANS. Arkansas has 4 USACE Districts. Section 402 of the Clean Water Act establishes the National Pollutant Discharge Elimination System (NPDES). The NPDES permit program regulates point source discharges of pollutants into waters of the United States (USEPA 2005). A NPDES permit is not required when applying pesticides directly to or over waters of the United States to control pests as long as the application is consistent with all relevant requirements under the Federal

Insecticide, Fungicide, and Rodenticide Act (FIFRA). Arkansas has an approved State NPDES Permit Program that is under the authority of ADEQ's Water Division.

The EPA, under authority of FIFRA, regulates the manufacture, distribution, sale, and use of pesticides in the U.S. (USEPA 2005). EPA approves a product label once it determines that a pesticide is in compliance with FIFRA health and safety requirements and can suspend or cancel registration of a pesticide if prolonged use poses unreasonable risks. FIFRA Sections 18 and 24(c) may apply to ANS rapid response plans. Section 18 authorizes EPA to allow states to use a pesticide for an unregistered use for a limited time. If an unregistered pesticide or a pesticide registered for a different end use or use pattern is called for and an emergency situation does exist, federal or state agencies may be able to obtain approval to use a non-labeled pesticide under FIFRA Section 18. An emergency condition is an urgent, non-routine situation that requires the use of a pesticide when no effective registered pesticide or alternative control practice is available, involves the introduction of a new pest, and will cause economic loss or significant risks to human health, endangered species, or the environment. Detection of ANS may qualify as an emergency condition in some cases. A Section 18 emergency exemption application should be used and ASPB's Pesticide Division is responsible for administering these permits. Section 24(c) authorizes states to register an additional use of a Federally-registered pesticide product or a new end use product to meet a special local need (USEPA 2005). This means that if the control action requires the use of an unregistered pesticide or a pesticide registered for a different use or use pattern and the state can demonstrate a special local need, FIFRA Section 24(c) can allow its' use. Section 24(c) registrations are also referred to as state labels and use is granted within that state only. With a Section 24(c) registration, the state must perform an ecological risk assessment (ERA). Therefore, Section 24(c) pesticide registrations may be more useful for ongoing control than for rapid response actions, as it will take time to conduct the ERA.

State Agencies

Arkansas Game and Fish Commission (AGFC)

AGFC is the primary state agency charged with managing the fish and wildlife resources of Arkansas while providing maximum enjoyment for the people of Arkansas. It oversees the protection, conservation and preservation of various species of fish and wildlife in Arkansas through habitat management, fish stocking, hunting and fishing regulations, and other programs to help Arkansas' wildlife to flourish. AGFC establishes regulations for hunting and fishing, conducts educational programs through nature centers located throughout the state, in schools, and for the general public, and has made a significant commitment to wildlife protection and management throughout the state.

There are general fishing regulations related to ANS. Certain fish species are banned within the state: it is unlawful to possess, import, or transport any snakehead (Family Channidae), walking catfish, stickleback, Mexican banded tetra, or piranha in Arkansas. European rudd (*Scardinius erythrophthalmus*) and any of the four Asian carp species (grass carp, bighead carp, silver carp, and black carp) are illegal to use or offer for sale as baitfish. It is unlawful to knowingly transport zebra mussels into or between the waters of the State of Arkansas.

Part of this responsibility includes working with the aquaculture industry. The AGFC has jurisdiction over what species can and cannot be raised in aquaculture facilities in Arkansas. It is unlawful for fish farmers to culture and/or sell species without first obtaining a Fish Farmer (Aquaculturist) Permit annually. AGFC maintains an Approved Aquaculture Species List that identifies which species may be freely imported into and traded within the state for aquaculture purposes. It is unlawful to raise or sell aquatic species not listed without obtaining either a Restricted Species Permit or an Unlisted Aquaculture Species Permit, as appropriate, from the Chief of Fisheries. Producers who wish to raise a restricted species must follow stringent guidelines to ensure that these species will not escape the facility. They are expected to assure that buyers of restricted species within Arkansas also have an approved permit. Failure to comply with permit terms or inability to show adequate measures of escape prevention may result in permit denial or revocation. Species covered by Restricted Species Possession Permits include silver carp, diploid black carp, bighead carp, and European rudd. Grass carp and triploid black carp are currently listed as Approved Aquaculture Species. Requests to import and culture species not specifically listed in the Fisheries Division Policy require an Unlisted Aquaculture Species Permit and are evaluated on a case-by-case basis. The producer must construct a barrier to prevent escape of juvenile and adult fish as well as provide justification of the need to import the species into the state and why species already on the approved list will not fill this need.

A lake may be used as a fish farm only when adequate control structures have been installed to prevent the inflow of water from adjacent bodies of water or without first removing all wild fish present in compliance with a plan approved by the Chief of Fisheries.

AGFC has recently accepted the role of granting Fish Farm Health Inspection Permits to those persons wishing to ship live fish or fish eggs into Arkansas from VHSV-positive states. An invoice or bill of lading must accompany all shipments of live fish or eggs, describing the origin(s) of all fish and/or eggs in the shipment. This is an annual permit issued in two six-month intervals. In order to obtain a permit, satisfactory documentation must include the following: (1) proof that an appropriate fish sample has been collected by a qualified independent party during the appropriate season; (2) inspection reports from a qualified testing laboratory indicating “negative” VHSV results by appropriate testing measures; and (3) written documentation from a qualified independent party stating that the fish are farm-raised, that they come from a VHSV-free water source, and that the fish or eggs have not been mixed with or potentially contaminated by fish or water that do not meet the standards specified for the Fish Farm Health Inspection Permit.

Along with animals and diseases, the AGFC also helps to regulate aquatic nuisance birds. In 2004 the double-crested cormorant was declared an invasive aquatic species by AGFC after investigations of the species’ impact on the Arkansas fisheries resources (Minute Order no. 04-082). All employees are instructed to work with APHIS/WS and USFWS to use “whatever means legally possible to prevent the establishment of nesting colonies of double-crested cormorants”.

Arkansas Pollution Control and Ecology Commission (APC&E)

The Arkansas Pollution Control and Ecology Commission is the environmental policy-making body for Arkansas. With guidance from the Governor, the Legislature, EPA, and others, the Commission determines environmental policy for the state and ADEQ implements that policy.

The Commission is comprised of 13 members, six representing state agencies and seven appointed by the Governor. The six agency representatives are directors or their designee of the: 1) Arkansas Department of Health, 2) AGFC, 3) Arkansas Forestry Commission, 4) Arkansas Natural Resources Commission, 5) Arkansas Oil and Gas Commission, and 6) Arkansas Geology Commission. The seven other members represent each of the four congressional districts in the state. Each district must have at least one representative on the Commission, but no more than two representatives.

APC&E was first created as the Water Pollution Control Commission as a part of the State Board of Health. The Commission's name was changed to the Arkansas Pollution Control Commission in 1965. Authority for air pollution control was added at that same time and the commission was removed from the Health Department. Act 1230 of 1991 clarifies the powers and duties of the Commission and the ADEQ Director.

Arkansas Department of Environmental Quality (ADEQ)

The Arkansas Department of Environmental Quality is the Arkansas state agency that strives to protect natural resources in Arkansas (air, water, and land) from pollution. It has regulatory authority to set and enforce safe environmental limits for industries that affect air, water, solid waste, hazardous waste, regulated storage tanks, and mining. ADEQ has proactive programs to encourage Arkansans to be good environmental neighbors by helping communities and businesses to develop recycling programs and assisting small businesses and communities with compliance and pollution prevention programs. ADEQ also has educational activities to promote environmental citizenship, train and license environmental professionals, involve students in environmental projects, conduct workshops, and help citizens to understand environmental issues in their communities.

Act 38 of 1971, a state government reorganization act, created ADEQ. This act provided for nomination of the Department Director by the Pollution Control and Ecology Commission (PC&E) and confirmation by the Governor with consent of the State Senate.

With reference to ANS, Regulation 2.402 (Nuisance Species) states: "All waters shall be free from substances attributed to man-caused point or nonpoint discharge in concentrations that produce undesirable aquatic life or result in the dominance of nuisance species".

ADEQ also grants barge-cleaning permits. These are general permits granted to Little Rock Harbor Service for bilge-cleaning processes.

EPA has set the standards for safe drinking water within the United States and oversees the states, localities, and water suppliers who implement those standards under the Safe Drinking Water Act of 1974 (42 U.S.C. 6). This law protects drinking water and all its sources, including lakes, rivers, reservoirs, springs, and ground water wells. National, health-based standards for drinking water were designed to protect against both naturally-occurring and man-made contaminants that may be found in drinking water. The National Primary Drinking Water Regulations set enforceable maximum levels for certain contaminants and also set requirements for water systems to test for those contaminants.

States can apply to EPA for primacy to implement the Safe Drinking Water Act within their own jurisdiction. If a state is granted primacy it means that it has the same primary drinking water regulation enforcement authority over public water systems within the state as EPA. States must adopt standards at least as stringent as EPA's and make sure that water systems meet these standards. All states and territories except Wyoming and the District of Columbia have been granted primacy. States, or EPA acting as a primacy agent, must test water systems for contaminants, review improvement plans, conduct inspections and sanitary surveys, provide training, and take action against water systems that do not meet the adopted standards. ADEQ holds these responsibilities in Arkansas.

Arkansas State Board of Health

The mission of the Arkansas State Board of Health is to promote public health policies and practices that assure a healthy quality of life for Arkansans. It is empowered to make all necessary and reasonable rules and regulations of a general nature for the protection of the public health and safety; for the general amelioration of the sanitary and hygienic conditions within the state; for the suppression and prevention of infectious, contagious, and communicable diseases; for the proper enforcement of quarantine, isolation, and control of such diseases; and for the proper control of chemical exposures that may result in adverse health effects to the public.

With regard to ANS, the Board of Health will be involved with any ANS that pose a threat to human health. It is also charged with developing regulations related to public water systems from a public health perspective. These rules and regulations interface with ANS because public water systems include bodies of water that have the potential to be part of pathways for the introduction of aquatic nuisance species. The Department of Health is the state agency responsible for implementing the Board's regulations.

Arkansas State Plant Board (ASPB)

ASPB has principal jurisdiction over harmful insect pests, plant diseases, and noxious weeds in the state of Arkansas. It is a division of the Arkansas Agriculture Department and plays a vital role in regulating certain ANS in Arkansas. ASPB was created under the authority of The Plant Act (A.C.A. §2-16-201 through §2-16-214) to protect the plant and plant products of this state. ASPB maintains a noxious weed list and a prohibited plant species list (Regulations on Plant Diseases and Pests, Circular 11 2007) (Appendix D). Noxious weeds are those that are declared to be a public nuisance and include alligatorweed, purple loosestrife, and water hyacinth. Currently ASPB has noxious weed programs in place for giant salvinia and purple loosestrife. Five areas are known to have had purple loosestrife in Arkansas – southern Randolph County, southern Stone County, Horseshoe Bend, Mammoth Spring State Park, and Beaverfork Lake near Conway. ASPB has applied Rodeo to infestations in these populations and continually monitors them. As of March 2013, no plants have been sighted in the past five years. Sightings of these two species should be reported to ASPB.

The prohibited plant list contains those species that present such a danger to the natural ecosystem that they are prohibited in Arkansas. No plant, seed or any reproductive structure of purple loosestrife, giant salvinia, or water hyacinth may be sold or utilized in plantings in the state.

Any producer in Arkansas must be inspected by ASPB and be given a Permit Number stating that the producer's plants have been inspected and have been found to be reasonably free of insects, diseases and noxious weeds. Out-of-state producers must also obtain a Permit Number by filling out the appropriate application forms and providing official certificates of inspection from the state of origin. Plants may be brought into the state without Permit Numbers, subject to inspection by ASPB on arrival.

The Nursery Fraud Act (A.C.A. §2-21-101 through §2-21-113) defines nursery stock to include "all field-grown florist stock, trees, shrubs, vines, cuttings, grafts, buds, fruit pits and other seeds of fruit and ornamental trees and shrubs, and other plants and plant products for propagation, except field, vegetable and flower seeds". ASPB requires all nurseries to be inspected at least once each year for insect pests, plant diseases, and noxious weeds (Circular 11 2007). A certificate of inspection is then awarded to nurseries that are found to be reasonably clean. All Nursery Dealers and/or Nursery Agents are required to have either a valid Nurseryman's license, or a Nursery Dealer's license issued by ASPB prior to offering for sale or selling nursery stock in Arkansas. Inspectors check facilities to ensure that proper conditions are maintained for keeping nursery stock in viable condition as well as free from infestation of insect pests, plant diseases and noxious weeds. Nursery landscape contractors involved in the installation of ornamental or horticultural plants must hold a valid Nursery Landscape Contractor's license unless they have a current Nurseryman or Nursery Dealer's license. Stock of nursery landscape contractors is inspected from time to time for infestations and noxious weeds. All Nurserymen, Nursery Dealers, Agents, or Nursery Landscape Contractors must make available invoices and applicable quarantine certificates on all sales of nursery stock upon request by ASPB.

Another important power ASPB has can be found under the Emergency Plant Act (A.C.A. §2-16-301 to §2-16-310). This act gives authority to ASPB to destroy "dangerous insect and plant diseases" that would threaten an established agricultural industry in the state. ASPB has the authority to prohibit the public from growing or maintaining any plants within a zone infested by harmful species and, if necessary to protect agriculture, destroy the infested area.

ASPB is authorized to enter into agreements with USACE to hold and save the U.S. free from claims that may occur from control operations jointly carried out by the board and USACE, or carried out by the board under financial assistance from USACE, for the control and eradication of alligator weed in Arkansas (A.C.A. §2-16-103).

ASPB also plays a role in protecting Arkansas' baitfish and ornamental fish industry from pathogenic and aquatic nuisance species. The Commercial Bait and Ornamental Fish Act (A.C.A. 2-5-201) established a voluntary certification program to provide high quality farm-raised bait and ornamental fish free of certain specified diseases, undesirable plants and/or animals, and other contaminants deemed injurious to the fish or fisheries (Appendix B). In 2007, ASPB was charged with the responsibility to certify that participating commercial bait and ornamental fish farms in Arkansas are free of pathogens, plants, animals, and other contaminants as outlined in Circular 21 (Regulations on Aquaculture in Arkansas). A fish farmer who is approved under these standards can represent their fish as *Arkansas Certified*. This new certification program will help to ensure that Arkansas Certified bait and ornamental fish are free of certain fish diseases that are a concern to the industry. The sale of fish that are infected is a major concern among producers and measures need to be taken to ensure that fish being transported are not carriers of harmful diseases such as SVCV and VHSV. To be eligible, bait

and ornamental fish must (1) have been spawned, hatched, and reared in Arkansas on a fish farm; (2) have been raised in accordance with procedures listed in Circular 21; (3) have met all inspection and testing requirements listed in Circular 21; and (4) be accompanied by a valid Arkansas Agriculture Department Certificate. An annual inspection during the summer will take place to visually check 50% of the total number of ponds on the farm for snail species, zebra mussels, and specific aquatic plants. All ponds must be inspected at least once every two years. Each year, documentation of two consecutive years of disease free status from an independent, APHIS approved laboratory must be presented as well.

Affected Organizations (No Jurisdiction)

Arkansas Farm Bureau- Aquaculture Division

The mission of the Arkansas Farm Bureau is to strive to be the voice of agricultural producers at all levels. This includes: 1) advocate for the interests of agriculture in the public arena; 2) disseminate information concerning the value and importance of agriculture; and 3) provide products and services which improve the quality of life for their members.

Catfish Farmers of Arkansas

The Catfish Farmers of Arkansas, Inc. is an association made up of producers, suppliers/industry related businesses, researchers/education personnel, and others involved in promoting, producing, and marketing Arkansas raised catfish. The mission of the association is to: 1) support research that benefits the Arkansas catfish industry; 2) disseminate information that is useful to the industry; 3) support legislation beneficial to the industry and oppose legislation contrary to their interest; 4) promote consumption of Arkansas raised catfish; and 5) enlist cooperation of and to cooperate with other organizations, associations, and institutions in furtherance of these objectives.

Local Governments and Chambers of Commerce

Local governments and Chambers of Commerce provide representation to businesses and markets directly affected by ANS. They strive to maintain a balance between use and preservation of their natural resources that are so important to local economies. They are the ones that pay for the final ANS policy results with either increased tax revenues or decreased tourism. They play a vital role in providing assistance with ANS education and awareness among residents as well as visitors to the state.

The Nature Conservancy

The Nature Conservancy's response to abating the damage caused to native biodiversity by the human-facilitated introduction of non-native, harmful invasive species is the Global Invasive Species Team. The web site of the Nature Conservancy (tncweeds.ucdavis.edu) provides resources designed to help all conservationists deal most effectively with invasive species.

National Programs

Part of the mission of the National ANS Task Force is to educate the general public about ANS and ways to prevent their spread. The National ANS Task Force has created two national campaigns in order to fulfill this task.

HabitattitudeTM

HabitattitudeTM (www.habitattitude.net) is a national campaign aimed at changing the behavior of hobbyists who may release organisms from their aquarium or water garden into the natural environment, unaware of the ecological and environmental impact that their actions cause. The main focus of HabitattitudeTM is to educate water garden and aquarium hobbyists on alternatives to releasing unwanted aquatic plant or fish species and why it is important such releases should be avoided. The National ANS Task Force developed this initiative; however USFWS serves as the lead federal agency. HabitattitudeTM also has the support of the pet and aquarium trade, the nursery and landscape industry, and NOAA Sea Grant College Program. Currently there are no partners listed from Arkansas.

Stop Aquatic Hitchhikers!TM

Led by USFWS and the U.S. Coast Guard, the Stop Aquatic Hitchhikers!TM is an ANS public awareness campaign aimed at recreational users of aquatic habitats. Recreational activities such as boating, fishing, swimming, waterfowl hunting, SCUBA diving/snorkeling, and personal watercraft use are well known for spreading ANS into areas that do not have established populations. The campaign promotes ANS awareness to empower recreational users to help stop the unintentional transport of ANS. The campaign's website (<http://www.protectyourwaters.net>) provides useful information on the types of ANS that are a problem, why they are a problem, how they are transported, and most importantly how recreational users can prevent spreading them to uninfested areas. Current partners from Arkansas include AGFC, Little Rock Air Force Base, USACE (Vicksburg District, Lake Ouachita Field Office), Arkansasstripers.com, Arkansas Bass Federation, Arkansas Fly Fishers, and the Arkansas Chapter of Trout Unlimited.

State Programs

The zebra mussel monitoring program in Arkansas is a joint program between the USGS and AGFC coordinated through annually renewed contracts. This program is an example of an early warning system in which seven or eight sites have been monitored for approximately 10 years. Through this program, zebra mussels were found in Plum Bayou, Lonoke County.

Jurisdiction Concerns and Issues

While an attempt has been made to identify each respective agency's jurisdiction and how ANS issues would be addressed by each, gaps and discrepancies may still persist. These authoritative gaps may not become apparent until a specific ANS issue arises. Efforts to reduce conflicts or constraints by such issues should be implemented to identify and address these shortcomings as far in advance as feasibly possible. These efforts may need to include initiating collaborative legislation to address any shortcomings between existing authorities and programs. This could help be accomplished by an annual review and meeting of the State's ANS Taskforce.

Ultimately, for ANS issues that arises where jurisdiction is lacking, it may require all authoritative agencies to address the situation and provide input. This collaborative effort could then be built upon and new legislation addressed at the appropriate time.

At this time, one apparent gap is with aquatic insects. If no agriculture crops or plants are directly impacted, the jurisdiction for control and management of an aquatic insect ANS is somewhat unclear. If it only posed an immediate threat to native aquatic insects, the jurisdiction and a lead agency's responsibility is obscure. To date aquatic insect conservation has been addressed jointly by AGFC and ANHC. It is the intent of the Arkansas ANS Taskforce to address and resolve this and any similar issues in a cooperative manner as necessary.

GLOSSARY

Acclimatization: the process by which an introduced species and resulting offspring adapt to a new environment.

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

Aquatic nuisance species (ANS): an organism that threatens the diversity or abundance of native species or the ecological stability of infested waters, or the commercial, agricultural, aquaculture or recreational activities dependent on such waters.

Bait: any species (fish, insect, invertebrate) sold for use as bait for recreational fishing.

Baitfish: any fish species sold for use as bait for recreational fishing.

Ballast: water or other matter placed in specific areas of the hull of a vessel to adjust the trim of a vessel for navigation stability. Species can be inadvertently transported in ballast water when it is released in another water body.

Ballast tank sediment: particles suspended in water pumped into ships for ballast that have settled to the bottom of the ballast tank. This sediment can harbor bottom-dwelling species that might be accidentally carried in a ship's ballast water and subsequently released in a new environment.

Biocontrol: the use of living organisms to control other living organisms. It frequently involves the introduction of a non-native predator, herbivore, pathogen or parasite that interacts with the invasive species in its natural geographic range.

Cryptogenic species: a species that cannot be determined to be native or a past introduction in a specific area.

Drainage basin: the catchment basin from which the waters of a stream, marsh, river, lake or groundwater system are drawn.

Dunnage: any packing material used to protect cargo from movement, moisture, contamination, or other damage. Dunnage such as straw and wood has sometimes served as media for species introduction in shipping.

Ecosystem: a community of organisms and their surrounding biota functioning as one unit.

Established species: a non-native species with a permanent, reproducing population that is unlikely to be easily eliminated through human action or natural causes.

Exotic species: a species that is not native to a designated geographic area or ecosystem.

Freshwater species: aquatic species native to freshwater.

Great Lakes: Lake Ontario, Lake Erie, Lake Huron (including Lake St. Clair), Lake Michigan, Lake Superior, and the connecting channels (St. Mary's River, St. Clair River, Detroit River, Niagara River, and the Saint Lawrence River to the Canadian border), and includes all other bodies of water within the drainage basin of such lakes and connecting channels.

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

Indigenous species: organisms naturally occurring in a specific geographic area or ecosystem.

Introduced species: an organism that is not native to a designated ecosystem or geographic area.

Introduction: intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

Invasive species: non-native organisms whose introductions cause or are likely to cause adverse environmental, economic, and/or human health impacts.

Mississippi Basin: The land area that drains into the Mississippi River or tributaries there to, which includes all or part of 31 states.

Monitor: to watch, observe, or check for a special purpose.

Native species: species within its natural range or natural zone of dispersal - the range it could or would occupy without direct or indirect introduction and/or care by humans.

Naturalization: the creation or occupation of an ecological niche by an introduced species; occurs after acclimatization.

Nonindigenous species: 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.

Parasite: an organism living in or on another organism, its host, and gaining benefit at the host's detriment.

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

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

Rapid response: fast containment, control, and eradication of an initial invasion.

Recovery: return of an ecosystem to a reasonably natural state after response to an ANS control action. May require reintroduction of native species or other restoration measures.

Regulation: rule or order that sets forth details or procedures and having the force of law.

Risk assessment: science-based process to evaluate the economic and/or environmental risk(s) of nonindigenous species.

Species: fundamental category of taxonomy, ranking below genus and subgenus, consisting of related organisms that in naturally occurring populations can produce fertile offspring.

Stakeholders: any and all interested and/or affected parties.

Terrestrial species: organisms living primarily on land.

Unintentional introduction: an introduction that occurs as the result of activities other than the purposeful or intentional introduction of the species involved, such as transport of ANS in ballast or in water used to transport fish, mollusks or crustaceans for aquaculture or other purposes.

Veliger: larval form of some mollusks.

Watershed: an entire drainage basin, including all its living and nonliving components.

ACRONYMS USED

ABOFGA	Arkansas Bait and Ornamental Fish Growers Association
ADEQ	Arkansas Department of Environmental Quality
AFC-UAPB	Aquaculture/Fisheries Center at the University of Arkansas at Pine Bluff
ANHC	Arkansas Natural Heritage Commission
ANS	Aquatic Nuisance Species
AGFC	Arkansas Game and Fish Commission
ANSTF	Aquatic Nuisance Species Task Force (national)
APHIS	Animal and Plant Health Inspection Service (USDA)
APHIS/WS	Animal and Plant Health Inspection Service, Wildlife Services
ARANSTF	Arkansas Aquatic Nuisance Species Task Force
ASPB	Arkansas State Plant Board
CFA	Catfish Farmers of Arkansas
FNWA	Federal Noxious Weed Act of 1974 (USDA-APHIS)
FONSI	Finding of No Significant Impact (USDA-Forest Service)
HACCP	Hazard Analysis and Critical Control Point
NANPCA	Nonindigenous Aquatic Nuisance Prevention & Control Act of 1990
NASS	National Agricultural Statistics Service
NZMMCWG	New Zealand Mudsnailed Management and Control Working Group
NISA	National Invasive Species Act of 1996
NPS	National Park Service
NRCS	Natural Resource Conservation Service
OIE	Organización Internacional de Epidemiología
PPA	Plant Protection Act of 2000 (USDA-APHIS)
PPQ	Plant Health, Protection, and Quarantine (USDA-APHIS)
SARP	Southeast Aquatic Resources Partnership
SMZ	Streamside Management Zone (USDA-Forest Service)
T&E	Threatened and/or Endangered species designated by USFWS
TWRA	Tennessee Wildlife Resources Agency
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USDC	United States Department of Commerce
USDOI	United States Department of Interior
USEPA	United States Environmental Protection Agency
USFDA	United States Food and Drug Administration
USFWS	United States Fish and Wildlife Service (USDOI)
USGS	United States Geological Survey

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APPENDIX A: ARKANSAS A.N.S. PLAN TASK FORCE MEMBERS

<u>Name</u>	<u>Affiliation</u>
Leonardo Acosta	National Park Service, Arkansas Post National Memorial
Jennifer Akin	Arkansas Natural Heritage Commission
Michael Armstrong	Arkansas Game and Fish Commission
Marilyn Barlett-O'Leary	Southeast Aquatic Resource Partnership
Thurman Booth	USDA/APHIS Wildlife Services
Johnny Cantrell	US Army Corps of Engineers, Ouachita Project
Kenneth Colbert	Arkansas Natural Resource Commission
Charles "Bo" Collins	Catfish Farmers of Arkansas
Betty Crump	USDA Forest Service, Ouachita National Forest
Josh Duzan	The Nature Conservancy
Shawn Egan	Norfolk Lake Chamber of Commerce
Patty Eklund	University of Arkansas at Pine Bluff, Aquaculture/Fisheries
Carole Engle	University of Arkansas at Pine Bluff, Aquaculture/Fisheries
Keith Garrison	Arkansas Waterways Commission
Al Gathright	Lake Ouachita Citizens Focus Committee
Mark Gibson	Arkansas Green Industry Association
Lucien Gillham	Arkansas Wildlife Federation
Arnie Habig	Lake Ouachita Citizens Focus Committee
John Harris	Arkansas State Highway and Transportation
Rachael Higdon	Arkansas Agriculture Department, Aquaculture Division
Lee Holt	Arkansas Game and Fish Commission
Mike Hoy	USDA/APHIS Wildlife Services
Kelly Irwin	Arkansas Game and Fish Commission
Lindsey Lewis	US Fish and Wildlife Service
Gene Martin	Arkansas Farm Bureau, Aquaculture Division
Ted McNulty	Arkansas Agriculture Department, Aquaculture Division
Mark Oliver	Arkansas Game and Fish Commission
Eric Park	Arkansas Bait and Ornamental Fish Growers Association
Melody Parsley	Arkansas Department of Health
Kevin Pierson	Audubon Arkansas
Randy Roberson	Arkansas Department of Parks and Tourism
Rhea Rylee	US Forest Service, Ozark-St. Francis National Forest
Mark Sattelberg	US Fish and Wildlife Service
Erica Shelby	Arkansas Department of Water Quality
Richard Standage	USDA Forest Service, Ouachita National Forest
Nathan Stone	University of Arkansas at Pine Bluff, Aquaculture/Fisheries
Clint Turnage	USDA/APHIS Wildlife Services
John Turner	Arkansas Natural Resource Commission
Brian Wagner	Arkansas Game and Fish Commission
Jim Wallace	Arkansas State Plant Board
Keith Whalen	USDA Forest Service, Ozark-St. Francis National Forest
Jerry Williamson	Arkansas Farm Bureau
Kelly Winningham	Arkansas Game and Fish Commission
Susan Weinstein	Arkansas Department of Health
Robert Wiedenmann	University of Arkansas at Fayetteville

**APPENDIX B: OFFICIAL STANDARDS FOR THE CERTIFICATION OF COMMERCIAL
BAIT AND ORNAMENTAL FISH IN ARKANSAS. ARKANSAS STATE PLANT BOARD**

AGENCY #209.02

CIRCULAR 21

ISSUED: March, 2007

REVISED: December, 2008

REGULATIONS ON AQUACULTURE IN ARKANSAS

This circular is issued in March, 2007, by the **Arkansas State Plant Board**. Other regulations issued by the Plant Board are covered in other circulars. Address correspondence to State Plant Board, P.O. Box 1069, Little Rock, AR 72203.

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Section I. Standards for the Certification of Commercial Bait and Ornamental Fish

Approved and Issued by:

ARKANSAS STATE PLANT BOARD

Under Authority of:

Commercial Bait and Ornamental Fish Act (A.C.A. 2-5-201)

SECTION I. Official Standards for the Certification of Commercial Bait and Ornamental Fish in Arkansas

A. Purpose

To provide high quality, farm-raised bait and ornamental fish, free of certain diseases, undesirable plants, undesirable animals, and other contaminants deemed injurious to fish or fisheries.

B. Authority

The Arkansas State Plant Board, a division of the Arkansas Agriculture Department, under act 1449 of 2005, is the official certifying agent.

C. Pathogenic and Aquatic Nuisance Species (ANS)

Within the detection limits of the appropriate official testing protocol, commercial bait and ornamental fish meeting these standards are certified free of the pathogens, plants, animals and other contaminants listed here:

- 1) Spring Viremia of Carp (SVCV)
- 2) Infectious Pancreatic Necrosis (IPNV)
- 3) Viral Hemorrhagic Septicemia (VHSV)
- 4) Infectious Hematopoietic Necrosis (IHNV)
- 5) Eurasian watermilfoil (*Myriophyllum spicatum*)
- 6) Giant Salvinia (*Salvinia molesta*)
- 7) Hydrilla (*Hydrilla verticillata*)
- 8) Zebra mussel (*Dreissena polymorpha*)
- 9) New Zealand mud snails (*Potamopyrgus antipodarum*)
- 10) Red-rimmed melania (*Melanoides tuberculata*)
- 11) Sticklebacks (Family Gasterosteidae)
- 12) Rudd (*Scardinius erythrophthalmus*)
- 13) Orfe (*Leuciscus idus*)
- 14) Silver carp (*Hypophthalmichthys molitrix*)
- 15) Bighead carp (*Hypophthalmichthys nobilis*)
- 16) Snakehead fish (Family *channidae*)
- 17) Quagga Mussel (*Dreissena rostriformis bugensis*)

D. Definitions

APHIS: Acronym for the U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

Certified Producer: A Fish Farmer approved under these standards to represent their fish as *Arkansas Certified*.

Fishery: A region of water used for commercial and/or sport fishing.

Fish Farm: A location and/or business entity established for the commercial culture of fish, under the continuous management of a fish farmer.

Fish Farmer: For the purpose of these standards, the holder of a valid *Fish Farmer (aquaculturist) Permit* issued by the Arkansas Game and Fish Commission.

E. Eligibility Requirements

To be designated as *Arkansas Certified*, bait and ornamental fish must:

- A) have been spawned, hatched, and reared in Arkansas on a fish farm,
- B) have been raised in accordance with the practices and procedures defined in these standards,
- C) have met all inspection and testing requirements defined in these standards,
- D) and, be accompanied by a valid Arkansas Agriculture Department certificate.

F. Fees

- i. The annual fee to the Plant Board for Certification shall be one dollar per surface acre of all ponds used to produce certified fish.
- ii. The fee to the Plant Board for additional ANS inspections required for farms failing annual inspections shall be one dollar per pond surface acre.

Note: Fees for veterinary supervision of disease sample collection and lab fees for disease testing are not included in the Plant Board fees and must be negotiated between the farm and the service providers.

G. Application for Participation

Farmers wishing to have their fish certified under these guidelines must make application on official Plant Board forms.

H. Cultural Practices and Business Procedures

As part of the application process, farmers (the individual holding the Arkansas Game and Fish Commission *Fish Farmer Permit*) must sign an affidavit agreeing to strictly adhere to the following cultural practices and business procedures:

- a. Will culture only those species listed on the Arkansas Game and Fish Commission *Approved Aquaculture Species List* or by Arkansas Game and Fish Commission permit. .
- b. Use only water from wells or recycled water from within the farm proper without mixture with outside waters or contact with non-certified fish. Surface waters from any uncertified area of the farm may not be recycled to any certified area of the farm.
- c. No fish will be stocked into any pond used for the production of certified fish unless they come from a source certified under these guidelines. In special circumstances, such as the availability of new species or breeds, and under strict control with reliable documentation, fish farmers may request exemption from this subparagraph and the Plant Board will respond to the request within 10 working days.
- d. If only a portion of a participating farm is to be certified, it must be separated from the uncertified portion according to a biosecurity plan approved by the Plant Board. The uncertified portion must not be used to produce any fish species also sold by the farm as certified.
- e. There will be no production or participation in the commerce of any salmonids species or any of the non-fish aquatic nuisance species listed in paragraph C. *Pathogenic and Aquatic Nuisance Species*.
- f. Silver carp and bighead carp may not be stocked into bait or ornamental fish production ponds.
- g. Certified fish may only be loaded on trucks into dry or disinfected tanks using water from the certified producer's fish farm. Trucks carrying uncertified fish may enter the loading area of a certified farm, but any tanks containing fish or water from an uncertified source must remain closed while loading or unloading certified fish.
- h. If any fish or water from an uncertified source are to be unloaded into the holding facility of a certified farm, the water and fish must be separated from certified fish according to a biosecurity plan approved by the Plant Board.
- i. No individuals, trucks, or equipment including boots, nets, and buckets may enter any area that has contact with or drains into any water used by the farm for certified fish production if those individuals, trucks, or equipment have had contact with fish or water not included in the Arkansas Certification program or from wild fisheries. Such individuals, trucks, or equipment that have been disinfected just prior to entrance may enter these areas.

I. Inspections

The Director of the State Plant Board or his agent may conduct investigations and/or make inspections as necessary to assure conformity with these standards. In particular, at least annually, the Plant Board shall make an on farm inspection of water sources, ponds, fish handling areas, equipment and records of fish sales and purchases.

As part of this annual inspection, an inspector from the Plant Board will visit the farm once per year during the summer. A visual check of 50% of the total number of ponds on the farm will be made for snail species, zebra mussels and specific aquatic plants. All of the ponds must be inspected at least once every 2 years. One pond edge will be examined for listed plants and snails and a hard surface (e.g., pier, post, drainpipe, aerator float) will be checked for zebra mussels. Any suspect plants or mollusks will be collected and submitted to an expert for confirmation. For fish species, visual inspection of farm holding vats will be conducted to insure that certified fish species being held in vats do not contain the listed ANS. Farm records will be examined for evidence of commerce in listed species.

In addition to Plant Board inspections, as part of the bi-annual sampling of fish for disease testing, the independent agent sampling fish will make note of the observance of any aquatic nuisance species. The Agent will preserve any unidentified fish species taken as a part of normal sampling procedures and submit those specimens along with disease testing samples to an independent APHIS approved laboratory for identification.

Farms that do not pass these inspections may not label or represent their fish as certified until all aquatic nuisance species have been eradicated and confirmed by a successful inspection. In addition, in order to maintain their certified status, these farms will undergo an additional aquatic nuisance species inspection one month after the first successful post eradication inspection. This follow up inspection will not be conducted during a period when the aquatic nuisance species would not be expected to be present, but will occur when conditions for detection are favorable.

J. Disease Testing

Each year, the certified producer or new applicants, must provide documentation of two consecutive years of disease free status from an independent laboratory approved by APHIS to test for the listed pathogens. Sampling, analysis and reporting is to be conducted as follows:

The sample must be 150 fish and must include moribund (sick) fish observed during the sampling process. It must be collected twice per year. Once during the months of October, November or December and once during the months of March, April or May.

Collection of the sample must be overseen by an APHIS accredited DVM. The collection must be made under the direct observation of the overseer to an extent that the official can attest to the origin of the fish and that the sampling scheme was appropriate to meet the standards detailed below.

The sample should include all of the ponds and grow out tanks and the final species and age composition of the sample should reflect the overall composition of the certified fish on the

farm. For example, if the farm has 5 ponds of koi and 10 ponds of goldfish to be certified, the final sample of 150 fish should be from all of the ponds and should be 33 % koi and 67 % goldfish with each pond of fish equally represented. For a 150 fish sample, you would need 50 koi (10 from each of the 5 ponds), and 100 goldfish (about 10 from each of the 10 ponds). For farms with more than 50 ponds, all species and sizes of fish must be included in each sample, but the ponds may be sampled in rotation so that all ponds are sampled at least once every two years.

It is not appropriate to sample fish from shipping and sorting facilities where fish are held for brief periods. The origin of these fish cannot be known with certainty and they may represent only a very low percentage of the fish lots present on the farm. Small numbers of some species may be efficiently captured with a dip net along the pond margin; other species may have to be captured with a small seine. In some cases, fish traps are appropriate. They may be placed in the ponds by the farmer but the sampling official must be present to oversee the checking of the traps and the removal of fish from the traps for the sample. Fish collected and removed from the ponds by the farmer without direct supervision by the overseer are not appropriate. Be sure to include any moribund fish that are observed during the sampling.

Farms testing positive for a listed pathogen may not label or represent their fish as certified until they have undergone a Plant Board supervised eradication, disinfection, re-establishment with fish from a certified source and have then re-established a 2-year history of disease free inspections according to the rules of this program. All Plant Board fees must be paid during the re-establishment period.

K. Certificates and Labeling

Producers accepted into the certification program will be issued official certificates, which are to be completed at the time the fish are loaded. Certificates are valid until the fish leave the certified producer's control. All certificates will bear the shipment date and shipper invoice number along with description of the shipment. All will expire within 2 weeks of issuance.

L. Transference of Certification

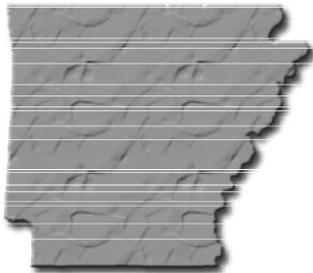
A certified producer may purchase fish from another certified producer then deliver those fish under their own certificate given that they receive a valid certificate from the seller and maintain that certificate in their records for inspection by the Plant Board.

Using the HACCP Approach for the Biosecurity of Your Farm



Developed by the
**Arkansas Bait and Ornamental
Fish Growers Association**

In cooperation with the
**University of Arkansas
at Pine Bluff
Aquaculture/Fisheries Center**



Diseases and exotic species pose an ever-increasing threat to Arkansas farms that market and ship bait and ornamental fish. The introduction of snakeheads, an invasive aquatic plant, or a nasty virus could directly hurt farm production, but the most immediate threat is lost sales resulting from new restrictions on fish movements. The best way to protect your business is to look for the routes by which exotic fish or diseases might end up in your product and then institute a prevention program. This is exactly what many other businesses, including fish processors, do to insure that their product is safe. The formal name for these programs is “HACCP” which stands for “Hazard Analysis and Critical Control Point.”

A HACCP program is a farm-level plan to consider hazards like exotic diseases, animals or plants in your aquaculture product, then find the exact place in the production process that each hazard can best be controlled. Sea Grant specialists in Minnesota and Michigan have developed a HACCP manual (Gunderson and Kinnunen 2001) to help northern state baitfish harvesters (and farmers) make sure their bait is not contaminated with exotic animals or plants. An example worksheet following this introduction shows how to identify significant hazards on your farm, and if they exist, how to develop your own HACCP plan.

The primary reasons for current interest in HACCP are recent highly publicized concern about the introduction of snakeheads into the US, Asian carps into the Great Lakes, and the first report of Spring Viremia of Carp (SVC) in the US. Unwanted exotic animals and plants that can cause environmental damage and displace native species are commonly referred to as Aquatic Nuisance Species (ANS).

States around the U. S. are seeking ways to prevent the spread of ANS. The Great Lakes region in particular has suffered from a host of exotic invaders, many linked to introductions via ballast water discharges from commercial shipping. The list of exotic species includes zebra mussels, spiny and fishhook waterfleas, rusty crayfish, ruffe, round gobies, hydrilla, water chestnut and Eurasian milfoil. Zebra mussels have made it all the way down the Mississippi River and into the Arkansas River. Bighead and silver carp have moved up the Mississippi River and there is concern that these fish species will enter the Great Lakes. The rudd and Asian carps (bighead, grass, silver and black) are also listed as aquatic nuisance species. This becomes an issue of importance to Arkansas baitfish producers because these fish species have been cultured in Arkansas.

The other new concern is SVC. Spring Viremia of Carp is a viral disease known in Europe for centuries. It has proven to be very deadly to common carp, koi, and quite a number of other fish species, and to be easily moved from place to place. It is such a significant disease that it is one of only 5 fish diseases that is on the OIE “reportable” list, a distinction that triggers obligatory international reporting and an aggressive response to new outbreaks. SVC has very recently been discovered in farm-raised fish in North Carolina and in several populations of wild fish in Wisconsin. Wildlife managers and regulators and the USDA are very concerned about the potential impact of this disease on wild fish populations and aquaculture.

A likely mechanism to prevent the introduction of SVC or ANS into new areas is to restrict the movement of fish that might be mixed with ANS or infected by SVCV. In order to keep from being shut out of important markets, it may be necessary for farmers to insure their customers and regulators that movement of Arkansas aquaculture products do not pose a significant threat to native plants and animals or local aquaculture. A HACCP-like program may be the best mechanism to provide that assurance.

The HACCP concept was developed by private industry to prevent hazards from occurring. It is used in food processing plants, for example, to identify steps in the production process where products could become contaminated with bacteria, and to prevent it from happening. Such a system for bait and ornamental fish production would be voluntary and self-policing. Because adopting a HACCP approach provides evidence that private firms are committed to preventing potential hazards, HACCP plans can help reduce or avoid government regulations.

The first step in a HACCP plan is to conduct a hazard analysis. This means making a list of the steps you take in producing, harvesting and shipping each species of bait or ornamental fish on your farm. At each step in the process, decide if there is any danger of the fish coming into contact or becoming contaminated with an exotic disease or ANS organism. A “Hazard Analysis Worksheet” is a good way to keep track of the various steps in producing each fish species. Appendix One gives an example for a golden shiner producer. The HACCP manual (Gunderson and Kinnunen 2001) states that only significant hazards should be identified and controlled with the HACCP system. What is a significant hazard? A hazard is considered significant if it is 1) reasonably likely to occur, AND 2) if not properly controlled, it is likely to result in an unacceptable risk (in this case, of spreading disease or ANS to new water bodies).

Many farmers in Arkansas are already making the first steps toward a HACCP program. The UAPB Fish Disease Diagnostic Laboratories are conducting semi-annual inspections of fish farms to demonstrate that significant viral diseases are not present. These inspections are carried out under USDA-APHIS direction and are highly respected in both international and interstate commerce. Farms are also evaluating their water supplies, severely limiting the movement of uninspected fish onto their farms, and verifying that undesirable species of plants and animals are not present. It is not yet clear that a full formal HACCP program is warranted, however, these early efforts have already been very effective in preventing a loss of markets by making regulators confident that fish from Arkansas do not pose a threat to their states.

Conducting a Hazard Analysis

For additional information or assistance in developing a HACCP plan for your farm, contact one of the UAPB - Aquaculture/Fisheries Extension Specialists. To include your farm in the APHIS certified disease inspection program, contact Dr. Andy Goodwin at UAPB.

Sources of Information:

Goodwin, A. 2002. Biosecurity of Fish Farms. *Arkansas Aquafarming* 19(2):1-3.

Goodwin, A. 2002. First report of Spring Viremia of Carp Virus (SVCV) in North America. *Journal of Aquatic Animal Health*. 14:161-164.

Gunderson, J. L., and R. E. Kinnunen, editors. 2001. Aquatic nuisance species – hazard analysis and critical control point training curriculum. Minnesota Sea Grant Publication MN SG-F11, Michigan Sea Grant Publication MSG-00-400.

Stone, N. 2002. Concern Increases Over Potential Impacts of Introduced Fish Species. *Arkansas Aquafarming* 19(1):1-3.

APPENDIX ONE

(Adapted from Gunderson and Kinnunen 2001).

ANS-Exotic Disease HACCP Plan – Golden Shiners Cultured for Sale as Baitfish

18) Product description

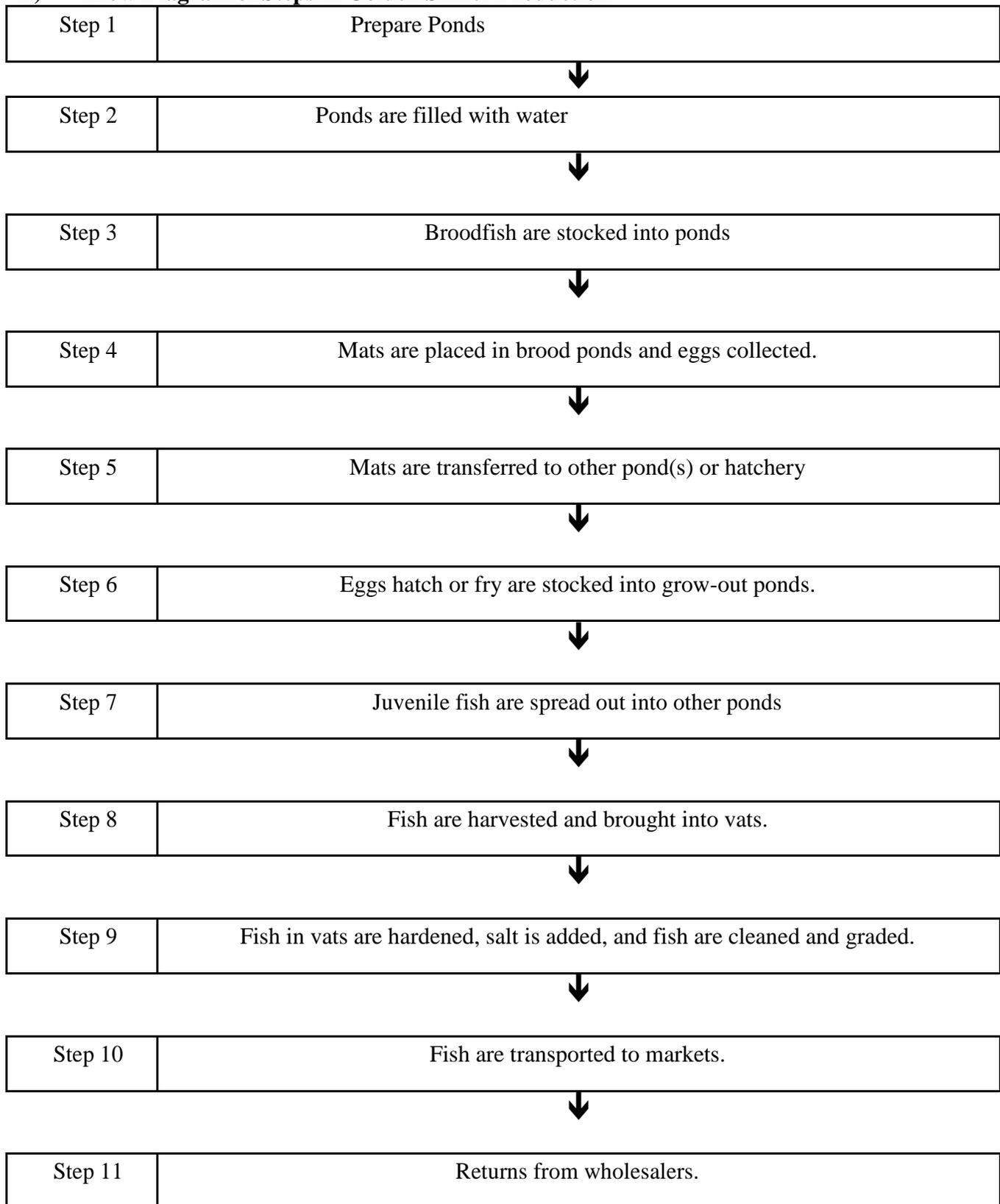
19) Example flow diagram for production and distribution

20) Hazard analysis worksheet

1) Production Description

Firm Name:	Best Bait Company
Firm Address:	Arkansas
Species of fish:	Golden shiners
Production method:	Raised in earthen ponds
Holding and distribution methods:	Held in vats in well water, then shipped to wholesalers

2) Flow Diagram of Steps in Golden Shiner Production



3) Hazard Analysis Worksheet for Golden Shiner Production (Example).

1	2	3	4	5	6
Steps in production, harvesting or shipping	Identify potential ANS or disease hazard	Are any potential hazards significant? (Yes/No)	Justify your decision in column 3	What control measures can be applied to prevent significant hazards?	Is this step a critical control point? (Yes/No)
Step 1 Prepare Ponds	Ponds are dried and disinfected	No	Disinfection would kill potential diseases and ANS		
	Ponds have untreated water remaining in pools	Yes	Pools might contain ANS or disease that could infect a new crop	Disinfect ponds before stocking	Yes
Step 2 Ponds are filled with water	Ponds are filled with well water	No	Well water is free of diseases & ANS		
	Ponds are filled with surface water	Yes	Future risk of significant disease, ANS problems	Verify that source water is free of ANS and important diseases	Yes
Step 3 Broodfish are stocked into ponds	Broodstock from an inspected farm (yours or other)	No	No risk of disease or ANS		
	Broodstock from uninspected farm	Yes	Broodstock may transfer disease to fry	Strict quarantine and testing or switch suppliers	Yes

1	2	3	4	5	6
Step 4 Mats are placed in brood ponds and eggs collected.					
Step 5 Mats are transferred to other pond(s) or hatchery	Mats from an inspected farm (yours or other)	No			
Step 6 Eggs hatch or fry are stocked into grow-out ponds.	Mats are brought from uninspected farm	Yes	Future risk of significant disease, ANS problems	Strict quarantine and testing or switch suppliers	Yes
Step 7 Juvenile fish are spread out into other ponds	Fry from an inspected farm (yours or other) Fry from uninspected farm	Yes	Future risk of significant disease, ANS problems	Strict quarantine and testing or switch suppliers	Yes

1	2	3	4	5	6
Step 8 Fish are harvested and brought into vats.	Fish are from an inspected farm (yours or other)	No	Fish from an inspected farm would be free of disease and ANS		
Step 9 Fish in vats are hardened, salt is added, and fish are cleaned and graded.	Fish are from an uninspected farm	Yes	Future risk of significant disease, ANS problems	Strict quarantine and testing or switch suppliers	Yes
Step 10 Fish are transported to markets.	ANS species mixed in with bait fish?	No	ANS species, if present, too big to fit through grader bars		
	Hauling own fish only (inspected farm) or properly disinfecting truck and equipment before return	No	No exotic diseases or ANS are present		
	Hauling fish from uninspected farm (yours or others) without disinfecting truck and equipment before next use	Yes	Risk of introducing new disease or ANS	Begin truck disinfection program	Yes

How to Have Your Fish Inspected by APHIS-Approved Protocols

- E) Contact Andy Goodwin at UAPB 1-870-543-8137 or 1-870-540-7811 or agooodwin@uaex.edu to begin the arrangements, discuss sampling rules, and for assistance with any of the steps below. This is a farm inspection not an inspection of an individual lot of fish. It must be repeated every 6 months. Both UAPB and a veterinarian will charge you for this service (details below).
- F) Contact your state APHIS “Area Veterinarian in Charge” (Veterinary Services, Arkansas Area Office, 1200 Cherry Brook Dr., Suite 300, Little Rock, Arkansas 72211. Phone: (501) 224-9515 Fax: (501) 224-5823). Tell the AVIC what you are up to. Arrange for APHIS to do a farm visit.
- G) Arrange with an APHIS-approved veterinarian to supervise the collection and shipping of the fish sample to UAPB. The veterinarian will charge you for this service. Check with the laboratory BEFORE sample collection to verify that they are ready to receive the fish and allow them to prepare tissue cultures for the certification tests. Contact your trade association or UAPB for help finding a vet. Remember that the vet must be APHIS-approved (vets know what that means!).
- H) Ship the sample to the lab following the shipping advice of the APHIS vet and the lab.
- I) Wait patiently for results. Viral certification takes at least 3 week. Due to the quantity of expensive materials required to do these tests, there is a fee of \$500 for this inspection service (\$800 for out of state inspections).
- J) The lab report is sent to the farm, the AVIC, and the APHIS approved vet that supervised sample collection. An invoice is sent along with the report.
- K) When you ship fish, many states will accept a copy of the inspection report as evidence that fish on your farm do not harbor dangerous viruses. More importantly, if you want to ship fish domestically or overseas, you can do so using official APHIS paperwork and an official APHIS seal. Keep in mind that the importing country will require that the paperwork that accompanies the fish bear an **original** seal stamped on the paperwork by the AVIC. Thus, though the sampling of fish may only have to take place twice a year (check the country’s rules), the paperwork for **each** individual shipment may have to pass through the hands of the AVIC for an original stamp.

Appendix D: Circular 11, State Plant Board, Regulations on Plant Diseases and Pests

CIRCULAR 11

-----FINAL RULE-----

Agency # 209.02

Revised: March, 2011

REGULATIONS ON PLANT DISEASES AND PESTS

This circular is issued in September, 1997, by the **Arkansas State Plant Board**. Other regulations issued by the Plant Board are covered in other circulars. Address correspondence to State Plant Board, P.O. Box 1069, Little Rock, AR 72203.

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Approved and Issued by:

ARKANSAS STATE PLANT BOARD

Under Authority of:

The Plant Act (A.C.A." 2-16-201 through 214) Emergency Plant Act (A.C.A. " 2-16-301 to 310) Nursery Fraud Act (A.C.A. " 2-21-101 through 113)

Arkansas Boll Weevil Suppression Eradication Act (A.C.A "2-16-601 through 617)

SECTION I. PUBLIC NUISANCE DECLARED

The following plant diseases, insect pests, and noxious weeds under the provisions of the Arkansas Plant Act (A.C.A. ' 2-16 - 201 *et seq*) are hereby declared to be a public nuisance, including anything infected, infested, or contaminated therewith. The extent to which these plant diseases, insect pests and noxious weeds are regulated is covered in this and other Plant Board circulars. Italicized pests are intent of horticulture inspections.

A. Plant Disease Pests Listed

1. *Chestnut blight* (chestnut and chinquapin)
2. *Phony peach, peach mosaic and peach rosette*
3. Fusiform and other gall rusts of pines
4. Texas root rot (cotton and other plants)
5. *Oak wilt* (oak, chestnut and other trees and shrubs)
6. *Cedar-apple rust*
7. *Fire blight* (pear, apple and other plants)
8. *Root knot nematode*
9. *Soybean cyst nematode*
10. *Foliar nematodes* (*Aphelenchoides besseyi* and others)
11. *Crown gall and other infectious galls*
12. *Hairy root of apple and rose*
13. *Bacterial spot of peach*
14. *Strawberry dwarf*
15. *Red stele of strawberry*
16. *Virus diseases on horticultural crops*
17. *Strawberry yellows* (genetic)
18. *Infectious cankers*
19. *Bacterial spot of tomato*
20. *Alternaria and septoria leaf spots of tomato*
21. *Late blight of tomato*
22. *Camellia petal blight*
23. *Azalea petal blight*
24. *Hoja blanca* disease of rice
25. *Internal cork of sweet potato*
26. *Black rot &/or Stem rot of sweet potato*
27. *Anthracnose on various host plants*
28. *Pink root of onion*
29. *Sting nematode*
30. *Blight and leaf spots damaging to plants*
31. *Collar rot*
32. *Dutch Elm disease*
33. *Phloem necrosis*
34. *Bud rot on strawberries*
35. *Fusarium wilt of tomatoes* (all races)
36. *Blueberry nursery stock diseases*
37. *Pinewood nematode*
38. *Blackleg of rape*
39. *Rose Rosette*

B. Insect Pests Listed

1. *Pink bollworm* (cotton and okra)
2. *Sweet Potato weevil*
3. *Fruit flies* (fruit and vegetable) does not apply to *Drosophila*
4. *Khapra beetle* and other stored grain insects
5. *Bruchids* and other pest of seeds (seeds of crops and other plants)
6. *Japanese Beetle* (trees, fruits, vegetables and other plants)
7. *Gypsy and Browntail moths* and other leaf-feeding insects (trees, shrubs and other plants)
8. *Fire ant, Argentine ant, carpenter ant* and other injurious ants
9. *Vegetable weevil*
11. *White-fringed beetle*
12. *European chafer*
13. *Termites*
14. *Powderpost beetles*

15. *San Jose scale and other scale insects*
16. *Woolly Aphis*
17. *White flies*
18. *Strawberry crown borer*
19. *Pine tip moth and other insects attacking pine shoots*
20. *Oriental fruit moth*
21. *Borers of all kinds*
22. *European red mite and other spider mites*
23. *Bagworms and other leaf-eating insects*
24. *Thrips*
25. *Aphids*
26. *Harlequin bugs*
27. *Roaches and other household insect pests*
28. *Elm leaf beetle*
29. *Cereal leaf beetle*
30. *Southern pine beetle*
31. *Brown garden snail, or any other plant destroying snail*
32. *Asian Ambrosia Beetle*

C. Noxious Weeds Listed

1. Field bindweed (**Convolvulus arvensis**)
2. Nut grass (**Cyperus rotundus**)
3. Wild onion and/or wild garlic (**Allium spp.**)
4. Johnson grass (**Sorghum halapense**)
5. Dodder (**Cuscuta spp.**)
6. Bermudagrass (**Cynodon dactylon**)
7. Cheat or Chess (**Bromus secalinus**) and/or (**Bromus commutatus**)
8. Darnel (**Lolium temulentum**)
9. Corncockle (**Agrostemma githago**)
11. Horsenettle (**Solanum carolinense**)
12. Purple nightshade (**Solanum elaeagnifolium**)
13. Buckhorn plantain (**Plantago lanceolata**)
14. Bracted plantain (**Plantago aristata**)
15. **Rumex spp.**
16. Blueweed (**Helianthus ciliaris**)
17. Morning Glory (**Ipomea spp.**)
18. Hedge Bindweed (**C. sepium**)
19. Red rice (**Oryza sativa var.**)
20. Curly indigo (**Aeschynomene indica**)
21. Tall indigo or coffee bean (**Sesbania exaltata**)
22. Giant foxtail (**Setaria faberi**)
23. Witchweed (**Striga spp.**)
24. Crotalaria (**Crotalaria spp.**)
25. Cocklebur (**Xanthium spp.**)
26. Moonflower (**Calonyction muricatum**)
27. Alligatorweed (**Alternanthera spp.**)
28. Balloonvine (**Cardiospermum halicacabum**)
29. Itchgrass (**Rottboellia exaltata**)
30. Thistle (**Carduus, Cirsium, Onopordum, Silybum, Scolymus, Salsola and other genera**)
31. Serrated Tussock (**Nassella trichotoma**)
32. *Purple Loosestrife* (**Lythrum salicaria**)
33. Barnyardgrass (**Echinochloa crusgalli**)
34. Water Hyacinth (**Eichornia crassipes, E. azurea**)
35. Japanese Blood Grass (**Imperata cylindrica**)
36. Tropical Soda Apple (**Solanum viarum**)

Any foreign insect, plant disease or weed which may be brought into Arkansas and whose habits and injuriousness under the conditions of agriculture in Arkansas are unknown, is regarded as dangerous and is declared to be a public nuisance.

PROHIBITED PLANT LIST

Plants contained on the following list present such a danger to the natural ecosystems in the state that they are hereby declared prohibited. No plant, seed or any reproductive structure may be sold or utilized in plantings in Arkansas.

1. Purple Loosestrife (*Lythrum salicaria*)
2. Giant salvinia (*Salvinia molesta*)
3. Water Hyacinth (*Eichornia crassipes*, *E. azurea*)
4. Japanese Blood Grass (*Imperata cylindrica*)

SECTION II. REGULATIONS ON VEGETABLE AND SMALL FRUIT PLANTS.

A. Regulations on the Sale of Vegetable Garden Plants including Sweet Potato and Strawberry Plants. Any person selling, offering for sale, or transplanting for sale any vegetable garden plants including sweet potato and strawberry plants for planting purposes within or into the State of Arkansas shall meet the following requirements. Vegetable plants grown in soil-less media are exempt from these regulations.

1. Sale in bulk is prohibited, except at production site to a local consumer.
2. Each container in which plants are offered for sale shall be conspicuously labeled in legible English language with the following:
 - a. Name and address of producer
 - b. Arkansas Permit Number
 - c. Varietal name
 - d. If sold in bundles:
 1. Number of plants per bundle
 2. Number of bundles in container
3. The above information may be stenciled, engraved or embossed on the containers, printed or rubber stamped on tags or labels attached to the containers, or on stakes displayed in each container, or displayed in any combination of these methods desired by the producer.
4. In addition to the above, each bundle of sweet potato plants shall also carry an individual label showing the producer's name and address. Bundle labels shall be supplied by the producer.
5. Every container or bundle which does not display complete labeling as described above shall be subject to an immediate Stop-Sale Order.
6. No Arkansas Permit Number shall be issued for sweet potato plants or vine cuttings originating in an area in which the sweet potato weevil is known to exist.

B. Securing Arkansas Permit Numbers.

Arkansas Producers. Permit Numbers will be assigned to Arkansas producers upon receipt of Plant Board application forms and the required inspection fees. Even though a Permit Number has been assigned, no sales shall be made until a producer's plants have been inspected and found reasonably free of insects, diseases and noxious weeds. The Plant Board shall cancel a Permit Number anytime the producer's plants are found infested with insects, plant diseases and noxious weeds which may be disseminated with the plants, as declared in Section 1.

Producers who wish to have their own rubber stamps, printed labels, special tags or stakes made with their Permit Number included thereon shall file applications early enough to allow time for this. The Plant Board does not supply labels or tags of any kind for plants.

C. **Out-of-State Producers.** Arkansas Permit Numbers may be obtained by out-of-state producers by filing:

1. Application forms provided by the Plant Board
2. Official certificates of inspection of state of origin
3. Appropriate Annual Registration fees

If early application, before inspections have been made, should be necessary to allow time for the preparation of rubber stamps, printed labels, special tags or printed stakes with the Arkansas Permit Number included thereon, the application shall be accompanied by a statement from a Plant Regulatory Official of the state involved certifying that the producer's plants will be kept under periodic inspection during the shipping season and that certificates of inspection will be filed with the Plant Board as inspections are made. The statement shall also certify that anytime a producer's plants do not pass inspection the State Plant Board shall be notified so the Arkansas Permit Number can be canceled.

By special permission of the Director, plants may be brought into Arkansas without Permit Numbers, to be inspected by Plant Board inspectors at a specified destination point on arrival, and Permit Numbers issued if plants are found to be reasonably free of diseases, insects and noxious weeds.

For fees or charges, See Section IV, Fees

D. **Special Regulations for the Production of Non-Certified Strawberry Plants.**

1. **Filing Application.** Application on forms furnished by the Plant Board may be made by either the grower or by shipper contracting for grower's plants, and must be made at least 10 days before inspection is desired and must be accompanied by necessary fees. To help insure against the red stele disease, no application will be accepted on a field known to have been exposed to red stele, for example, by drainage from a known-infested field, or if the mother-plants have come from a known-infested field. If possible, applications should be made by September 1. If application is made by the contractor, a copy of the contract must accompany the application. Also verification must be made as to variety, source, quantity and quality of plants used to plant fields to be inspected.

2. **Field Inspections.**

a. **1st-year fields** set with either Arkansas or out-of-state certified plants will be given fall inspection, and then certified for digging, up to February 15, after which date if any plants are still undug a red stele inspection will be made, and if found satisfactory, will be reapproved.

b. **1st-year fields** set with non-certified plants can be given fall inspection, plus Red Stele inspection after March 15 or sooner if conditions are such that a satisfactory inspection can be made before that date, and then be approved.

c. **1st-year fields** set with non-certified plants, if they average 3 rooted runner-plants per mother-plant at blooming time, can be inspected for red stele at blooming time, and again in the fall and then be approved.

d. **2nd-year fields**, regardless of source of plants, can be inspected for red stele at blooming time, and again in the fall and then be approved.

e. **Fall inspection** will be made as nearly as possible between September 1 and October 31. Inspectors will dig and examine not less than 100 plants per acre, taking plants from not less than 15 places per acre, well distributed.

1. Fields will be condemned if more than 3% of plants show root-knot nematodes, or if more than 3% of new plants show crown borer signs, or if more than 10% of old and new plants combined show crown borer signs.

2. Fields will be condemned if more than 3% of the plants are affected with either summer dwarf, yellows, or bud rot, except that fields containing not more than 10% of any of these, if rouged down to the 3% tolerance and reinspected, will be passed.

3. Fields generally or severely infested with leaf spot or scorch will be condemned.

4. Fields containing noxious weeds, such as wild garlic or nut grass, which might be spread in the bundles of plants, will be condemned. On fields which pass fall inspection, **strawberry plant certificates** will be issued, dated to expire February 15, under which plants from said fields may be sold up to that time. This applies to fields set with inspected plants only.

f. **Red Stele Inspection.** If fall-inspected and-passed fields are not dug by February 15, another inspection must be made before they are sold, and if the plants are then found free of disease, a new certificate will be issued which will be valid for the remainder of the shipping season, expiring June 30. Inspectors will dig and examine not less than 100 plants per acre, taking plants from a number of places well-distributed. The location of places of digging plants shall be at the discretion of the inspector. He will make every effort to dig plants in area where red stele is likely to be most evident. Plants will be examined by slicing several roots on each plant so that the stele of the root is exposed. Should even 1 plant show red stele, this will disqualify the entire field (suspected plants will be sent to the University of Arkansas, Plant Pathology Department for confirmation).

3. Certificates.

a. **Strawberry Plant Certificates**, both those expiring February 15 and those expiring June 30, will be issued only to the growers of the plants, for use on their own plants that are inspected and approved.

b. **Nursery Certificates** (or dealer's certificates), instead of strawberry plant certificates, will be issued to growers or contractors who deal in bought strawberry plants, in addition to their own plants, or who grow other nursery stock in addition to strawberry plants. A complete record of all sales must be kept by the applicant and shall be made available to the Plant Board upon request.

Note: For Regulations governing the production of certified, that is Foundation, Registered, Certified Blue Tag, or Certified Green Tag strawberry plants, contact the Plant Board office.

For fees charged, see Section IV, Fees.

E. Special Regulations for the Production of Certified Seed Sweet Potatoes and Sweet Potato Plants.

1. **Filing Application.** Growers desiring to produce certified seed sweet potatoes must file application on forms furnished by the Plant Board, along with the necessary fees, by June 15 of each year. Applications for the certification of sweet potato plants must be filed at least 30 days prior to the bedding of the seed, along with the necessary fees.

Application forms will be furnished for this purpose. Applicants must agree to get prior approval of bedding sites, bed only Arkansas certified seed, and sell only Arkansas certified plants.

2. **Inspections.** Fields for the production of certified seed shall be inspected twice during the growing season by Plant Board inspectors to determine freedom from diseases, insects and noxious weeds. To qualify, fields must be in a reasonably good state of cultivation and free enough from weeds and grass so that a complete observation of the sweet potatoes can be made at each inspection. Also, fields must be apparently free of disease, insects and noxious weeds as declared in Section 1 that might be disseminated

with the seed.

At least one or more inspections of plant beds shall be made during the selling season, and to qualify plants must be reasonably free of diseases, insects, and noxious weeds as declared in Section 1, that may be disseminated with the plants.

At least one storage or bin inspection shall be made on seed potatoes for certification. Potatoes shall be so stored that they are accessible for a complete inspection, and no chance of contamination by other potatoes. If potatoes are found to be free of disease and insects and have qualified in other respects they are eligible for certifications.

3. Grade Standards. Seed sweet potatoes which are sold as certified shall meet the following standards. They must be smooth, free from dirt, breaks, cracks, serious crooks, bruises, decay, decayed spots, disease sign, and insect damage or signs. They must be from one inch to three and one-half inches in diameter, and at least three inches and not over nine inches long, and not over 5% may be round, or oval shaped, unless the buyer specifies "field run" in which case any potatoes over one-half inch in diameter may be included. They must be packed in new containers.

4. Records. Applicants shall keep a complete set of records in regard to sales and upon request records shall be made available to the Plant Board.

For fees charged, see Section IV, Fees

SECTION III. REGULATIONS FOR NURSERY STOCK, NURSERYMEN, NURSERY DEALERS AND AGENTS, AND NURSERY LANDSCAPE CONTRACTORS.

Nursery stock as defined in the Nursery Fraud Act (ACA ' 2-21-101 to 113) shall include all field-grown florist stock, trees, shrubs, vines, cuttings, grafts, buds, fruit pits and other seeds of fruit and ornamental trees and shrubs, and other plants and plant products for propagation, except field, vegetable and flower seeds.

A. Sale and Transportation of Nursery Stock.

1. All nursery stock sold or transported within or into the State of Arkansas shall have attached to the outer container thereof either a certificate of inspection or a dealer's certificate. If transported within or into the State of Arkansas by means other than a common carrier, the driver of the vehicle must have in his possession either a certificate of inspection or a dealer's certificate, a copy of which shall be given to the person or to each of the several persons to whom the nursery stock is delivered.

2. Any person desiring to ship nursery stock into Arkansas shall:

a. File with the Plant Board an official certificate of inspection showing that the nursery has been inspected and found reasonably free of insect pests, plant diseases and noxious weeds. Or, this information may be certified to the Plant Board by the nursery inspection official of the state of origin.

b. Attach a valid copy of the certificate of inspection of the state of origin to each package, box or bundle of nursery stock shipped into Arkansas. On multiple-order shipments, a certificate must be attached to each individual order as well as to the outer package. On container-grown or balled and burlapped bulk shipments, a certificate may be attached to the invoice covering each delivery.

3. No fee shall be charged out-of-state nurserymen or dealers who deliver nursery stock to Arkansas nurserymen and dealers, or who ship directly from their out-of-state locations to Arkansas purchasers.

4. Any person who is selling nursery stock in person within the state directly to the consumer must obtain a nursery dealer, nurseryman, agent, and/or nursery landscape contractor license and pay the prescribed annual fee.

B. Inspection of Nurseries, Dealer's Stocks and Sales by Agents and Nursery Landscape Contractors.

All nurseries shall be inspected at least once each year for insect pests, plant diseases, and noxious weeds and a written notice of the findings of such inspection shall be given by the Plant Board to the owner or manager of each nursery. Upon the inspection of the nursery and proper fulfillment by the nurseryman in charge thereof of the requirements and conditions contained in said notice and upon full payment of the fees and costs hereinafter prescribed, the Plant Board shall issue a certificate of inspection. Application for inspection of nurseries must be made by August 15 of each year.

1. **Nurseryman's License.** Nursery dealers and/or agents are required by law to have a valid license issued by the State Plant Board prior to offering for sale or selling nursery stock in Arkansas. Stock of nursery dealers and that sold by nursery agents shall be inspected from time to time, inspections to be made in heel yards, in transit, and/or after stock has been sold. Dealers must provide facilities for keeping nursery stock in viable condition, either outdoors or indoors, and inspectors will check such facilities for compliance, as well as infestation of insect pests, plant diseases and noxious weeds.

2. **Nursery Dealers License.** Any dealer who holds a nursery dealers license under the provisions of the Arkansas Nursery Fraud Act 1919, as amended, may secure a dealer's certificate by filing with the Board an affidavit stating that he will keep the Director informed of the names and addresses of the nurserymen from whom he secured his nursery stock and that he will not ship under his dealer's certificate any nursery stock unless the grower of said nursery stock is in possession of a valid certificate or permit issued by the Board.

3. **Nursery Landscape Contractors.** Those nursery dealers involved in the installation of ornamental or horticultural plants, or offering for sale, or selling nursery stock in Arkansas, through the planting of nursery stock for compensation, are considered to be nursery landscape contractors. If not already holding a valid Arkansas Nurseryman or nursery dealers license, nursery landscape contractors will be required to obtain a valid nursery landscape contractor license issued by the State Plant Board to perform such services.

a. Stock of nursery landscape contractors shall be inspected from time to time with inspections to be made in heelyards, in transit and/or after stock has been planted. Inspectors will check for viability of stock, infestations of insects, plant disease and noxious weeds.

b. Nursery landscape contractors that do not maintain a heelyard shall submit a list of no more than 10 contract jobs, which have been completed within the last 12 months, so that inspection of plant materials can be made on site. This list of jobs must be submitted to the Arkansas State Plant Board by May 15th of the preceding licensed year.

4. **Nurserymen, Nursery Dealers, Agents or Nursery Landscape Contractors.** *Must Make Records Available Upon Request.* Nurserymen, nursery dealers, agents or nursery landscape contractors must make available invoices and applicable quarantine certificates on all sales of nursery stock upon request of the Authorized State Plant Board Designees.

5. **Limited Nurseryman License.** This category is required to have a valid license issued by the State Plant Board prior to offering for sale or selling nursery stock in Arkansas. The Limited Nurseryman License is defined by selling only plants which are propagated and produced by that grower. They are not allowed to broker other regulated plants, which were produced by another grower, nor are they allowed to supply another business to sell their plant materials. The Limited Nurseryman License status will be limited to those producing less than 500 square feet of nursery stock per year. This license does not include contracting or installation of nursery stock.

C. Green-Colored Wax on Nursery Stock. The sale or offering for sale of rosebushes or their nursery stock covered with green-colored wax is prohibited in Arkansas.

D. Licensing. All licenses for Nurseryman, Nursery Dealer and Landscape Contractor must be renewed annually. The licenses are valid from November 1 of the current year until October 31 of the following year. License fees are \$10.00 and all facilities must be inspected before a license will be issued. See Section IV for fee charges. License

renewal applications should be submitted to the Plant Board to allow time for inspections, processing and issuance to take place prior to the October 31 deadline.

1. Late Fees: Any application postmarked after October 31 will be subject to a late charge of fifty (50%) percent of the license and inspection fees.

For fees charges, see Section IV, Fees.

SECTION IV. FEES.

The following annual and/or item fees shall apply to plants and nursery stock as covered by these regulations:

Limited Nurseryman License 75.00 Includes:
 Container or field grown stock solely propagated by themselves of no more than 500 square feet per year. To qualify for the Limited Nurseryman License, please see Section III #6.

Nurseryman:

Level I Inspection Fee including License Fee \$150.00 Includes:
Container Grown Stock- Less than 3 acres
Field Grown Stock – Less than 10 acres

Level II Inspection Fee including License Fee \$300.00 Includes:
Container Grown Stock -More than 3 acres up to and including 10 acres.
Field Grown Stock - More than 10 acres up to and including 25 acres.

Level III Inspection Fee including License Fee \$450.00 Includes:
Container Grown Stock -More than 10 acres up to and including 40 acres.
Field Grown Stock - More than 25 acres and up to including 70 acres

Level IV Inspection Fee including License Fee \$600.00 Includes:
Container Grown Stock - More than 40 acres
Field Grown Stock - More than 70 acres
 Nurseries having additional heelyards in locations or towns other than at nursery must obtain dealer's or agent's license for each sales outlet.

Nursery Certificate Tags 15¢ Each.

Nursery Dealers: (& Agents)

Level I Inspection Fee \$140.00
 Level I License Fee \$10.00 Includes:
Container Grown Stock - Up to and including 5000 sq.ft. heelyard or display area.

Level II Inspection Fee \$290.00
 Level II License Fee \$10.00 Includes:
 More than 5,000 sq. ft. Up to and including 15,000 sq. ft. of heelyard or display area

Level III Inspection Fee \$440.00
 Level III License Fee \$10.00 Includes:
 More than 15,000 sq. ft.

Dealers having more than one sales outlet or display area must obtain

dealer's or agent's license for each separate location.

Nursery Certificate Tags 15¢ each

Nursery Landscape Contractors:

Level I Inspection Fee \$140.00

Level I License Fee \$10.00 Includes:
If Landscape contractor maintains a heelyard this covers first 5,000 sq. ft. of that heelyard or display area. Also covers planting site inspection of plants where landscape contractor does not maintain a heelyard or display area.

Level II License Fee \$290.00

Level II Inspection Fee \$10.00 Includes:
Heelyard of more than 5,000 sq. ft. Up to and including 15,000 sq. ft.

Level III License Fee \$440.00

Level III Inspection Fee \$10.00 Includes: Heelyards over 15,000 sq. ft.

Out-of-State Nurseries:

Registration Fee Not required unless the state in which the nursery is located requires a registration fee of Arkansas nurseries. In such cases an equivalent fee will be charged.

License Fee \$10.00 (These fees apply only if nursery has agents selling within the state. In such cases planting site inspections will be made.)
Inspection Fee

(Inspection fee structure will be the same as in state.)

Horticultural:

Advice Certificate \$1.00

Strawberry Inspection: State Inspected

Application Fee \$25.00 Not required when grower is also a nurseryman and has paid nursery fees.

Inspection Fee \$1.50 per each 1/4 acre

Certification Tags 15¢ Each

Sweet Potato Certification - Seed

Inspection Fee \$25.00 for 1st acre, plus \$6.00 for each additional acre

Certification Labels 15¢ each

Sweet Potato Certification - Plants

Inspection Fee \$10.00 plus 2 cents per square foot

Certification Labels 15¢ each

Non-Certified Sweet Potato Plant Beds:

Inspection Fee \$10.00 plus 2 cents per square foot

Sweet Potato Weevil Inspection:

Inspection Fee: \$10.00 per acre

Trapping		
Fumigated Sweet Potatoes	5¢	for each bushel
Unfumigated Sweet Potatoes	5¢	for each bushel

**Vegetable, Garden, Truck and Strawberry Plants:
(if grown in a medium containing soil)**

Inspection Fee	\$20.00	Minimum Fee
	20¢	per sq. ft. for plants to be sold from beds or in pots.
	50¢	for each crate, box, bucket, or basket of bundled plants

**Out-of-State Vegetable, Garden, Truck and Strawberry Plants:
(if grown in a medium containing soil)**

Registration Fee	\$100.00	Minimum Fee: (Fees shall be calculated on the basis of previous sales in Arkansas or on anticipated sales (Subject to Audit) for
	50¢	for each crate, box or basket
Permits for plants brought into state under special permission	50¢	each. Plants are inspected at destination. No registration fee is required.

Phytosanitary Certificates (State Certificate) and Federal Limited Permits.

Issuing fee	\$15.00	each certificate for non-commercial shipments (valued at less than \$1250.00 or as determined by current Federal Regulations.)
	up to \$100.00	each certificate for non-commercial shipments (valued at more than \$1250.00 or as determined by current Federal Regulations.)
Sampling fee (State or Federal)	\$7.50	each certificate when Plant Board must take sample.

Reinspection Fee: When an extra trip is made necessary because of late application, because of findings of a previous inspection, or for other reasons, an additional charge may be made as follows: \$30.00 for first one-half day or fraction thereof for each inspector, plus \$10.00 per hour for each inspector's time in excess of the one-half day.

SECTION V. Stop-Sale Notices.

Stop-Sales Notices. Plant Board inspectors will check for compliance with the regulations contained in Circular 11, as well as the laws under which they are promulgated. Stop-Sale Notices shall be issued for the following reasons:

- A. Selling, offering for sale, or transporting within or into Arkansas plants and nursery stock as herein regulated without being officially covered by a license and/or certificate or permit.
- B. Failure to label in accordance with the law and regulations as herein outlined.
- C. Selling, offering for sale or transporting within or into Arkansas for sale, plants and nursery stock as herein regulated that are diseased, insect-infested, containing noxious weeds, dead, or in weak condition.
- D. Mislabeled or misrepresented as to variety, count, size, quality, grade or condition.

E. Shipped or moved from an area either within or outside Arkansas that is covered by a quarantine of the Federal or State government, without having been officially cleared and so documented.

When a stop-sale notice is issued, a copy shall be given to the person in possession of the stock in question.

As specified in the law, it shall be unlawful to sell, transport or dispose of in any way, plants and nursery stock covered by a stop-sale notice, without first having been authorized in writing by the Plant Board. The Plant Board reserves the right to publish a notice of quarantine of stock in the local newspaper against any person when it is deemed necessary for failure to comply with the proper disposal of condemned stock.

SECTION VI. Regulations Governing the Movement of Sweet Potatoes into the State from Areas Infested or Suspected of Being Infested with Sweet Potato Weevil.

Sweet potatoes, or plants or vines thereof, which have been grown or stored in counties or parishes now or hereafter known to be infested with the sweet potato weevil, must not be transported into or stored, used, or distributed within the state of Arkansas, except as follows:

A. Sweet potatoes must be moved only to consignee who holds a valid permit (issued on request) from the Arkansas State Plant Board, authorizing said consignee to receive shipments of fumigated potatoes between July 1 and January 31 of each year.

B. Sweet potatoes must be fumigated with methyl bromide immediately prior to shipment in a manner approved by the Director of the Arkansas State Plant Board. (a) Only sweet potatoes which have been inspected and found apparently free of weevils will be eligible for fumigation. (b) Fumigation certificates signed by an authorized plant quarantine official, showing number of bushels, car number, dosage, time of exposure, temperature, name and address of consignor and consignee and any other information required by the Director, must be mailed to the Plant Board at Little Rock when the shipment is made. (c) Duplicate copy of certificate must be attached to waybill, or be in possession of the driver of vehicle. (d) Each container in the shipment must bear an official fumigation tag. (e) Sweet potatoes must be moved into Arkansas immediately after fumigation.

C. Permit-holder (consignee) must notify the Plant Board, Little Rock, immediately on arrival of each shipment. With said notification, permit-holder must remit to the Plant Board a one-cent fee for each bushel of sweet potatoes in said shipment.

1. Sweet potato plants or vines must not be transported into Arkansas under any condition.

2. The Plant Board will inspect on arrival as many of the fumigated shipments as possible. Should living stages of sweet potato weevil be found in any shipment, or should it be found that any of the provisions of this rule are not being complied with, the Director may invalidate any or all permits issued under this rule. The Director may cause to be destroyed, refumigated or removed from the state, any shipment in which live stages of the weevil are found.

Exception for Canning Plants. Sweet potatoes fumigated as described in Paragraphs 2 and 3 may be brought to canning plants for immediate canning at any time, provided culls and refuse are sterilized at the plant.

A. "Unfumigated sweet potatoes may be brought to canneries at any time provided the canner and broker or hauler has a signed Compliance Agreement on file with the Plant Board binding him to the following:

1. Special permission shall be obtained from the Director of the Arkansas State Plant Board before bringing weevil-area potatoes into the state. Permission shall be restricted to the following area and purpose:

a. **Area** - That section of Northwest Arkansas included in the following counties: Baxter, Benton, Boone, Carroll, Cleburne, Conway, Crawford, Faulkner, Franklin, Fulton, Independence, Izard, Jackson, Johnson, Lawrence, Madison, Marion, Newton, Pope, Pulaski, Randolph, Searcy,

Sebastian, Sharp, Stone, Van Buren, Washington and White. Prohibited elsewhere in the state.

b. **Purpose** - Immediate canning only. Seed, bedding, table use, etc., prohibited, entire state.

2. Each load shall be accompanied by an official certificate of the state of origin showing apparent freedom from weevils.

3. Each load shall be officially sealed by the originating inspector and remain sealed until opened for canning.

4. Certificates and seals from each load shall be kept by cannery and surrendered to inspector upon request.

5. If shipped by rail at any time or truck between January 1 and July 1, certificates must show treatment of load with a pesticide recommended and registered for such use.

6. Shipment must be in tight rail cars or van-type trucks with vents screened. Tarpaulin-covered loads will not be accepted.

7. Potatoes must be canned immediately upon arrival. In emergency cases potatoes may be unloaded and stored for not more than 48 hours in such a way that weevils, if present, cannot escape and cause infestation.

8. No potatoes may be carried away from canning plant, and all must be canned except culls.

9. Culls, wastes and cleanings must be:

a. Processed through lye vat at regular plant speed and temperature and flushed down drain, or

b. Collected in a tank covered with hot lye solution (Minimum 185 degrees F.), allowed to soak for 1 hour, then either buried 2 feet deep, flushed down drain, or fed to livestock immediately.

10. After canning, plant premises must be thoroughly cleaned and sprayed with an insecticide to kill any live weevils thereon.

11. Trucks and rail cars after unloading and before leaving premises must also be cleaned and sprayed as in number 10 above, and cleanings disposed of as in number 9 above.

12. Plant Board inspectors will make periodical, unannounced inspections to check for conformity with all items stipulated herein, but will not necessarily remain through entire canning process each visit.

13. Inspectors will recommend cancellation of this Agreement and withdrawal of the Director's special permission if serious discrepancies with the stipulations are noted.

14. An inspection fee of 5 cents per bushel will be charged, based upon duplicate load certificates, which are received by the Plant Board office from the out-of-state inspector. These certificates and seal numbers must match those kept by the canner from each load and surrendered to Plant Board inspector."

Sweet potatoes grown in counties or parishes which are free or which have been declared free of potato weevil will be admitted into Arkansas without fumigation, provided each load is accompanied by a certificate of the quarantine officer of the state where grown, giving name and address of grower, number of bushels in the load, destination of load, name of county or parish where grown, and certifying that said county or parish is free of sweet potato weevil, and the date issued

SECTION VII. MISCELLANEOUS REGULATIONS

A. Sale or Transportation of Seed Irish Potatoes is prohibited within the state (Irish potatoes which are represented orally or in writing as being suitable for planting purposes) unless the potatoes have been inspected in the field and certified as true to variety and free from disease, by the official certification agency of the state in which they were grown; and the official certification tag of said state must be sealed to each bag or container thereof.

B. Use of Misleading Words Prohibited. Seed Irish potatoes must not be accompanied by tags, labels, or other devices on which are used the words "Inspected or Certified" or on which are used any other word or words which might suggest a similar meaning, unless said potatoes have in fact been certified as to freedom from disease and as to varietal purity by the official certification agency of the state in which they were grown.

C. Texas (Phymatotrichum) Root Rot. Nursery stock, strawberry plants and vegetable plants grown or originating in the counties of Miller and Little River, and in any other counties in which the phymatotrichum root disease is hereafter found to exist, which are affected with said disease, shall be prohibited from moving into any other portion of the state or into other states.

The Director may refuse further services of the Plant Board to anyone who owes the Board for fees, until the fees are paid or until satisfactory arrangements are made for paying them.

D. Phytosanitary Certificates. For sampling, inspecting or analyzing, and issuing phytosanitary certificates for soybeans, rice, small grains, cottonseed, cottonseed meal, soybean meal, lumber and other plant products or plants, the charge will be \$15.00 per certificate.

E. Plant Destroying Snails. The Brown Garden Snail, **Helix aspersa**, has been reported in Arizona, California, Florida, Louisiana and South Carolina. It is a plant feeder and very destructive to many host plants. It is readily transported on infested nursery stock. The shipment, therefore, of nursery stock into Arkansas from infested states, or from any state hereafter found infested with this or any other snail known to be a serious plant pest, shall be subject to the following:

1. Nurseries in infested states who desire to ship plants into Arkansas shall file certificates of inspection with the Arkansas State Plant Board. As part of such certificate, or attached to it, there shall be a declaration signed by the state's regulatory officer stating that the nursery concerned has been inspected and found free of the Brown Garden Snail, **Helix aspersa**.

F. Amended certificates of inspection will also be accepted for nurseries which ship only:

1. Bare root nursery stock free of soil.
2. Cured bulbs free of soil.
3. Nursery stock from tightly enclosed greenhouses or other structures where official inspections are made to assure the enclosures are free of snails.

A valid copy of the state of origin certificate of inspection shall be attached to each package, box or bundle of nursery stock shipped into Arkansas, or to the invoice accompanying each bulk delivery of balled and burlapped or container-grown stock.

G. Infested nurseries may ship plants into Arkansas under either of the following conditions:

1. **Fumigation.** Certificates and invoices shall accompany each load showing that the stock has been fumigated in a gastight chamber with methyl bromide, 2 1/2 pounds per 1,000 cubic feet, 70 degrees F. or above, for 2 hours; or with HCN, 25cc per 100 cubic feet, 50 to 85 degrees F., for 1 hour.
2. **Quarantine Area Certification.** Nursery stock will be accepted if accompanied by certificates and invoices showing that the plants have, under official supervision, been:
3. Held in a separate, designated quarantine area for at least 30 days.

4. Treated intermittently with baits and sprays.
5. Inspected and re-inspected for Brown Garden Snail.
6. Completely free of harmful snails for at least 30 days.

Nursery stock or plant material arriving in Arkansas from an infested state without proper certification will be held under Stop-Sale Order until properly certified, or returned to the shipper at his expense, unless found infested with living Brown Garden Snails or other snails known to be serious plant pests.

Nursery stock or plant material found infested with Brown Garden Snail or any other dangerous plant pest will be destroyed, or fumigated at the shipper's expense, provided the infestation can be eliminated without hazard of spread of the pest during treatment.

H. Fusarium Wilt of Tomatoes. A new race of the tomato fusarium wilt organism (**Fusarium oxysporum f. sp lycopersici** Race 2) has been found in the pink tomato section of Southeast Arkansas. This organism is a serious threat to commercial tomato production anywhere in the state. To prevent the spread of Race 2, or other new races which may hereafter develop, the following regulations shall apply to all producers of vegetable plants in Bradley and Drew Counties, and in every county where Race 2 or other new races may subsequently be found.

The movement of tomato plants within or from the above described regulated area is prohibited, except when such plants are produced under inspection of the State Plant Board and in compliance with the following special regulations:

1. Soil used in beds, pots, cups, flats, pot-beds and cold frames for plant production, or to rest containers upon, shall be obtained from areas where tomatoes have not been grown in the past.
2. Soil and/or soil-media mixtures shall be decontaminated by one of the following methods before use in plant production:
 - a. Bulk soil shall be confined on a concrete slab or sheet of polyethylene plastic over the ground surface during fumigation.
 - b. Bulk soil shall be no more than 12 inches deep to assure gas penetration.
 - c. Holes shall be punched in the soil at 12 inch centers to facilitate gas penetration.
 - d. Soil in pot-beds, coldframes and holding areas shall be loosened as deep as practicable to assure gas penetration.
 - e. Fumigation covers shall be air tight (no holes).
 - f. Special care shall be taken when removing the cover to prevent recontamination with untreated soil.
3. Methyl Bromide fumigation (4 pounds per 100 cubic feet of soil for a minimum of 24 hours at 40 degrees F. or above).
 - a. Bulk soil shall be confined on a concrete slab or sheet of polyethylene plastic over the ground surface during fumigation.
 - b. Bulk soil shall be no more than 12 inches deep to assure gas penetration.
 - c. Holes shall be punched in the soil at 12 inch centers to facilitate gas penetration.
 - d. Soil in pot-beds, coldframes and holding areas shall be loosened as deep as practicable to assure gas penetration.
 - e. Fumigation covers shall be air tight (no holes).
 - f. Special care shall be taken when removing the cover to prevent recontamination with untreated soil.
4. Heat sterilization shall be acceptable if performed according to Extension Service recommendations (Misc. Publication 64, "Control of Disease and Insect Pests in the Plant Bed").
5. Artificial media (new or unused peat, perlite, vermiculite, etc.) may be used without decontamination if reasonable precautions are taken against contamination with untreated soil (i.e., mixing on sterilized surfaces, etc.).
6. All flats, boxes, pots, cups, tools, etc., which have been used in plant production or which have come in contact with untreated soil must be decontaminated, preferably by Methyl Bromide fumigation.
7. Plant house interior surfaces must be decontaminated (all surfaces of benches, timber supports, heating and ventilating equipment, walls, ceilings, floors, etc.).

8. This shall also apply to surfaces of coldframes, pot-beds and holding areas.

9. An effective decontaminant spray or drench may be prepared with 50% commercial Clorox, or with 1 gallon commercial formaldehyde to 18 gallons water. After using either material, ventilate until fumes can no longer be detected before growing plants (a few hours to several days for Clorox, longer for formaldehyde, depending upon conditions).

10. Direct traffic from tomato fields to plant production areas must not be permitted.

- a. Wash hands with soap and decontaminate shoes with 50% Clorox before entering the plant house, cold frames or holding areas.

11. Locally grown seed shall not be planted.

- a. A tag or invoice showing purchase of seed from an established seed firm must accompany application for inspection.

- b. In cases of dire necessity locally grown seed may be used if hot water treated (122 degrees F. for 25 minutes). Advance permission must be obtained from Director of Plant Industry Division.

“These regulations shall apply in addition to and do not replace any other regulations now given in "Regulations on Plant Diseases and Pests" (Circular 11).

I. Blueberry Nursery Stock. The production of blueberries is a new and growing industry in Arkansas. Diseases such as red ringspot, necrotic ringspot, stunt and phytophthora root rot pose a serious threat to the blueberry industry, especially in its developing stages. To prevent the spread of these and other diseases by blueberry nursery stock the following regulations shall apply to all blueberry plants produced in Arkansas for sale.

Mother Blocks. All blueberry plants produced in Arkansas shall be grown from cuttings taken from mother blocks which have been established as prescribed by these regulations and kept under rigid inspection and rouging by the State Plant Board. Mother blocks shall be established by one of the following methods:

1. Transplanting or clearly designating and setting apart plants which have been inspected and found to be free of serious diseases, including the above, or
2. Setting plants which have been indexed or otherwise officially determined to be free of harmful diseases, or
3. Setting plants which have been produced in an approved official certification program in Arkansas or another state, or
4. Setting plants which have been produced from cuttings from an officially approved mother block established and maintained as set out in these regulations.

5. **New Varieties.** When it appears advantageous to the Arkansas blueberry industry to bring in a promising new variety which does not qualify for entry under (1) through (4) above, cuttings, rooted cuttings or plants may be brought into Arkansas and grown in isolation under inspection, indexing or other testing until officially determined to be free of harmful insects and diseases. When such official determination has been made, said plants shall be eligible for the establishment of mother blocks as in (1) and (2) above.

Proof of origin in the form of affidavits or sales invoices or certification tags, shall be required for cuttings, rooted cuttings or plants which are to be used in establishing approved mother blocks if from a source other than the applicant nurseryman's own blocks.

Mother Blocks:

1. Shall not be fruited for production purposes.
2. Shall be clearly designated and set apart from fruiting fields and when possible located where they will not receive drainage from fruiting fields.
3. Shall be inspected by the State Plant Board as often as necessary and at optimum times for the detection of such diseases as red ringspot, necrotic ringspot, other virus diseases, stunt, phytophthora root rot, fungus cankers, crown gall, and harmful insects and mites.
 - a. All obviously diseased or seriously infested plants found in a mother block shall be removed and destroyed within 10 days of inspection.
 - b. Plants suspected of being diseased or infested shall be submitted to the appropriate department at the University of Arkansas for an official determination. Those plants officially determined to be diseased or seriously infested shall be removed and destroyed when such is determined to be necessary.

Production of Blueberry Nursery Stock.

1. **Cuttings** taken from a mother block shall be:
 - a. Rooted in beds on raised benches or raised gravel to break contact with the soil. If the bedding medium contains soil or is being reused the medium shall be fumigated with an approved fumigant according to label directions. Heat sterilization performed according to directions in Extension Circular 540, "Control of Diseases and Insect Pests in the Plant Bed," shall be acceptable. Artificial media (**new** peat, perlite, vermiculite, washed sand, etc.) may be used without fumigating or heat treating if reasonable precautions are taken against contamination.
 - b. Rooted in beds located where they will not receive drainage from fruiting fields or mother plant blocks.
2. **Rooted Cuttings.** Rooted cuttings shall be transplanted to:
 - a. Fields which have been fumigated with an approved fumigant according to label directions, or
 - b. Containers in which the growing medium, if it contains soil or is being reused, has been fumigated or heat treated as in III (a) 1 above. Artificial media (**new** peat, perlite, vermiculite, washed sand, etc.) may be used without fumigating or heat treating if reasonable precautions are taken against contamination. Used containers shall be decontaminated by washing with 30% Clorox solution before reusing. Containers shall be placed on raised benches or on raised gravel beds in such manner as to avoid contact of the plants or containers with contaminated soil or water. Container blocks or field blocks shall be located where they will not receive drainage from fruiting fields or mother plant blocks.
3. **Nursery Stock.** Blueberry nursery stock when produced as prescribed herein may be sold as:
 - a. Cuttings.
 - b. Rooted Cuttings.
 - c. Field-grown plants.
 - d. Container-grown plants.

Proof of origin must be provided to the purchaser if the cuttings, rooted cuttings or plants are to be used in the establishment of new mother blocks or for the production of rooted cuttings or container-grown or field-grown plants for sale.

Application of Regulations. These regulations shall apply in addition to and do not replace any regulations

covering nursery stock now in effect as covered by Plant Board Circular 11, "Regulations on Plant Diseases and Pests," nor do they replace or supersede any requirement of the Arkansas Plant Act or the Arkansas Nursery Fraud Act.

Fees. The nursery license and inspection fees described in Circular 11, Section IV shall apply.

Effective Date. To avoid penalizing plant production by current methods while mother blocks are being established, these regulations shall become effective in two stages. Present plant production practices may be continued until December 31, 1984, after which date all cuttings shall be taken and started as prescribed in these regulations. After December 31, 1986 all cuttings, rooted cuttings and plants produced in Arkansas for sale shall be produced as set forth in these regulations.

J. Lythrum Species (Including but not limited to Purple Loosestrife). All Lythrum species including any hybrid cross thereof is hereby declared to be a public nuisance and designated a noxious weed. It is prohibited to transport, buy, sell, offer for sale, or to distribute Lythrum species inter or intra state. The planting of plants and/or plant parts including seed is strictly prohibited in the State of Arkansas.

K. Rules and Standards for Certification of Certified Blackberry Plants. The production of blackberry nursery stock is an important industry in Arkansas. Diseases such as rust, anthracnose, crown gall and viruses, as well as pests such as cane borers and nematodes pose a threat to the blackberry nursery industry. To prevent the spread of these problems by nursery stock, the following certification regulations shall apply to the production and sale of certified blackberry nursery stock in Arkansas.

1. Definitions
2. Certifying Agency Insurance of Certificate
3. Blackberry Certification Standards
4. Requirements for Production of Foundation, Registered and Certified Blackberry Stock
5. Inspections
6. Inspection Standards
7. General Requirements for Plants
8. Blackberry Certification Fees
9. Certified Planting Stock Pre-Marketing, Identification and Grade
10. Blackberry Tagging or Stamping and Plant Inspection
11. Application of Regulations

1. Definitions

- a. **Board** - means the Arkansas State Plant Board.
- b. **Blackberry** - means cultivated *Rubus* species and related plants that are considered blackberry botanically.
- c. **Cane cutting** - is a cane section of two or more nodes or buds (length 4-6 inches) to be transplanted to produce a plant.
- d. **Crown** - is the persistent (perennial) base of the plant; the junction between canes and roots (some varieties have buds that arise primarily from the crown).
- e. **Director** - means the director of the State Plant Board or his duly appointed representative.
- f. **Hardwood cutting** - is taken from a mature woody stem for the purpose of propagation.
- g. **Indicator plant** - means any herbaceous or woody plant used to index or determine virus infection.
- h. **Indexing** - is a procedure to determine virus or other pathogen infection by inoculation from the plant to be tested to an indicator plant (grafted onto plant to be tested) or by any other approved method.
- i. **Mericlones** - are plants clonally propagated from a single meristem tip.

- j. **Micropropagation** - is plant multiplication *in vitro*. Blackberry is propagated in tissue culture by aseptic transfer of meristem tip cultures to produce Nuclear stocks.
- k. **Nodal cutting** - is a cane cutting with a single node to produce a plant.
- l. **One-year-old plants** - means well rooted plants that have developed during one growing season.
- m. **Primocane** - (succulent plants) is the current season's growth that develops from root or basal crown buds.
- n. **Root cuttings** - is a root section with one or more buds.
- o. **Softwood** - cutting is taken from a green, immature, actively growing stem of a woody plant during spring or early summer for the purpose of propagation.
- p. **Succulent plant** - means a small, actively growing plant that is developing from root buds, not having passed through a dormant period.
- q. **Virus infected (affected)** - means presence of a virus (es) or yellows disease agent in a plant or plant part. The word "virus" shall be used hereafter to include yellows disease.
- r. **Virus-like** - means a disorder of genetic or non transmissible origin, or a graft-transmissible disorder resembling a virus disease, including but not limited to diseases caused by viroids and phytoplasmas

2. Certifying Agency Issuance of Certificate

The issuance of a certified state of Arkansas plant tag or stamp under this chapter affirms solely that the tagged or stamped blackberry stock has been subjected to certification standards and procedures by the department. The Board disclaims all expressed or implied warranties, including without limitation, implied warranties of merchantability and fitness for particular purpose, regarding all plants, and plant materials under this chapter.

The Board is not responsible for disease, genetic disorder, off-type, failure of performance, mislabeling, or otherwise, in connection with this chapter. No grower, nursery dealer, government official, or other person is authorized to give any expressed or implied warranty, or to accept financial responsibility on behalf of the Plant Board regarding this chapter.

Participation in the blackberry planting stock certification program is voluntary.

3. Blackberry Certification Standards

The following specific rules constitute the requirements and standards for classes and sources of blackberry certified stock:

- a. **Nuclear stock** shall be derived from plants that have been micropropagated, indexed, apparently free from other pests, and evaluated in field tests for trueness-to-variety. Nuclear stock may exist as *in-vitro* tissue culture plantlets or potted plants in a screened greenhouse. Sources of plants grown as nuclear stock must be approved by the State Plant Board.
- b. **Foundation stock** is produced from Nuclear stock and grown in a greenhouse or screenhouse to exclude insects.
- c. **Registered stock** is produced from Foundation stock in greenhouse, screenhouse, or field.
- d. **Certified stock** is produced from Registered stock in greenhouse, screenhouse, or field.

4. Requirements for the Production of Foundation, Registered and Certified Blackberry Stock

- a. **Facilities** (greenhouse, screenhouse, water, equipment, etc.) for plant production must be approved by the Board before Foundation stock is procured by the producer.

b. Foundation stock

1. Foundation plants may be maintained indefinitely if grown in an insect-proof facility (greenhouse), in sanitized substrate, and indexed every three years by the United States Department of Agriculture or other personnel approved by the Board.
2. Growers may use micro-propagation techniques to multiply foundation plants prior to planting in a foundation greenhouse provided the micro-propagated plants are isolated from other non-indexed blackberry plants, and the micro-propagation facilities are approved by the Board.
3. In greenhouse or screenhouse, Foundation plants shall be produced in separate sanitized containers with labeling of cultivar name and lot number (if applicable).
4. Non-certified *Rubus* species must not exist within 152 meters (500 feet) of the perimeter of the greenhouse. Weeds that host disease of major concern must be controlled within 152 meters (500 feet) of the perimeter of the greenhouse. Insects that vector diseases of major concern should be controlled in isolation areas.
5. Non-certified *Rubus* species must not exist within the greenhouse or screenhouse.
6. Blossoms shall be removed before the blossoms open.

c. Registered stock

1. Registered plants may be maintained indefinitely if grown in an insect-proof facility (greenhouse), in sanitized substrate, and indexed every three years.
2. In greenhouse or screenhouse, Registered plants shall be produced in separate sanitized containers with labeling of cultivar name and lot number (if applicable).
3. Non-certified *Rubus* species must not exist within 152 meters (500 feet) of the perimeter of the greenhouse. Weeds that host disease of major concern must be controlled within 152 meters (500 feet) of the perimeter of the greenhouse. Insects that vector diseases of major concern should be controlled in isolation area.
4. Non-certified *Rubus* species must not exist within the greenhouse or screenhouse.
5. For field production, soil treatment is required with an approved method (ex. solid soil fumigation with methyl bromide + chloropicrin). Weeds that host diseases of major concern will be controlled. Insects that vector diseases of major concern should be controlled in isolation area.
6. Non-certified *Rubus* species must not exist within 152 meters (500 feet) of the perimeter of the field used to produce certified blackberry stock. Each lot and/or different cultivars are labeled and separated by a distance of 4.25 meters (14 feet) or a physical barrier that prevents intermingling of roots.
7. Field produced Registered stock shall not be harvested beyond one year.
8. Blossoms shall be removed before the blossoms open.

d. Certified stock

1. Certified plants may be maintained indefinitely if grown in an insect-proof facility (greenhouse), in sanitized substrate, and indexed every three years.
2. In greenhouse or screenhouse, Certified plants shall be produced in separate sanitized containers with labeling of cultivar name and lot number (if applicable).
3. Non-certified *Rubus* species must not exist within 152 meters (500 feet) of the perimeter of the greenhouse. Weeds that host disease of major concern must be controlled within 152 meters (500 feet) of the perimeter of the greenhouse. Insects that vector diseases of major concern should be controlled in isolation area.
4. Non-certified *Rubus* species must not exist within the greenhouse or screenhouse.
5. For field production, soil treatment is required with an approved method (ex. solid soil fumigation with methyl bromide + chloropicrin). Weeds that host diseases of major concern will be controlled. Insects that vector diseases of major concern should be controlled in isolation area.
6. Non-certified *Rubus* species must not exist within 152 meters (500 feet) of the perimeter of the field used to produce certified blackberry stock. Each lot and/or different cultivars are labeled and

separated by a distance of 4.25 meters (14 feet) or a physical barrier that prevents intermingling of roots.

7. Field-produced Certified stock shall not be harvested beyond one year.

8. Blossoms shall be removed before blossoms open.

e. Documentation of soil treatments and use of plant protectants shall be made available to the Board.

f. A map identifying cultivars and lots must be provided to the Board.

5. Inspections

a. Greenhouse/Screenhouse

1. Grower will regularly inspect plants. All plants that are symptomatic of disease will be removed and destroyed. The grower will keep a logbook recording cultivar and number of destroyed plants and make it available to Board inspectors.

2. Grower will inspect in and around the greenhouse perimeters to ensure isolation standards are being met.

3. Board inspectors must inspect and approve any greenhouse that has not been used for successful production of indexed blackberry plants.

4. During the production of certified plants, Board inspectors will do at least one inspection during the growing period when plants are likely to express symptoms of virus infection, crown and cane gall infections and other disorders. The Board may conduct additional inspections if deemed necessary.

5. All plants that are of off-types, crown gall infected, virus infected, or exhibiting virus-like symptoms during inspections will be flagged by Board inspectors.

6. Grower will remove all flagged plants immediately after inspection by the Board inspector. Effective roguing techniques must include removing the undesirable plant and all of its roots.

b. Field

1. The grower should inspect fields regularly during the growing season and rogue all plants with symptoms of disease, etc. The Board should be informed if any problems are found.

2. The Board inspector will perform three inspections of fields for certified plant production:

a. First inspection during April

b. Second inspection during July

c. Third inspection during October.

Additional inspections may be performed if deemed necessary.

3. All plants that are of off-types, crown gall infected, virus infected, or exhibiting virus-like symptoms during inspections will be flagged by Board inspectors.

4. Grower will remove all flagged plants immediately after inspection by the Board inspector. Effective roguing techniques must include removing the undesirable plant and all of its roots as well as all the plants and plant parts within ten feet of the undesirable plant.

6. Inspection Standards

a. Greenhouse, General Requirements

1. Unit of certification shall be the entire greenhouse.

2. Isolation: Non-certified *Rubus* species must not exist within the greenhouse. Non-certified *Rubus* species must not exist within 152 meters (500 feet) of the perimeter of the greenhouse. Weeds that host disease of major concern must be controlled within 152 meters (500 ft) of the perimeter of the greenhouse. Insects that vector diseases of major concern should be controlled in isolation area.

b. Field, General Requirements

1. Unit of certification shall be the field or a portion of field. Any portion of the field that does not meet inspection standards may be delimited if it will not jeopardize the remainder of the field.
2. Isolation: Non-certified *Rubus* species must not exist within 152 meters (500 feet) of the certified plants. Weeds that host diseases of major concern must be controlled within 152 meters (500 feet) of the certified plants. Insects that vector diseases of major concern should be controlled in isolation area.

c. Specific Greenhouse and Field Tolerance, maximum % of factor

Factor	Foundation Stock	Registered Stock	Certified Stock
Anthracnose	0	2.0	5.0
Crown and cane gall	0	0.1	1.0
Nematodes	0	0.05	0.1
Rust, systemic	0	0	0
Virus diseases	0	0.05	0.5
Other diseases	0	0.2	0.5
Varietal mixture	0	0	0
Root, cane or crown inhabiting insects	0	0.05	0.1

7. General Requirements for Plants

- a. Growers may sell Foundation, Registered or Certified stock as certified plants.
- b. An official certificate will accompany each sale of certified Blackberry plants or stock. This certificate will list the viruses indexed and other details. Each container/plant will be labeled with variety and certification information.
- c. A complete record of the number of certified Blackberry plant/stock sales will be maintained and made available to the official certifying agency. The record will include
 1. Class
 2. Cultivar
 3. Date of Shipment
 4. Number of Plants or Stock Shipped.
- d. General Inspection Standards for Plants:
 1. Apparently free of biotic and abiotic diseases, insects, and other pests.
 2. True-to-variety characteristics.
 3. Good leaf color and plant size.
 4. Satisfactory plant size to meet the expectations of the customer.
 5. Plants will not be shipped with non-certified plants.

8. Blackberry Certification Fees

- a. Blackberry certification application fee. Applicant will be required to obtain a valid Nurseryman's license and pay the required fees as prescribed for the Nurseryman category. The blackberry certification application and fee is in addition to the Nurseryman fee. The certification fee is assessed for the sole

purpose of defraying expenses incurred in the additional inspection and certification requirements protocol.

The applicant must furnish all information requested on the Application for Inspection Form and must allow the inspector to take samples of plants or plant parts from any certified planting for inspection and testing purposes. A separate application is required and a \$50.00 fee shall be paid for each cultivar/variety unit entered for certification. Each lot or field of each cultivator shall be listed separately on the application. Application for certification inspection for the following year must be filed with the Arkansas State Plant Board, Post Office Box 1069, Little Rock, Arkansas 72203 by **Oct. 31**, accompanied by the appropriate fees.

b. A grower desiring to produce certified blackberry plants as herein provided shall establish with the Board facts evidencing sufficient experience to produce healthy, high quality stock.

c. The Board will remove any applicant failing to renew certification by the designated due date of the certification program. Failure to pay fees by the designated due date shall also result in removing the applicant from the certification program.

d. The Board will not accept applications from growers owing the Board for previous services.

9. Certified Planting Stock Pre-marketing, Identification and Grade

a. All blackberry planting stock meeting the requirements of this chapter can be identified by the State Plant Board tag or stamp issued under by the Board.

b. All containers must be new and marked with the name and address of the grower, class of certified stock, variety and lot number.

c. The quality and grading of the stock is the responsibility of the grower.

10. Blackberry tagging or stamping and plant inspection

a. "Certified" stock shall be identified with the state of Arkansas official certified blackberry plant tag or stamp under the supervision of the Board after plants have passed inspection.

b. Only plants meeting Arkansas standards for blackberry plants shall be tagged or stamped.

c. All containers shall be marked with the name and address of the grower, grade or class of stock, and variety.

11. Application of Regulations

This certification program is strictly voluntary and these regulations shall apply in addition to and do not replace any regulations covering nursery stock now in effect as covered by Plant

Board Circular 11, "Regulations on Plant Diseases and Pests", nor do they replace or supersede any requirement of the Arkansas Plant Act of 1917, A.C.A. 2-16-201 thru 214 or the Arkansas Nursery Fraud Act of 1919, A.C.A. 2-21-101 thru 113.

L. RULES AND REGULATIONS FOR THE ARKANSAS BOLL WEEVIL ERADICATION PROGRAM

Section I: Purpose. Pursuant to Ark. Code Ann. § 2-16-605, the purpose of these rules is to develop and establish procedures for the eradication of Boll Weevil within and applying uniformly to the whole State of Arkansas, to establish per acre annual Assessments that offset program costs, to provide procedures for the collection of such Assessments, to specify conditions for the movement of regulated articles, and to provide penalties for violations of these rules.

Section II: Declaration of Boll Weevil as a Plant Pest. Pursuant to Ark. Code Ann. § 2-16-602(a), the Boll Weevil (*Anthonomus grandis* Boheman) is declared to be a plant pest and a nuisance, as is any plant or other regulated article infested therewith or that has been exposed to infestation and is likely to lead to additional infestation.

Section III: Definitions. For the purpose of these rules, the following definitions shall apply:

1. **APHIS** - means United States Department of Agriculture, Animal and Plant Health Inspection Service.
2. **Arkansas Cotton Grower's Organization, Incorporated, d/b/a Arkansas Boll Weevil Eradication Foundation** - means the nonprofit organization comprised of Arkansas Cotton Growers to provide guidance and assist in policy decisions during the eradication program, and certified by the Plant Board pursuant to Ark. Code Ann. § 2-16-612.
3. **Assessment** - means the amount charged to each Cotton Grower to finance, in whole or part, a program to suppress or eradicate the Boll Weevil in this state and calculated on a per-acre basis pursuant to Ark. Code Ann. § 2-16-614(b).
4. **Boll Weevil** - means *Anthonomus grandis* Boheman in any stage of development.
5. **Boll Weevil Eradication Program** - means the program initiated under Ark. Code Ann. § 2-16-601 et seq.
6. **Certificate** - means a document issued or authorized by the Plant Board indicating that a regulated article is not contaminated with Boll Weevils.
7. **Grower's Compliance Certificate** - means a document issued or authorized by the Plant Board indicating that a Cotton Grower has complied with the requirements of these rules and the Cotton Grower's cotton may be ginned in Arkansas.
8. **Compliance Agreement** - means a written agreement required between the Plant Board and any person engaged in growing cotton, dealing in, or moving regulated articles wherein the latter agrees to comply with specified provisions to prevent dissemination of the Boll Weevil.
9. **Cotton** - means any cotton plant or cotton plant product upon which the Boll Weevil is dependent for completion of any portion of its life cycle.
10. **Cotton Grower** - means any person, other than a cash rent landlord, who is engaged in or has as economic risk in the business of producing, or causing cotton to be produced, for market.
11. **Eradication Zone** - means a geographical area designated by the Plant Board in which the Boll Weevil Eradication Programs will be undertaken and managed pursuant to Ark. Code Ann. § 2-16-610.
12. **Exposed** - means any area or location subjected to Boll Weevil infestation.
13. **Gin Trash** - means all waste material produced during the cleaning and ginning of seed cotton. It does not include the lint, cottonseed, or gin waste.
14. **Gin Waste** - means all forms of unmanufactured cotton fiber (including gin notes) produced at cotton gins, other than baled cotton lint.
15. **Infested** - means actually infested with a Boll Weevil or so exposed to infestation that it would be reasonable to believe that an infestation exists.
16. **Inspector** - means any employee of the Plant Board or any other person authorized by the Plant Board

to enforce the provision of these rules.

17. **Non-Commercial Cotton** - means cotton intended for any purposes other than sale or scientific purposes under Section XII of these rules.

18. **Permit** - means a document issued or authorized by the Plant Board to provide for the movement of regulated articles to restricted designation for limited handling, utilization, or processing.

19. **Person** - means any individual, partnership, corporation, company, society, or association, or other business entity.

20. **Plant Board** - means the Arkansas State Plant Board, which is the agricultural plant regulatory agency of the State of Arkansas.

21. **Quarantine Area** - means any portion of the State of Arkansas designated as such pursuant to Ark. Code Ann. § 2-16-609.

22. **Regulated Area** - means any portion of an eradication zone designated for any purpose necessary to the execution of the Boll Weevil Eradication Program.

23. **Regulated Article** - means any article of any character carrying or capable of carrying the Boll Weevil, including, but not limited to, cotton plants, seed cotton, cottonseed, other hosts, gin trash, gin equipment, mechanical cotton pickers, and other equipment associated with cotton production, harvesting, or processing.

24. **Seed Cotton** - means cotton as it comes from the field prior to ginning.

25. **Shipment or Shipments** - means the items to be transferred or moved, or the act or process of transferring or moving items from one point to another.

26. **USDA** - means the United States Department of Agriculture.

27. **Used Cotton Equipment** - means any equipment used previously to harvest, strip, transport or process cotton.

28. **Waiver** - means a written authorization which exempts a Person or any organization from compliance with one or more requirements of these rules.

Section IV: Eradication Zones. The eradication zones for the State of Arkansas are defined as follows:

1. **Southwest Zone** shall consist of the following counties: Bradley, Calhoun, Clark, Cleveland, Columbia, Dallas, Garland, Grant, Hempstead, Hot Springs, Howard, Lafayette, Little River, Miller, Montgomery, Nevada, Ouachita, Pike, Polk, Saline, Scott, Sevier, and Union.

2. **Southeast Zone** shall consist of the following counties: Arkansas, Ashley, Chicot, Conway, Crawford, Desha (that portion lying south of the Arkansas river), Drew, Faulkner, Franklin, Jackson, Jefferson, Johnson, Lincoln, Logan, Lonoke, Perry, Phillips, Pope, Prairie, Pulaski, Sebastian, St. Francis, Woodruff, and Yell.

3. **Central Zone Area** shall consist of the following counties: Baxter, Benton, Boone, Carroll, Cleburne, Desha (that portion lying north of the Arkansas river), Fulton, IZard, Lawrence, Lee, Madison, Marion,

Monroe, Newton, Poinsett ((that portion lying east of the St. Francis River (administered as central zone but operationally handled as part of the Northeast Ridge zone)), Randolph, Searcy, Sharp, Stone, Van Buren, Washington and White.

4. **Central Zone Area 2** shall consist of the following counties: Crittenden, Cross, and Independence.

5. **Northeast Ridge Zone** shall consist of the following counties: Clay, Craighead (that portion lying west of the St. Francis river), Green and Poinsett (that portion lying west of the St. Francis river.)

6. **Northeast Delta Zone** shall consist of the following counties: Craighead (that portion lying east of the St. Francis river) and Mississippi.

Zones have been designated in accordance with the Boll Weevil Eradication and Suppression Act (Ark. Code Ann. §§ 2-16-601 *et seq.*)

Section V: Submission of Reporting Forms, Assessments, Penalties for Late Payment, Cotton Destruction, and Exemptions.

1. Pursuant to Ark. Code Ann. § 2-16-608, upon passage of the grower referendum, all Cotton Growers in the eradication zones shall be required to participate in the eradication program as set forth herein. Pursuant to Ark. Code Ann. § 2-16-610, where mandated, all Cotton Growers in an eradication zone shall be required to participate in the eradication program as set forth herein.

2. Cotton Acreage Reporting. Each Cotton Grower shall submit annual cotton acreage reporting information, listing the acreage and location of all cotton being grown by the Cotton Grower in this state. Personnel of the Cotton Grower’s Organization will be responsible for determining by use of global positioning systems or other appropriate technology the exact amount of acreage planted by individual growers.

3. Cotton Acreage. Cotton Growers shall report their cotton acreage to the Plant Board, or its designated agent, no later than June 15 of each year in which field operations of the Boll Weevil Eradication Program are in effect in their eradication zone (“Cotton Acreage”). The Plant Board may formulate and institute a method of assessing and collecting the fees associated with the Cotton Acreage. Any Cotton Grower who fails to file the Cotton Acreage report in the manner prescribed by the Plant Board by June 15 shall be subject to a penalty of up to Three Dollars (\$3.00) per acre. Failure to pay the cotton acreage assessment could result in late payment fees of Three Dollars (\$3.00) per acre if payment is not received by the deadline set by the invoice.

4. Assessments. The per acre Assessment shall be as determined by the applicable referendum or by action of the State Plant Board. The per acre Assessment payable by the Cotton Grower shall be based on the Cotton Grower’s Cotton Acreage report. As of the date of these rules, the Assessment for each eradication zone may be or have been up to the amounts shown below.

	<u>Southwest</u>	<u>Southeast</u>	<u>Central 1</u>	<u>Central 2</u>	<u>NE Ridge*</u>	<u>NE Delta</u>
Year 1	\$15.00	\$15.00	\$15.00	\$15.00	\$10.00	\$8.00
Year 2	\$35.00	\$35.00	\$30.00	\$25.00	\$25.00	\$14.00
Year 3	\$35.00	\$30.00	\$35.00	\$30.00	\$24.00	\$14.00
Year 4	\$25.00	\$35.00	\$35.00	\$30.00	\$24.00	\$TBD
Year 5	\$20.00	\$35.00	\$35.00	\$30.00	\$22.00	\$TBD

NE Ridge Zone (E. Poinsett assessment is same as NE Ridge but instituted a year later.)

During the years (the maintenance period) following the years specified above, the per acre annual Assessment in the Southwest Zone shall not exceed \$10 per acre, and the per acre annual assessment in the

Southeast and Central Zones shall not exceed \$12 per acre. Maintenance assessments in the NE Ridge zone shall not exceed \$8 per acre. Establishment of a maintenance program in the N E Delta zone will be determined at the end of the eradication program.

Upon recommendation of the Arkansas Cotton Grower's Organization, Inc., the Plant Board may adjust the annual Assessments within the limits allowed by the referendum then in effect. In the NE Delta zone, annual assessments will be established by Plant Board action. Assessments for 2011 and possibly for additional years, will be set at \$14.00 per acre. Such Adjustments may be made at the time and in the manner determined by the Plant Board to be in the best interest of the Boll Weevil Eradication Program. In making such adjustments, the Plant Board may consider facts and information it determines to be relevant, including, but not limited to, climate and environmental conditions, finances and the overall state of the cotton industry.

5. Collection of Assessments. Assessments shall be payable by the Cotton Grower in one (1) installment, as provided below:

a. The payment shall be paid by the payment date established by the appropriate invoice.

The payment shall be an amount equal to the Cotton Grower's Cotton Acreage multiplied by the per acre assessment fee or such amount as is established by the appropriate invoice. Cotton Growers in the Southwest, Southeast, Central, and NE

Ridge zones shall make such payments payable to the "Arkansas Boll Weevil Eradication Foundation" and cotton growers in the NE Delta zone shall make payments to "Arkansas State Plant Board" and deliver the payment to the Plant Board, or its designated agent, no later than the payment date established by the invoice, of each year in which such Assessments are payable. Cotton Growers who fail to make the payment by the payment date established by the invoice, shall be subject to a penalty of up to Three Dollars (\$3.00) per acre for unpaid acreage, based on planted cotton acreage.

b. An Assessment will be paid by one person. That person, the producer (the person responsible for planning, managing and/or performing the cultural practices associated with producing the crop), or their respective attorney-in-fact, shall execute the applicable reports prescribed by these rules. All billing information must be provided, by producers to Cotton Growers Organization employees who will be collecting assessment invoicing information. The information will be recorded by the Cotton Growers Organization employee on a form developed specifically for this purpose. The producer is responsible for insuring that information delivered to the Plant Board is correct. The Producer is held ultimately responsible for payment of the assessment and will be subject to appropriate penalties and late fees if assessments are not received. Grower's Compliance Certificates, described below, shall not be issued until the entire Assessment, and any applicable penalty, is paid as required.

c. In the event a Cotton Grower fails to pay Assessments and/or penalties as required under these rules, pursuant to Ark. Code Ann. § 2-16-617(c) and (d)(2), the Plant Board may file a lien with the appropriate county office and the Arkansas Secretary of State on the cotton, subject to such assessments, and on the Cotton Grower's subsequent cotton crops until all such amounts are paid in full.

6. Cotton Destruction. Pursuant to Ark. Code Ann. §§ 2-16-610(e) and 2-16-617(a), any Cotton_Grower who fails to pay all Assessments and/or penalties within thirty (30) days after notice from the Plant Board shall, upon direction of the Plant Board, destroy all cotton plants in which the Cotton Grower has an interest and which are subject to Assessment. Any such cotton plant not destroyed shall be deemed a public nuisance. The Plant Board may apply to any court of competent jurisdiction for the issuance of a judgment and order for condemnation and destruction of the nuisance. The Cotton Grower shall be liable for all court costs, fees, and other expenses incurred in any action taken under this paragraph 9.

7. Grower's Compliance Certificate. Pursuant to Ark. Code Ann. § 2-16-617(d), no gins in the State of Arkansas shall gin any cotton grown in an eradication zone in which field operations of the Boll Weevil Eradication Program are in effect, or from any other state, unless and until that Cotton Grower files with the gin a Grower's Compliance Certificate issued by the Plant

Board certifying that said Cotton Grower has paid all fees, Assessments, penalties, and costs imposed and required pursuant to § 2-16-601 et seq., as amended, or proof of exemption there from as provided in paragraph 12 below. It is the responsibility of each Cotton Grower to procure a Grower's Compliance Certificate for the crop year for each FSA farm number on which cotton is planted, or proof that an exemption for compliance has been granted from the

Plant Board. The Cotton Grower must file the Grower's Compliance Certificate with their gin each crop year.

8. Ginner's Penalty. Any gin that gins cotton for any Cotton Grower who has not filed a current valid Grower's Compliance Certificate or proof of exemption issued by the Plant Board shall be subject to a penalty in the amount of \$50.00 per bale for each bale ginned for such non-complying Cotton Grower. This provision does not prohibit the movement of seed cotton within the State of Arkansas for protection from loss or efficient storage prior to ginning.

9. Exemption Due to Hardship. Pursuant to Ark. Code Ann. § 2-16-217(e), Cotton Growers may apply for exemption from payment of any Assessment or penalty imposed by these rules, on the basis that such payment will impose undue financial hardship on the Cotton Grower. Criteria for hardship may include, but are not limited to:

- a. late or unavailable financing through no fault of the Cotton Grower,
- b. regional economic conditions, and
- c. regional climate/environmental conditions.

Any Cotton Grower who wishes to request an exemption from payment of the Assessment or the penalty or both shall apply for the exemption on forms prescribed by the Plant Board. Except for instances beyond the control of the Cotton Grower, the application for this exemption must be received by the Plant Board at least thirty (30) days before the due date of the Assessment for which exemption is requested. A separate application must be filed for each calendar year for which the Cotton Grower seeks an exemption. Each such application shall contain information on which the Cotton Grower relies to justify an exemption on the basis of undue financial hardship. In the event the application for exemption is not filed within the time prescribed herein, the application shall include information that describes the circumstances that prevented a timely filing. The application form shall include an oath or affirmation of the applicant as to the truth of all information in the application.

The Plant Board shall forward each completed exemption application form and any information accompanying the form to the Arkansas Cotton Grower's Organization, Inc. The Arkansas Cotton Grower's Organization, Inc. shall determine whether each applicant qualifies for a hardship exemption based on the information contained in or accompanying the application form. If the Arkansas Cotton Grower's Organization, Inc. determines that the payment of the Assessment or the penalty or both would impose undue financial hardship on a

Cotton Grower who has applied for an exemption, the Arkansas Cotton Grower's Organization, Inc. may:

- a. exempt the Cotton Grower from payment of the Assessment or the penalty or both, or
- b. permit the Cotton Grower to pay the Assessment or penalty or both on an installment payment plan and prescribe the payment schedule.

Upon making a determination on any application for exemption, the Arkansas Cotton Grower's Organization, Inc. shall notify the Plant Board of its determination, which shall be binding on the applicant. The Plant Board shall then promptly notify the affected Cotton Grower in writing of the

determination. If an exemption is denied, the Assessment and penalties for the year in which the application is made will be due at the time they would otherwise have been due if the application had not been filed, or within thirty (30) days after the date of the notice of the determination, whichever is later.

10. Penalties. The Plant Board shall assess Cotton Growers penalties for failure to comply with the reporting and/or payment requirements of these Regulations. Penalties are payable in full to the Arkansas Boll Weevil Eradication Foundation within thirty (30) days of the date of the penalty assessment. Any such penalties assessed must be paid before the Plant Board may issue a Grower's Compliance Certificate under Section V, Paragraph 10 of these Regulations.

Penalties must be paid as provided herein even if the Cotton Grower appeals the penalty under subparagraph 14 below.

11. Appeal of Penalties. Unless specifically provided for elsewhere in these rules, any person (Cotton Grower, gin or otherwise) assessed a penalty under these rules may appeal the penalty assessment to the Plant Board within thirty (30) days of the date of the penalty assessment.

Such appeal must include all information upon which the appealing party bases its appeal. The Plant Board Director may revoke, modify, or affirm the penalty and shall rule on the appeal within forty-five (45) days of the Plant Board's receipt of the appeal. The Director's ruling shall be in writing and mailed to the appealing party via first class United States mail. Any refunds due on the penalty assessment shall be paid promptly in compliance with the applicable fiscal rules and regulations. The Director may seek the recommendation of the

Arkansas Cotton Grower's Organization on any appeals under this Paragraph 14. Provided, however, any such recommendation from the Arkansas Cotton Grower's Organization shall not be binding on the Plant Board Director.

12. Limit on Penalties. Section V provides for various penalties in connection with reporting acreage and paying assessments, each of which is a separate violation and cause for penalty. Notwithstanding the type of penalties imposed under Section V, the total amount of penalties assessed against a particular Cotton Grower shall not exceed \$15.00 per acre of cotton for the crop year and acreage in issue.

Section VI: Cotton Stalk Destruction Incentive.

If during the Boll Weevil Eradication Program seasonal growing conditions promote early maturation and harvesting of cotton in Arkansas, the Plant Board may, upon recommendation from the Arkansas Cotton Grower's Organization, Inc., establish a per acre incentive credit for early stalk destruction. Such incentive credit shall be applied to the Cotton Grower's Assessment for the following year. In the event a Cotton Grower's Certified Acreage in the following year is not sufficient to fully consume the incentive credit in such following year, the Cotton Grower may apply to the Plant Board for a refund of the unused incentive credit, using forms prescribed by the Plant Board. The rate per acre of any such incentive credit, whether uniform for the entire State, or variable, shall be established and made available to all participating Cotton Growers no later than September 1 of the current growing year. No incentive credit established under this paragraph shall be credited or paid to the Cotton Grower by the Plant Board until the date of the Cotton Grower's stalk destruction has been confirmed to the Plant Board by eradication program personnel.

Section VII: Planting Cotton in the Eradication Zone.

1. Prohibited Planting. Pursuant to Ark. Code Ann. § 2-16-610(b)(1), the Plant Board may prohibit the planting of cotton in designated areas where Boll Weevil eradication treatments cannot be effectively or legally applied due to factors concerning the public welfare if determined by the Plant Board that planting cotton jeopardizes the success of the program (Prohibited Planting Area). The Plant Board shall identify all Prohibited Planting Areas no later than March 1 of each year. Notice of the Prohibited Planting Area shall be published in a local newspaper of general circulation covering the Prohibited Planting Area at least once

a week for four (4) consecutive weeks in the month of March. In the event a Prohibited Planting Area is not designated by March 1 of the year in issue, the Plant Board's purchase or destruction of cotton shall be in accordance with Section IX below.

2. Notice of Destruction. Pursuant to Ark. Code Ann. § 2-16-611(b), the Plant Board may by written order require the destruction of cotton planted in a Prohibited Planting Area after publication of the first notice required in paragraph 1 above. Said order shall be delivered to the Cotton Grower via certified United States mail. The order shall identify the cotton to be destroyed by Township, Range, and Section, or portion thereof. The order shall specify the date by which the Cotton Grower must destroy the crop at the Cotton Grower's expense, which date shall be at least ten (10) calendar days after the date of the order. The order shall further state that in the event the Cotton Grower does not destroy the cotton by the specified date, the Plant Board will destroy the cotton and assess the cost of destruction against the Cotton Grower. The Assessment under this section shall be payable within thirty (30) calendar days after destruction and shall be treated as any Assessment for purpose of enforcing these rules. Provided, however, the Cotton Grower may appeal an order under this paragraph to the Director of the Plant Board. The appeal must be received by the Plant Board within ten (10) calendar days of the date of the order. The Director of the Plant Board shall issue an order on the appeal within ten (10) calendar days of the Plant Board's receipt of the appeal.

3. Non-Commercial Cotton. Non-commercial cotton shall not be planted in an eradication zone in which field operations of the Boll Weevil Eradication Program are in effect without a waiver issued in writing by the Plant Board. Application for a waiver shall be submitted in writing and the Plant Board's decision to grant or deny the waiver may be based on all of the following:

- a. Location of growing area
- b. Pest conditions in the growing area
- c. Size of the growing area
- d. Accessibility of the growing area
- e. Any stipulations set forth in a compliance agreement between the applicant and the Plant Board that are necessary to the Boll Weevil Eradication Program.

Section VIII: Treatment of Boll Weevil in the Eradication Zones.

The eradication of the Boll Weevil in an eradication zone shall be in accordance with the USDA National Boll Weevil Cooperative Control Program and shall be executed by the Plant Board and the Arkansas Cotton Grower's Organization, Inc., with the assistance of the USDA Animal and Plant Health Inspection Service. The Final Environmental Impact Statement, dated 1991, issued by the USDA Animal and Plant Health Inspection Service for the National Boll Weevil Cooperative Program is incorporated into these rules.

Section IX: Purchase of Cotton for Effectuation of Program Objectives.

Pursuant to Ark. Code Ann. § 2-16-611(a), in the event Prohibited Planting Areas are not identified by the date prescribed in Section VII above, or the Plant Board otherwise determines it to be in the best interest of the Boll Weevil Eradication Program, the Plant Board or the Arkansas Cotton Grower's Organization, Inc. may purchase growing cotton. The Arkansas Cotton Grower's Organization, Inc. shall determine the purchase price for such cotton. After such purchase, the Plant Board may manage or dispose of the purchased cotton as it determines best. If the Cotton Grower objects to the purchase price determined by the Arkansas Cotton Grower's Organization, Inc., the Cotton Grower may appeal the determination to the Plant Board within 15 days of the date of such determination. Such appeal must include all information upon which the appealing Cotton Grower bases its appeal. The Plant Board Director shall rule on the appeal within thirty (30) days of the Plant Board's receipt of the appeal. The Director's ruling shall be in writing and mailed to the Cotton Grower and the Arkansas Cotton Grower's Organization, Inc. via first class United States mail.

Section X: Quarantine. Establishing Quarantine. In carrying out the purpose of these rules, the Plant Board may designate a quarantine area in accordance Ark. Code Ann. § 2-16-609.

Section XI: Issuance of Certificates and Compliance Agreements, Cancellations, Attachments and Cotton Gin Certificates. Certificates may be issued for the movement of regulated articles from, into or through a regulated area, as determined to be necessary by the Plant Board.

Section XII: Scientific Purposes.

All cotton planted within the state of Arkansas notwithstanding the size of the acreage or plant is subject to the coverage of these rules, provided, however, the Plant Board may designate experimental areas for experiments designed to contribute to the development of scientific knowledge deemed of importance to the production of cotton. Cotton Growers in designated experimental areas and affected thereby, may be exempted from specified requirements of these rules, provided, however, that such Cotton Growers abide by a Compliance Agreement applicable to the experimental areas.

Section XIII: Entry of Authorized Personnel Upon Properties.

Pursuant to Ark. Code Ann. § 2-16-607(b), Plant Board personnel are authorized to inspect any fields or premises and any property located therein or thereon for the purpose of determining whether such property is infested with the Boll Weevil. Such inspections must be conducted between sunrise and sunset. Such inspections include, but are not limited to, taking of specimens, examining and obtaining records, and applying or supervising treatments to the soil, plants or any regulated articles. This may include removal and destruction of plants, plant parts, or other regulated articles.

Section XIV Restricting Access to Eradication Zone and Regulated Area.

Pursuant to Ark. Code Ann. § 2-16-605, the Plant Board may issue rules that restrict entry by unauthorized persons or any other activities affecting, or affected by, the Boll Weevil Eradication Program on any premises in an eradication zone or in any regulated area.

M. FOREST TREE SEEDLING FUMIGATION.

- a. All forest tree seedlings shall meet the requirements of all applicable state and federal plant pest quarantines.
- b. All certified tree seedlings offered for sale or imported under permit into the State of Arkansas shall meet the following requirements:
 - a. Seedlings shipped within and into the state used for afforestation and reforestation shall be healthy vigorous stock and must be apparently free of injurious plant pests, including but not limited to infectious diseases, nematodes, insects, and quarantined pests.
 - b. To aid in ensuring apparent freedom from injurious plant pests, the grower shall make appropriate use of approved pesticides or other alternate practices during the growing of planting stock. This includes, but is not limited to, a pre-sowing tarped soil application of methyl bromide.
 - c. All plants shall be field inspected by the state plant inspector prior to the initiation of lifting operations

N. REGULATIONS FOR THE PRODUCTION OF RICE HAVING COMMERCIAL IMPACT

These regulations are established to carry out the provisions as specified in Act 1238 (An Act to Assign To The Arkansas State Plant Board Specified Powers, Duties and Responsibilities, Including The Duty To Develop And Enforce Regulations Relating To Rice Identified As Having Characteristics Of Commercial Impact; And For Other Purposes.)

1. Definitions.

- a. **Rice** – plants and grain from plants of the genus *Oryza*.

b. Characteristics of Commercial Impact – Characteristics that may adversely affect the marketability of rice in the event of commingling with any other rice and includes, but is not limited to those characteristics:

1. That cannot be identified without the aid of specialized equipment or testing
2. That create a significant economic impact in their removal from commingled rice
3. Whose removal from commingled rice is not feasible.

c. Commingle – the mixing of two or more quantities of grain that have different characteristics. These characters may or may not have direct commercial value but may have an effect on the commercial value of the total commingled lot.

d. Characteristic – a chemical component (including the plant DNA), physical appearance, physical structure or other ingredient that could adversely affect the production and marketing for potential profit by persons involved in crop production.

e. Producer – a person, corporation, partnership, association or other legal entity involved in the production of a crop for the purpose of placing the harvest of that crop in commerce.

f. State Plant Board – the agency charged with developing and enforcing regulations relative to, but not limited to, matters affecting agricultural plant production.

g. Certification – in the context of these regulations, shall mean the approval of specific varieties, strains, selections or lots of rice for production in the state.

h. Scientific Review Committee – a group of individuals each of whom is known by the Plant Board Director to have knowledge of scientific, industrial or business elements that would aid in the evaluation of the material under consideration.

i. Research – activities that involve growing rice plants, harvesting rice grain and/or performing chemical, mechanical or other pertinent operations on the plants and/or grain in order to accurately measure/define/develop the characteristics exhibited by the material.

2. Product Ownership

Ownership of the characteristic with commercial impact must be declared in documents filed with the Plant Board. The appropriate forms for making such declaration will be provided by the Plant Board. All regulatory activities will be handled through that declared owner or such other person or entity as dictated by the owner.

3. Eligibility Requirements

a. Eligibility requirements are such that a detailed description of the morphological, physiological and other characteristics that distinguish it from other varieties or related processes must be provided to the Plant Board. A suitable test for the purposes of detection/validation of the proposed characteristic must be provided. Information, designated as Confidential Business Information, collected in the process of administering these regulations will be considered exempt from Freedom Of Information Act due to the Trademark Exclusion contained in that act.

b. Rice possessing characteristics of commercial impact must have been registered and received commercial production approval from all appropriate federal agencies that have regulatory interest in the characteristics. These agencies include but may not be limited to:

1. Environmental Protection Agency

2. Department of Agriculture
3. Food and Drug Administration.

c. Any variety, line, strain or other designated selection of rice that had ever required a USDA or other agency permit for research or production will be required to submit to these regulations.

d. Eligibility for research exemption will be determined by the Plant Board through a review of laboratory management practices and production protocols by Plant Board staff.

4. Scientific Review Committee

a. A Scientific Review Committee may be appointed by The Plant Board to evaluate applications received under these regulations. The Scientific Review Committee shall consist of producers, not employed by or be on the board of any other entity represented on the committee, scientists from Arkansas educational entities, such as colleges and universities or the University of Arkansas Cooperative Extension Service; representative(s) of rice mills operating in Arkansas; representative(s) from the regulated companies; representative(s) of merchandisers located in Arkansas; the director of the Dale Bumpers National Rice Research Center; and the Director of the Arkansas State Plant Board shall be a permanent ex-officio standing member of the committee.

b. The committee shall review and make recommendations to the board concerning, but not limited to: 1) Identifying rice that has characteristics of commercial impact; 2) Reviewing rice identified as having characteristics of commercial impact upon receipt of a petition from the purveyor of the rice; 3) Recommending rules establishing terms and conditions for planting, producing, harvesting, selling, transporting, processing, storing, or otherwise handling rice identified pursuant to c, 1 of this paragraph, and 4) Reviewing the efficacy of terms, condition, and identity preservation programs imposed on the planting, producing, harvesting, transporting, drying, storing, or other handling of rice identified under section c, 1 of this paragraph using the most current industry standards and generally accepted scientific principles.

c. The criterion for evaluation for suitability for production shall encompass but not necessarily be limited to:

1. The characteristic of economic impact
2. Potential impact of characteristic on value of other crops
3. Potential for accidental introduction of characteristic into other crops
4. Quantity of production requested
5. Benefit expected to be brought to society from the characteristic
6. Ability of the owner of the characteristic to comply with all regulations
7. Ability of the owner of the characteristic to bear financial obligations for fees, fines and regulatory costs if contaminations are discovered
8. Other concerns arising in the committee deliberations.

5. Fees

a. An application fee will be charged to each owner/applicant for each and every characteristic considered, even if the same characteristic had been previously considered for the same or different applicant.

b. The application fee will be established at One Thousand (\$1000.00) Dollars and will be due with the appropriate form when application is made to the Plant Board for consideration of production.

c. The application fee is non-refundable in the event the production application is denied or the application abandoned.

d. Fees will be charged for each applicable inspection that is required to comply with these regulations.

e. Inspection fees will be established at \$100.00 per visit. One re-inspection will be provided (for a specific visit) at no additional charge if the initial inspection detects conditions that result in an order to cease operations. Additional inspections that are required due to failure to correct unacceptable conditions will be assessed an inspection charge equal to the initial inspection fee for each and every visit made by the inspector. The frequency of these re-inspections will be determined by the Plant Board. The re-inspections will be scheduled to insure compliance with the regulations and permit conditions.

f. Any rice developed at Public Institutions and/or the research programs from those institutions shall not be subject to application fees as referenced in section (a) above but will adhere to all other items in these regulations.

6. Permits

a. **Production Permit** - Application for a production permit shall be made to the Plant Board sufficiently in advance (minimum of four (4) months) of the expected first planting to allow full evaluation by Plant Board staff and, if deemed appropriate by the Plant Board Director, by a Scientific Review Committee.

b. **Permit Application Form** - The appropriate form will be supplied by the Plant Board for making the application.

c. **Functional Permits** - Depending on the characteristic of economic impact, a determination may be made by the Plant Board Director that other functions, such as planting, harvesting, transporting, processing and storage, associated with the production of rice having the characteristic, may also need to be permitted. To accommodate this effort, the owner of the characteristic of economic impact should be prepared to identify all parties that are expected to handle any of the rice in any form or function.

d. **Fees for Functional Permits** - Functions that are deemed to present a risk of causing/allowing a cross contamination to occur and as a result necessitate inspections, may be required to pay a fee for securing the permit and for having the inspections made.

Restrictions specific to the characteristic of economic impact will be contained in the permit.

7. Violations

a. Failure to secure permit. Failure to secure a permit prior to engaging in activities to initiate any facet of the process of production of a crop, including but not limited to:

1. Marketing of planting seed
2. Movement of any viable seed containing a target characteristic into Arkansas
3. Movement of viable seed from storage to an area that might support production of the crop
4. Placement of a seed lot (bulk, bagged or tote) into any type storage facility in Arkansas
5. Planting (or placement of viable seed into contact with any substance that might support germination and growth of the resulting plants), will be considered a violation.

b. Non-adherence to any and all conditions of an issued permit, any of the published regulations and any section of the enabling legislation will be considered a violation.

c. Penalties for Violations. Penalties will be administered according to the provisions contained in § 2-15-208 of ACT 1238. The appended Penalty Matrix (Appendix A) outlines the violations and the

appropriate penalty for each of those violations. Each day of a continuing violation will be considered a separate violation.

d. **Level of Violation.** Violations may be judged to be of Major or Minor level for enforcement actions. The enforcement level classification will be determined by any of the following factors individually or in combination:

1. length of time violation occurred before permit was issued (30 days or more is major)
2. Nature of the characteristic involved
3. Economic consequences resulting from violation (impacts of more than \$1000.00 are major)
4. Number of entities impacted by violation (more than 3 would be major)
5. Quantity of previously approved rice impacted by the violation (more than 500 bushels would be major)
6. Other factors deemed appropriate by the State Plant Board Director.

8. 2011 Planting Seed Testing

All seed (including pre-commercial lots of seed, commonly known as breeder seed or parental lines of hybrids prior to production of Foundation Grade seed) used for any planting in 2011 shall undergo testing prior to April 1, 2011 for the purpose of identifying seed lots that contain variants of LLRice.

a. **Testing Labs.** All seed samples shall be submitted to a lab that has validated the 35S bar test.

b. **Sampling.** Any seed sample collected for the purpose of complying with these regulations must be “officially drawn” samples under supervision of Plant Board Inspectors or an employee of another state’s AOSCA member. The Plant Board (or cooperating state representative) shall be responsible for submitting the samples for testing, receiving and disbursing test results and maintaining the chain of custody of the samples throughout the sampling and testing process.

c. **Seed Source.** Any seed anticipated to be used for planting rice must be tested. Seed produced inside Arkansas as well as any seed produced in other states but entering Arkansas through a purchase must be sampled and tested. Purchased seed from other states that has undergone testing under the same protocol as outlined in these regulations and receiving a “not detected within the specified detection limits” and has documentation to present the results shall be exempt from additional testing. All lots of seed, be they bagged or in bulk, shall be subject to these regulations.

1. **Carryover Seed.** Any seed tested in a previous year in a manner compliant with these regulations, held in a sealed bag, is not required to undergo new GMO testing. Any seed, to be used for planting, held over in any container, structure or vessel that is open and/or would not prevent introduction of untested seed (such as but not limited to bins, tote bags, superbags, open barrels, grain trucks, grain wagons, or grain carts) must be re-sampled and undergo current year testing.

d. **Participation.** Entities having seed, saved from their own production, that is to be used for planting seed, are responsible for contacting the Plant Board and requesting having a sample collected for submission for testing.

e. **Testing.** The testing protocol (commonly referred to as the 35S bar test) shall be conducted by a lab that uses a validated protocol.

f. **Detection Level.** Testing shall be conducted to effect detection at the .01% level with a 95% confidence interval. Any sample that has a detection in any portion of the submitted sample shall be ruled as being positive or having a detection within the detection limits.

g. **Records Retention.** Sample submission forms, results reports and any other records developed in

carrying out this testing, shall be retained by the applicant (those entities owning and having the seed lot submitted for testing) and made available for review upon request by a authorized representative of the Arkansas State Plant Board.

h. Transfer of Seed. Copies of testing results for individual lots of seed shall be provided to anyone who purchases any portion of the tested lot. Results for all lots, of which any portion was purchased, shall be provided to the purchaser.

i. Authorized for Sale. Any lot of seed tested, utilizing proper protocols, that received a “not detected within the specified detection limits” result, shall be legal for sale.

j. Failed Seed. Any lot of seed that tests “detected within the specified detection limits” for LLRice shall immediately be removed from the seed market and must be moved through the grain marketing channels with proper identification as containing GMO characteristics or be destroyed.

k. Exemption. “Specialty” rice producers and millers who handle ONLY those rice varieties with characteristics, such as aromatic qualities, that do not enter the grain marketing channels may be exempt from these regulations under specific conditions (including but maybe not limited to):

1. Their seed source can be documented and verified.
2. Records that confirm the specialty rice will not enter the long grain market channels.

9. Rough Rice Testing.

Testing of rough rice produced from crops planted with seed subjected to the prescribed testing may be carried out in the normal course of commerce. All positive detections arising from that testing shall be forwarded to the Plant Board. Any and all records pertaining to post harvest rough rice testing by any entity, business or individual, shall be made available to the Plant Board upon request.

a. Upon notification of a positive test on post harvest rough rice, the Plant Board will immediately initiate an investigation to determine if the source of the LL Rice can be isolated.

b. Records relating to testing of planting seed will be reviewed and the testing lab will be contacted to confirm results in hand.

1. Any errors found in the testing and reporting on the planting seed will be subject to review by the Plant Board and consideration of assessment of civil penalties as outlined in the Enforcement Response Penalty Matrix.

2. The receiving facility, of the positive post harvest rough rice, will be asked to follow any USDA protocol for handling positive rough rice that insures proper disposition/usage of that lot of rough rice.

10. Random Testing.

The Plant Board may undertake random sampling of grain holding facilities (including but not limited to farm storage, seed bins or elevator grain bins) and in seed facilities to enforce the prohibition on planting seed with LL traits.

SECTION VIII. QUARANTINES

A. GYPSY MOTH QUARANTINE

Revoked December 9, 1983 after two (2) successive years of negative annual surveys.

B. IMPORTED FIRE ANT QUARANTINE

Whereas, it has been determined, and so declared, that a serious insect pest, the imported fire ant, (**Solenopsis saevissima richteri Forel**), is known to exist in Arkansas, and is known to be a serious pest of humans, crops, livestock, and wildlife.

Whereas, the fire ant may be disseminated by the transportation or movement of the following products or substances:

- a. Soil and unprocessed sand or gravel, separately or with other things
- b. Forest, field, or nursery-grown woody or herbaceous plants with soil attached
- c. Plants in pots or containers
- d. Grass sod
- e. Unmanufactured forest products such as stump wood or timbers if soil is attached
- f. Any product or substance which may hereafter be found capable of spreading the imported fire ant.

1. Movement of said products or substances from areas which are now or may hereafter be designated by the U.S. Department of Agriculture as imported fire ant regulated areas is prohibited except under regulations which have been or may hereafter be made by the U.S. Department of Agriculture.

2. Areas which are found infested or which are so situated as to be subject to infestation with the imported fire ant must be treated to eradicate it. In lieu of requiring the property to be treated by the owner, or at the owner's expense, the Board may elect to apply the treatment, in cooperation with USDA at no cost to the owners. Property owners will be notified when treatment is to begin through newspapers, radio, television, and by personal contact where feasible.

C. PEACH MOSAIC QUARANTINE

Revoked November 10, 1972, after eight (8) successive years of negative annual surveys.

D. PHONY PEACH DISEASE QUARANTINE

Standard State Quarantine Order No. 2, as Revised June 13, 1951

Effective on and after July 2, 1951

DISEASE: Phony Peach, a virus disease of peach and certain other stone fruits.

State & Counties Currently Affected by Phony Peach Disease

Alabama	Entire State
Florida	Entire State
Georgia	Entire State
Louisiana	Entire State
Mississippi	Entire State

Arkansas	Counties of Arkansas, Ashley, Bradley, Chicot, Columbia, Crittenden, Cross, Desha, Drew, Hempstead, Howard, Jefferson, Lafayette, Lee, Lincoln, Little River, Miller, Monroe, Nevada, Phillips, Pike, Poinsett, St. Francis, Sevier, Union, & Woodruff
Missouri	Dunklin
North Carolina	Counties of Anson, Cumberland, Gaston, Hoke, Polk, & Rutherford
South Carolina	Counties Aiken, Allendale, Bamberg, Barnwell, Cherokee, Chesterfield, Edgefield, Greenville, Lancaster, Laurens, Lexington, Marlboro, Orangeburg, Richland, Saluda, Spartanburg, Sumter, & York
Tennessee	Counties of Chester, Crockett, Dyer, Fayette, Hardeman, Hardin, Lake, Lauderdale, McNairy, Madison, & Weakley
Texas	Counties of Anderson, Bexar, Brazos, Camp, Cherokee, Freestone, Limestone, McLennan, Milam, Rusk, San Augustine, Smith & Upshur.

Regulated Products:

All peach, plum, apricot, nectarine, and almond nursery stock.

Conditions Governing Shipment:

Transportation by any means whatsoever of the regulated products from any regulated area either into, or within, or from the State of Arkansas, is permitted only when there is securely attached to the outside of each shipment a valid nursery inspection certificate issued by an authorized official of the state of origin and bearing the name and address of the consignor of the regulated articles contained therein.

Requirements for Certification:

Certificates or permits shall be issued only on the following conditions:

1. That each nursery in the phony peach infested areas producing the regulated products shall apply to the State quarantine official for approval of the proposed nursery-growing site on or before August 15 of each year
2. Selected nursery sites shall be at least 300 yards from wild or domesticated plum, 1/2 mile from phony-infested commercial orchards, and 1/2 mile from urban area
3. The one-half environs of the nursery site shall be inspected prior to October 1, and all phony trees found within such environs removed prior to November 1
4. All budding shall be restricted to the slip-bud method.

Removal of Areas from Regulations:

When satisfactory evidence has been presented that no phony peach disease has been found for a period of three years in any county or state affected by this quarantine, said county or state shall be removed from these regulations.

Shipment of Regulated Products for Scientific Purposes:

Regulations of this quarantine do not apply to shipments of regulated products to the United States Department of Agriculture or to other recognized institutions for scientific purposes except that a special permit must be secured for the entry into or movement within the State of Arkansas of such products.

E. PINK BOLLWORM QUARANTINE

For information concerning Pink Bollworm quarantine, request Circular 16.

F. SOUTHERN PINE BEETLE QUARANTINE

Revoked December 2, 1982.

G. SOYBEAN CYST NEMATODE QUARANTINE

Revoked December 4, 1981.

H. SWEET POTATO WEEVIL QUARANTINE

Adopted March 11, 1983 after proclamation of a State Emergency by Governor Bill Clinton. For information request a copy of the quarantine.

I. WHITE-FRINGED BEETLE QUARANTINE

Revoked June 30, 1975 at the same time the Federal quarantine was revoked.

J. GIBBERELLA FUJIKUROI (BAKANAE STRAINS) QUARANTINE

The Arkansas State Plant Board has found and determined and does hereby declare the fungus *Gibberella fujikuroi* (bakanae strains), causal agent of the rice disease **Bakanae**, commonly known as “foolish seedling disease”, a public nuisance, a pest and a menace to the rice industry.

The purpose of this quarantine is to prohibit introduction of the disease and its causal agent into rice production areas of Arkansas. The movement of *Gibberella fujikuroi* (bakanae strains) regulated articles from infested areas into Arkansas is hereby restricted.

Quarantine Implementation:

The Arkansas State Plant Board will implement the *Gibberella fujikuroi* (bakanae strains)/Bakanae or Foolish Seedling Disease of Rice-quarantine immediately upon adoption of the regulations. Regulatory action will be implemented at the discretion of the Board.

Definitions:

1. **Certificate** - A document issued or authorized by the Arkansas State Plant Board, or regulatory official of the state of origin, indicating that a regulated article is not contaminated with *Gibberella fujikuroi* (bakanae strains), or has been treated in such a manner as to eliminate the organism. Such articles may be moved to any destination.
2. **Compliance Agreement** - A written agreement between the Arkansas State Plant Board and any person engaged in growing, dealing in or moving regulated articles wherein the latter agrees to comply with conditions specified in the agreement to prevent the dissemination of *Gibberella fujikuroi* (bakanae strains).
3. **Exemptions** - Provisions contained in these Regulations which allow for modifications in conditions of movement of regulated articles from regulated areas under specified conditions.

4. **Farm Operator** - Person responsible for the production and sale of a rice crop on any individual farm.
5. **Infected** - Presence of the causal organism on or in seed or any plant part that may or may not sustain and support the living and reproduction of the organism.
6. **Infested** - Actually infested with the organism or so exposed to infestation that it would be reasonable to believe that an infestation exists.
7. **Inoculum** - Spores or any other part of the causal organism that might serve to cause the organism to survive and reproduce on any plant or plant part that it comes into contact with.
8. **Inspector** - Any authorized employee of the Arkansas State Plant Board, or any other person authorized by the Arkansas State Plant Board to enforce the provisions of these rules.
9. **Limited Permit** - A document issued or authorized by the Arkansas State Plant Board or a designated regulatory official to provide for the movement of regulated articles to restricted destination for limited handling, utilization or processing or for treatment.
10. **Mill Operator** - A person responsible for the operation of a manufacturing plant, and all facilities of that plant, involved in the processing, packaging or handling of rough rice and rice products.
11. **Milled Rice** - Rice that has been subjected to processing to produce products from rough rice.
12. **Milling Rice** - Rice that has been produced, handled, acquired and destined for processing through a mill.
13. **Person** - Any individual, corporation, company, society, association or other business entity.
14. **Regulated Area** - Any state or any portion of such state that is known to be infested with *Gibberella fujikuroi* (bakanae strains).
15. **Research Rice** - Any rice seed or rice plant parts that are to be used in a recognized research project conducted by a state or federal program under the supervision of a trained and credentialed professional staff that has in place proper safety programs to prevent the accidental release and/or spread of the disease.
16. **Rice Mill** - Any manufacturing plants and all associated facilities that are involved in processing rough rice to produce rice related products.
17. **Rice** - All parts of rice and wild rice plants of the genera *Oryza*.
18. **Rice Hulls** - The outer covering of the rice seed that usually is removed in the milling process.
19. **Rice Production Area** - Any area utilized in the growing of rice plants for production of the plant and/or subsequent seed for harvesting.
20. **Rice Products** - Any commodity or product that has been produced from any part of the rice plant and may contain parts of the original plant structure or they may be unrecognizable as having originated from the rice plant because of being subjected to additional processing.
21. **Rice Mill Waste** - Any trash or discarded material that was originally contained or in contact with rice plants, seed or other plant parts utilized in a milling process.
22. **Rough Rice** - Rice seed harvested, handled and transported in the same form it was in immediately following harvest and removal from the rice plant.

23. **Seed Assay** - Any test available to be applied to a sample, lot or other quantity of seed to determine the presence of *Gibberella fujikuroi* (bakanae strains).

24. **Seed Rice** - Seed removed from the rice plant and subjected to such processing as to make the seed suitable for use as planting material for subsequent rice crops. This processing may include but is not limited to cleaning, treating and bagging. Depending on the handling and products applied to this seed it may or may not be suitable for human consumption.

25. **Treatment** - Any process that may be applied to rice seed or other plant parts in an attempt to modify/or affect the presence of *Gibberella fujikuroi* (bakanae strains).

26. **Used Rice Equipment** - Any equipment previously used to harvest, strip, transport, destroy or process rice.

Regulated Articles:

The following are regulated under the provisions of this Section:

1. The causal agent, *Gibberella fujikuroi* (bakanae strains), in any living stage of development
2. Rice
3. Rough Rice
4. Seed Rice
5. Research Rice
6. Milling Rice
7. Rice Hulls
8. Rice Mill Waste
9. Used Rice Equipment
10. Any other products, articles or means of conveyance, not covered by subparagraphs (1) to (9) of this Rule, when determined by an inspector they present a hazard of spread of *Gibberella fujikuroi* (bakanae strains) and the person in possession thereof has been so notified.

Conditions Governing the Movement of Regulated Articles:

The following conditions govern the movement of regulated articles:

1. A certificate or limited permit is required to transport regulated articles from a regulated area into or through any rice production area.
2. A certificate or limited permit for movement of regulated articles may be obtained from the Arkansas State Plant Board or an authorized cooperator/collaborator agency.
3. A certificate or limited permit may be issued by an inspector if a regulated article:
 - a. Has originated in the non-infested area of this state or in a non-infested area of any other state and has not been exposed to infestation at any time; or
 - b. Has been treated to eliminate infestation; or
 - c. Has been subjected to a seed assay to determine if the causal agent is present and none is found; or
 - d. Has been grown, manufactured, stored or handled in such a manner that in the judgment of the inspector no infestation will be transmitted thereby.
4. Limited permits may be issued by an inspector to allow the movement of non-certified regulated articles for specified handling, utilization, processing or treatment in accordance with approved procedures, provided the inspector has determined that such movement will not result in the

spread of *Gibberella fujikuroi* (bakanae strains).

5. When certificates or limited permits are required, they shall be securely fastened to the regulated article or to the outside of the container in which the regulated article is being moved.

6. Any certificate or limited permit which has been issued or authorized may be withdrawn by the inspector if he determines that the holder thereof has not complied with any conditions for the use of such documents or with any conditions contained in a compliance agreement.

7. Persons requesting certification or a limited permit must request the services from an inspector(s) at least 48 hours before the services are needed. The regulated articles must be assembled at the place and manner in which the inspector designates outside the rice production area. The following information must be provided at the time the request is submitted:

- a. The quantity of the regulated article to be moved
- b. The location of the regulated article
- c. The names and addresses of the consignee and consignor
- d. The method of shipment
- e. The scheduled date of shipment.

Quarantine Area:

Any rice production area where *Gibberella fujikuroi* (bakanae strains) and/or Bakanae (Foolish Seedling Disease) have been confirmed to occur.

Inspection and Disposal:

An inspector is authorized to stop and inspect any regulated article moving into a rice production area. Any article found to be infested with *Gibberella fujikuroi* (bakanae strains) or having originated in an area where *Gibberella fujikuroi* (bakanae strains) is known to occur and not certified, shall be subject to treatment or confiscation and destruction, without compensation, as required by the Arkansas State Plant Board.

Compliance Agreement:

As a condition of issuance of certificates or limited permits for the movement of regulated articles, any person engaged in purchasing, assembling, exchanging, handling, processing, utilizing, treating or moving such articles may be required to sign a compliance agreement stipulating that he/she:

1. Maintain such safeguards against the establishment and spread of any infestation;
2. Comply with such conditions as to the maintenance of identity, handling and subsequent movement of such articles; and
3. Cleaning and treatment of means of conveyance and the containers used in the transportation of such articles as may be required by the inspector.

Any compliance agreement may be cancelled by the inspector who is supervising its enforcement whenever he finds, after notice and opportunity to present views has been accorded to the other party thereto, that such other party has failed to comply with the conditions of the agreement. Any compliance agreement may be cancelled when compliance is no longer required.

Violations and Penalties:

Any violation of these rules may be subject to civil penalties under the authority of the Arkansas Plant Act

of 1917, A.C. A. Section 2-16-203.

K. ARKANSAS THOUSAND CANKER DISEASE OF BLACK WALNUT QUARANTINE

Thousand Cankers Disease (TCD) is a disease complex involving the Walnut Twig Beetle (*Pityophthorus juglandis*) and a *Geosmithia* fungus. These organisms attack and eventually kill walnut trees. The disease has spread across the Western United States and poses a serious threat to the native black walnut trees of Arkansas. Black Walnut trees are prized for their edible nuts, valuable lumber, ornamental shade qualities, and as a vital component in the forest ecosystem. This quarantine is in place to keep the disease from spreading into Arkansas from infested areas.

The Thousand Cankers Disease Quarantine shall be effective on filing of the rule. The specific requirements of the quarantine are as follows:

1. Quarantine Areas:

Quarantined areas shall consist of the entire states of Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Tennessee, Utah, and Washington; and any other state or foreign country known to be infested.

2. Regulated Articles:

- a. all plants and plant parts of the genera *Juglans* including but not limited to nursery stock, budwood, scionwood, green lumber, and other material living, dead, cut or fallen, including logs, stumps, roots, branches, and composted and uncomposted chips.
- b. all life stages of the walnut twig beetle (*Pityophthorus juglandis*); all life stages of the *Geosmithia* fungus (*Geosmithia morbida*).
- c. firewood of any non-coniferous (hardwood) species.

3. Restrictions:

Except as otherwise provided herein, all commodities and articles covered are prohibited entry into or through Arkansas from areas under quarantine unless specifically listed as exempt (see list below); no person, firm, corporation or other entity shall import, plant, receive for delivery, or otherwise accept or bring into Arkansas any regulated articles from any Thousand Canker Disease of Black Walnut infested area designated by the Arkansas State Plant Board.

4. Commodities exempt from quarantine requirements:

- a. All nuts, nut meat and hulls of the genera *Juglans*.
- b. Milled lumber 100% bark-free, kiln-dried with squared edges.
- c. Finished walnut wood products without bark, including walnut furniture, instruments, and gun stocks.
- d. Nonviable, preserved specimens of the walnut twig beetle (*Pityophthorus juglandis*).

5. Penalties: Per existing penalty matrix in Circular 11.

The quarantine is effective until the Arkansas State Plant Board amends the quarantine or determines that the quarantine is no longer necessary.

ADDENDUM “A”

ENFORCEMENT RESPONSE PLAN

PENALTY MATRIX

NURSERY INSPECTION QUARANTINE SECTION		Other: A: License Review B: Probation C: Invalidation of License
ENFORCEMENT POLICY		
ARKANSAS ADMINISTRATIVE PROCEDURES ACT A.C.A. 25-15-201		Range of \$50.00 to \$1,000.00

- Minor Violation: A violative incident which does not involve human health, safety, or endanger the environment; or other incidents of non-compliance which do not create a competitive disadvantage for licensees in full compliance.
- Major Violation: A violative incident which affects human health, safety, or the environment; or other incidents of non-compliance which create a competitive disadvantage over licensees in full compliance; or a history of repetitive violative incidents.

VIOLATION	VIOLATION LEVEL	1ST Level of Enforcement	2ND Level of Enforcement	3RD Level of Enforcement	4TH Level of Enforcement
Failure to Secure a License or Permit Number	Minor	50 - 100	101 - 200	201 - 400	401 - 600
	Major	100 - 400	401 - 600	601 - 800	801 - 1000
	Other			A-B-C	C
Failure to Fulfill Contracts or Other Related replacements or adjustments	Minor	50 - 100	101 - 200	201 - 400	401 - 600
	Major	100 - 400	401 - 600	601 - 800	801 - 1000
	Other			A-B-C	C
Misrepresentation for the purpose of deceiving or defrauding	Minor	50 - 100	101 - 200	201 - 400	401 - 600
	Major	100 - 400	401 - 600	601 - 800	801 - 1000
	Other			A-B-C	C
Repeated sales of poor quality	Minor	50 - 100	101 - 200	201 - 400	401 - 600
	Major	100 - 400	401 - 600	601 - 800	801 - 1000
	Other			A-B-C	C

VIOLATION	VIOLATION LEVEL	1st Level of Enforcement	2nd Level of Enforcement	3rd Level of Enforcement	4th Level of Enforcement
Unable to produce required records	Minor	50 - 100	101 - 200	201 - 400	401 - 600
	Major	100 - 400	401 - 600	601 - 800	801 - 1000
	Other			A-B-C	C
Buying, digging, or possessing Ginseng out of season without proper documentation	Minor	50 - 100	101 - 200	201 - 400	401 - 600
	Major	100 - 400	401 - 600	601 - 800	801 - 1000
	Other			A-B-C	C
Shipped or moved regulated articles from a quarantine area without proper treatment or certificate	Minor	50 - 100	101 - 200	201 - 400	401 - 600
	Major	100 - 400	401 - 600	601 - 800	801 - 1000
	Other	Material will be returned to seller at seller's expense, or treated on site with a labeled and approved pesticide by a licensed Pest Control operator.	Material will be returned to seller at seller's expense, or treated on site with a labeled and approved pesticide by a licensed Pest Control operator.	Material will be returned to seller at seller's expense, or treated on site with a labeled and approved pesticide by a licensed Pest Control operator.	Material will be returned to seller at seller's expense, or treated on site with a labeled and approved pesticide by a licensed Pest Control operator.
Failure to label in accordance with the law and regulations	Minor	50 - 100	101 - 200	201 - 400	401 - 600
	Major	100 - 400	401 - 600	601 - 800	801 - 1000
	Other			A-B-C	C
Selling, transporting or disposing of in anyway, plants and nursery stock covered by a stop-sale notice	Minor	50 - 100	101 - 200	201 - 400	401 - 600
	Major	100 - 400	401 - 600	601 - 800	801 - 1000
	Other			A-B-C	C
Violating a compliance agreement	Minor	50 - 100	101 - 200	201 - 400	401 - 600
	Major	100 - 400	401 - 600	601 - 800	801 - 1000
	Other			A-B-C	C

ADDENDUM “B”
ENFORCEMENT RESPONSE PLAN
PENALTY MATRIX
CHENIERE RICE REGULATIONS

PENALTY MATRIX - Arkansas Rice Certification Act (Act 1238 of 2005), Cheniere Rice Regulations of 2006

Violation	Violation Level	1 st Level of Enforcement		2 nd Level of Enforcement		3 rd Level of Enforcement		4 th Level of Enforcement	
		Enforcement Action	Civil Penalty Fine	Enforcement Action	Civil Penalty Fine	Enforcement Action	Civil Penalty Fine	Enforcement Action	Civil Penalty Fine
1. Sells, offers for sale, plants, produces, harvests, stores, distributes, transports, or processes (conditions) for planting Cheniere or other Rice seed identified as having characteristics of commercial impact.	Minor*	A	\$30,000 - \$50,000 per unit per day violation continues		\$50,000 - \$75,000 per unit per day violation continues		\$75,000 - \$100,000 per unit per day violation continues		\$100,000 per unit per day violation continues
	Major*	A,B		A,B,C		A,B,C		A,B,C	
2. Transporting any rice seed identified as having characteristics of commercial impact across state lines.	Minor*	A	\$30,000 - \$50,000 per unit per day violation continues		\$50,000 - \$75,000 per unit per day violation continues		\$75,000 - \$100,000 per unit per day violation continues		\$100,000 per unit per day violation continues
	Major*	A,B		A,B,C		A,B,C		A,B,C	
3. Representing rice seeds/grain which is indistinguishable by seed characteristics to be a variety without characteristics of commercial impact, without having adequate information for such representation.	Minor*	A	\$30,000 - \$50,000 per unit per day violation continues		\$50,000 - \$75,000 per unit per day violation continues		\$75,000 - \$100,000 per unit per day violation continues		\$100,000 per unit per day violation continues
	Major*	A,B		A,B,C		A,B,C		A,B,C	
4. Failure to obtain required test data on planting rice seed sold, offered for sale or distributed within or into Arkansas.	Minor*		\$30,000 - \$50,000 per unit per day violation continues		\$50,000 - \$75,000 per unit per day violation continues		\$75,000 - \$100,000 per unit per day violation continues		\$100,000 per unit per day violation continues
	Major*	A,B		A,B,C		A,B,C		A,B,C	

*Minor or Major determined by: Nature of the characteristic involved

Number of entities impacted by violation (more than 3 would be major)

Economic consequences resulting from violation (impacts of more than \$1,000.00 are major)

Enforcement actions:

- A. Seizure, stop-sale, stop-movement
- B. Board/Committee Hearing
- C. Referral to Prosecuting Attorney

Other Factors deemed appropriate by the State Plant Board Director

Quantity of previously approved rice impacted by the violation (more than 500 bushels would be major)

Appendix E: Approved Species List- Aquaculture

Fisheries Division Policy Approved Aquaculture Species List October 1, 2002

Approved Species List

The intent of this list is to delineate species that pose minimal threat to Arkansas' aquatic biota. These species may be freely imported into the state, and traded within the state, for aquaculture purposes. This does NOT approve the release of any species into the public waters of the state.

Class Crustacea

Family Cambaridae

Procambarus acutus (White River Crayfish)

Procambarus clarkii (Red Swamp Crayfish)

Family Palaemonidae

**Macrobrachium rosenbergii* (Malaysian Prawn) – certified disease-free
(certification must be posted on-site)

Class Osteichthyes

Family Polyodontidae

Polyodon spathula (Paddlefish)

Family Lepisosteidae

Lepisosteus oculatus (Spotted Gar)

Lepisosteus osseus (Longnose Gar)

Lepisosteus platostomus (Shortnose Gar)

Family Amiidae

Amia calva (Bowfin)

Family Anguillidae

Anguilla rostrata (American Eel)

Family Clupeidae

Alosa chrysochloris (Skipjack Herring)

Dorosoma cepedianum (Gizzard Shad)

Dorosoma petenense (Threadfin Shad)

Family Salmonidae

* *Oncorhynchus clarki* (Cutthroat Trout)

* *Oncorhynchus mykiss* (Rainbow Trout)

* *Salmo trutta* (Brown Trout)

* *Salvelinus fontinalis* (Brook Trout)

* *Salvelinus namaycush* (Lake Trout)

Family Esocidae

Esox americanus (Grass Pickerel)

Esox niger (Chain Pickerel)

Family Cyprinidae

* *Carassius auratus* (Goldfish, including ornamentals)

* *Ctenopharyngodon idella* (Grass Carp)

* *Mylopharyngodon piceus* (Black Carp) – TRIPLOIDS ONLY

Cyprinella venusta (Blacktail Shiner)

* *Cyprinus carpio* (Common Carp, including koi)

Hybognathus nuchalis (Miss. Silvery Minnow)

Luxilus chrysocephalus (Striped Shiner)

Lythrurus umbratilis (Redfin Shiner)

- Notemigonus crysoleucas* (Golden Shiner)
Notropis atherinoides (Emerald Shiner)
Notropis boops (Bigeye Shiner)
Notropis buchmanii (Ghost Shiner)
Notropis volucellus (Mimic Shiner)
Opsopoeodus emiliae (Pugnose Minnow)
Pimephales notatus (Bluntnose Minnow)
Pimephales promelas (Fathead Minnow)
Pimephales vigilax (Bullhead Minnow)
Semotilus atromaculatus (Creek Chub)
- Family Catostomidae
- Erimyzon oblongus* (Creek Chubsucker)
Erimyzon sucetta (Lake Chubsucker)
Hypentelium nigricans (Northern Hogsucker)
Ictiobus bubalus (Smallmouth Buffalo)
Ictiobus cyprinellus (Bigmouth Buffalo)
Ictiobus niger (Black Buffalo)
Minytrema melanops (Spotted Sucker)
Moxostoma erythrurum (Golden Redhorse)
Catostomus commersoni (White Sucker)
- Family Ictaluridae
- Ictalurus furcatus* (Blue Catfish)
Ameiurus melas (Black Bullhead)
Ameiurus natalis (Yellow Bullhead)
Ameiurus nebulosus (Brown Bullhead)
Ictalurus punctatus (Channel Catfish)
Noturus gyrinus (Tadpole Madtom)
Noturus nocturnus (Freckled Madtom)
Pylodictis olivaris (Flathead Catfish)
- Family Aphredoderidae
- Aphredoderus sayanus* (Pirate Perch)
- Family Cyprinodontidae
- Fundulus notatus* (Blackstripe Topminnow)
Fundulus olivaceus (Blackspotted Topminnow)
- Family Poeciliidae
- Gambusia affinis* (Mosquitofish)
- Family Atherinidae
- Labidesthes sicculus* (Brook Silverside)
- Family Percichthyidae
- Morone chrysops* (White Bass)
Morone mississippiensis (Yellow Bass)
 * *Morone saxatilis* (Striped Bass)
- Family Centrarchidae
- Centrarchus macropterus* (Flier)
Lepomis cyanellus (Green Sunfish)
Lepomis gulosus (Warmouth)
Lepomis humilis (Orangespotted Sunfish)
Lepomis macrochirus (Bluegill)
Lepomis marginatus (Dollar Sunfish)
Lepomis megalotis (Longear Sunfish)
Lepomis microlophus (Redear Sunfish)

Lepomis punctatus (Spotted Sunfish)
Micropterus dolomieu (Smallmouth Bass)
Micropterus punctulatus (Spotted Bass)
Micropterus salmoides (Largemouth Bass)
Pomoxis annularis (White Crappie) – < 6 inches
Pomoxis nigromaculatus (Black Crappie)
Elassoma zonatum (Banded Pygmy Sunfish)

Family Percidae

Percina caprodes (Logperch)
Stizostedion canadense (Sauger)
Stizostedion vitreum (Walleye)

Family Sciaenidae

Aplodinotus grunniens (Freshwater Drum)

Family Cichlidae

* *Oreochromis aureus* (Blue Tilapia)
* *Oreochromis mossambicus* (Mozambique Tilapia)
* *Oreochromis niloticus* (Nile Tilapia)

Class Amphibia

Family Ranidae

Rana catesbeiana (Bullfrog)
Rana sphenoccephala (Southern Leopard Frog)

* Denotes nonnative species

Hybrids

It is our intent that production or sale of any hybrid is permissible if both parent species are included on the Approved Aquaculture Species List.

Wild Crayfish

The harvest and sale of native Arkansas crayfish species that naturally colonize aquaculture ponds and are cultured incidental to production of other aquaculture species is allowed.

Wild Turtles

The harvest and sale of native Arkansas turtle species that naturally colonize aquaculture ponds and are cultured incidental to production of other aquaculture species is allowed, unless the species is protected by other codes (see AGFC Code Section 39).

Aquarium Species

It is not the intent of this policy to constrain aquarium trade. Marine and tropical aquatic species commonly distributed in the aquarium trade may be sold without special permit, as long as they are held only in closed aquarium systems and are not prohibited by other codes (e.g. AGFC Code 32.13 CERTAIN EXOTIC FISH PROHIBITED).

Restricted Species

Some species are well established in Arkansas aquaculture but under criticism at regional and/or national levels. While we do not currently restrict the trade in these species, persons possessing or desiring to possess these species are requested to apply to AGFC for a Restricted Species Possession Permit. This permit will detail the location of their facilities, measures taken to eliminate the possibility of escape, and the numbers and species to be held (these numbers are best estimates and will only be updated when permit is renewed for the next year). The permitted culture of any restricted aquaculture species shall be

conducted in a responsible manner that minimizes the possibility of escape. Permitted aquaculturists are required to construct a barrier that prevents escape of juvenile and adult fishes from culture ponds. Pond drainpipes should be double screened prior to any pond drainage with at least one screen being of a mesh size small enough to prevent the passage of any permitted fish present in the pond. These and any other measures listed on the application to eliminate the possibility of escape will be considered the “best management practices” that the applicant agrees to implement. AGFC will maintain records of the number and location of these species in the state, and determine if sufficient precautions are taken to prevent escape into the waters of the state. AGFC will review applications based on the best information available to evaluate the potential for escape. If this potential is acceptably low, the Chief of Fisheries will grant a no-cost special holding permit for these species, renewable annually. In the event that restricted aquatic organisms are released or escape from a permitted facility into waters of the state, the permittee shall notify the Arkansas Game & Fish Commission (AGFC) immediately. The permittee shall not be responsible for unforeseen occurrences such as floods, lightning or sabotage. Facilities with ponds prone to flooding shall limit culture of Restricted Species to areas least likely to become inundated. Holders of Restricted Species Possession Permits are expected to assure that buyers of these species within Arkansas also have an approved permit. Failure to comply with permit terms or inability to show adequate measures of escape prevention may result in permit denial or revocation.

The species covered by these permits include the following:

Class Osteichthyes

Family Cyprinidae

Scardinius erythrophthalmus (European Rudd)

NOTE ***NOW LISTED AS INJURIOUS SPECIES:***

Diploid *Mylopharyngodon piceus* (Black Carp)

Hypophthalmichthys molitrix (Silver Carp)

Hypophthalmichthys nobilis (Bighead Carp)

The injurious wildlife listing means that under the Lacey Act it is illegal to import or to transport live bighead carp, including viable eggs or hybrids of the species, across state lines, except by permit for zoological, education, medical, or scientific purposes.

EXAMPLE #1: A producer maintains diploid black carp to produce triploid black carp for sale to catfish farmers to control snails in their ponds. The individual has previously applied for a Restricted Species Possession Permit for diploid black carp, documenting sufficient measures to prevent escape and been issued a no-cost permit. The individual may sell triploid black carp to his customers and may sell diploid black carp to other black carp producers after ensuring that they also have Restricted Species Possession Permits to possess diploid black carp.

EXAMPLE #2: A food fish producer purchases bighead carp, holds them in raceways for a few days, then ships them to an out-of-state fish market. The individual has previously applied for a Restricted Species Possession Permit for bighead carp, easily documenting sufficient measures to prevent escape (held in raceways with blocked egress) and been issued a no-cost permit. The individual is then able to purchase the fish, hold them, and ship them to other markets (assuming it is in compliance with regulations of the destination state).

Turtles

There exist businesses in Arkansas that specialize in the captive propagation of turtles. The turtle species listed below are native to Arkansas and may be cultured by those who obtain a Commercial Turtle Dealer/Breeder Permit from the Commission and report production by species (see AGFC Code Section 39).

Class Reptilia

Family Chelydridae

Chelydra serpentina (Common Snapping Turtle)

Family Emydidae

Chrysemys picta dorsalis (Southern Painted Turtle)

Deirochelys reticularia miaria (Western Chicken Turtle)

Graptemys geographica (Common Map Turtle)

Graptemys ouachitensis (Ouachita Map Turtle)

Graptemys pseudogeographica kohnii (Mississippi Map Turtle)

Pseudemys concinna (River Cooter)

Trachemys scripta elegans (Redeared Slider)

Family Kinosternidae

Kinosternon subrubrum hippocrepis (Mississippi Mud Turtle)

Sternotherus carinatus (Razorback Musk Turtle)

Sternotherus oderatus (Common Musk Turtle)

Family Trionychidae

Apolone spinifera (Spiny Softshell)

Trionyx muticus muticus (Midland Smooth Softshell)

Other Species Covered under Separate Permits

The following species are governed by separate code and have their own permit requirements. This policy does not seek to add any further permitting requirements for these species.

Class Reptilia

Family Alligatoridae

Alligator mississippiensis (American Alligator) – Federal Permit Required

Family Chelydridae

Macrolemys temminckii (Alligator Snapping Turtle) – AST Farmer/Dealer Permit Required

Permits to Culture Unlisted Species

Requests to import and culture species not listed in this policy will be evaluated on a case-by-case basis. The burden of proof will rest with the applicant to show that measures are in place to essentially prevent the possibility of escape, or that escapement will have no significant ecological impact (i.e. species can not survive in waters of Arkansas due to temperature, salinity, or other environmental factor). The permitted culture of any unlisted aquaculture species shall be conducted in a responsible manner that excludes the possibility of escape from culture ponds. Permitted aquaculturists are required to construct a barrier that prevents escape of juvenile and adult fishes from culture facilities. The applicant will also need to provide justification as to the need to import the species into the state and why species listed in this policy will not fill the need. In the event that unlisted aquatic organisms are released or escape from a permitted facility into waters of the state, the permittee shall notify the Arkansas Game & Fish Commission (AGFC) immediately.

EXAMPLE #1: A producer in southern Arkansas wishes to raise yellow perch. This species is not native to Arkansas and has begun to show up in reservoirs in the north part of the state. Since the habitat in the producer's area is hostile to yellow perch (water chemistry and summer temperatures), AGFC issues an Unlisted Aquaculture Species Permit.

EXAMPLE #2: A producer wants to grow Australian redclaw crayfish. This species is not native to Arkansas (or the US) but is found in comparable latitudes in Australia. The producer's plans are to

raise them inside in heated raceways and have no discharge. This is found to eliminate the chance of escape and AGFC issues an Unlisted Aquaculture Species Permit.

PERMIT PROCESSING PROCEDURES

Permit Renewal

Restricted Species Possession Permits and Unlisted Aquaculture Species Permits will be issued on an annual basis to correspond with expiration dates of Fish Farmer Permits. Arkansas Game and Fish Commission is responsible for providing renewal notices to permit holders six weeks in advance of permit expiration date. Existing permits will remain in effect past listed expiration date if a renewal application is pending.

Permit Review

Restricted Species Possession Permits and Unlisted Aquaculture Species Permits are granted at the approval of the Chief of Fisheries. The Chief of Fisheries will solicit input as needed in the review of individual applications.

Modification of Lists

Any individual may petition AGFC to add or remove species on the *Approved Aquaculture Species List* or the *Restricted Aquaculture Species List*. The petition must provide thorough documentation of why a species should or should not be included on a list. Petitions should address the biological threat of the species, including native range, habitats utilized, movement patterns, spawning requirements, reproductive rate, food habits, and temperature and water quality limitations. They should include documentation of any introductions or escapes outside the species native range. They should also evaluate the potential impacts to native species through predation, competition, disease transmission, and displacement. Petitions should include copies of all pertinent reference material.

Petitions to add or remove species on the *Approved Aquaculture Species List* or the *Restricted Aquaculture Species List* will be responded to by the Chief of Fisheries after consultation with an advisory board representing: Arkansas State Aquaculture Coordinator, Stuttgart National Aquaculture Research Center, Aquaculture / Fisheries Center at UAPB, U S Fish & Wildlife Service, Arkansas Natural Heritage Commission, and Arkansas Game and Fish Commission staff.

Appendix F: Example of Arkansas Outdoors Press Release

ARKANSAS OUTDOORS

June 6, 2007 - Keith Stephens (501) 223-6342, e-mail: kastephens@agfc.state.ar.us

Today's Topics:

Elk festival to feature on-site permit drawing - *Click here for photo-*

<http://www.agfc.com/news/arkansasoutdoors/arkansasoutdoors-current.aspx>

TAPT – the hunting community's newest status symbol - *Click here for photo-*

<http://www.agfc.com/news/arkansasoutdoors/arkansasoutdoors-current.aspx>

Holiday Island fishing pier dedicated - *Click here for photo-*

<http://www.agfc.com/news/arkansasoutdoors/arkansasoutdoors-current.aspx>

Camp Robinson produces new state record tilapia *Click here for photo-*

<http://www.agfc.com/news/arkansasoutdoors/arkansasoutdoors-current.aspx>

Arkansas Big Bass Bonanza set for June 22-24 - *Click here for photo-*

<http://www.agfc.com/news/arkansasoutdoors/arkansasoutdoors-current.aspx>

Bat-O-Rama is on tap at Devil's Den Park - *Click here for photo-*

<http://www.agfc.com/news/arkansasoutdoors/arkansasoutdoors-current.aspx>

Elk festival to feature on-site permit drawing

JASPER – It's June, so that must mean that Jasper and Newton County residents are full of activity preparing for their annual Buffalo River Elk Festival. The festival is scheduled to begin Friday, June 29, and continue through Saturday, June 30.

An added attraction for this year's hunt will be an on-site drawing for someone who makes application at the Elk Festival. Sign up, stick around and you may win a permit. For this permit, the lucky hunter must be present. Just like the other public land elk permits to be drawn, entrants must be an Arkansas resident.

The highlight of the festival is the Arkansas Game and Fish Commission drawing for elk hunting permits. Thousands of hopeful elk hunters applied for last year's hunting permits. The two-segment season will be held Sept. 24-28 and Dec. 3-7.

The drawings and most of the activities will be at the courthouse square in Jasper with a kids' fishing derby on the banks of the Little Buffalo River. There will also be a talent show, turkey shoot, Arkansas State Championship Elk Calling Contest, Miss Elk Festival Beauty Pageant and a Dutch oven cook-off sanctioned by the Arkansas Dutch Oven Society.

Successful elk hunting applicants will be able to take along non-hunting helpers, according to Mike Cartwright, elk program coordinator for the AGFC. "A hunter can hire a professional guide, but guides must have permits from the National Park Service if they guide on Buffalo National River land," Cartwright said. Hunters may also need an AGFC commercial guide license if they are charging for their services. The elk hunting permits will be issued for specific zones along and near the Buffalo River.

The Arkansas Game and Fish Commission and Rocky Mountain Elk Foundation will be present with several educational programs. For the hunting enthusiasts, drawings for elk permits will be held each hour starting at noon on Saturday.

The AGFC will be present with several educational programs. For the hunting enthusiasts, drawings for elk permits will be held each hour starting at noon on Saturday.

TAPT – the hunting community’s newest status symbol

LITTLE ROCK – Alligator hunting is coming to Arkansas this fall. Although twice as many alligator hunting permits as elk hunting permits will be issued, their rank as a bragging point should be just as high.

Officially, the alligator permits are called Temporary Alligator Possession Tags. Alligators are a federally managed species and must be registered with federal officials once they are harvested. The TAPT will confirm the hunter’s legal right to the alligator from the time of harvest until a federal Convention on International Trade in Endangered Species permit is issued.

Forty TAPTs will be available only to Arkansas residents and will be divided into three categories. Seventeen private land permits will be assigned directly to private land owners in Alligator Management Zones 1 and 3. Another eight at-large private land permits will be divided between Alligator Management Zones 1 and 3. At-large permits will be distributed by random draw to applicants with written permission to access private waters in the management zones and cannot be used on public waters.

Five public land permits in Alligator Management Zone 1 and 10 public land permits in Alligator Management Zone 3 also will be issued through a random draw. These permits are for designated public waters and can not be transferred to other public waters.

Hunting will take place only at night during the last two weekends in September. The season will begin one-half hour after sunset on Friday, Sept. 21, until one-half hour before sunrise on Monday, Sept. 24. The second season will begin one-half hour after sunset on Friday, Sept. 28, until one-half hour before sunrise on Monday, Oct. 1.

Alligators must be caught and subdued using a handheld snare or handheld harpoon before being dispatched with a shotgun or bang stick (a shotgun-like device used for sharks and similar hunting in saltwater areas). Alligators must be restrained before dispatching to prevent loss of the harvested animal in deep water. Allowing hunters to shoot or otherwise attempt to take an unrestrained alligator would likely result in the loss of many alligators without a successful harvest.

The alligator permit application period is underway and will end midnight June 29. Applicants must have a valid resident big-game license and must be 16 or older by June 29, 2007, to apply for a permit. Non-residents may participate only as assistants to the hunter. Each hunter will be allowed up to three assistants. Persons convicted of AGFC regulation violations totaling 12 or more points in the last three years are not eligible. Only one application may be submitted per person.

Successfully drawn applicants will be notified by mail. They will be required to pay \$35 for the permit and must attend a training workshop, where they will receive instructions for the hunt.

For more information on the alligator hunt, log on to www.agfc.com or visit any AGFC office. Applications may be made online or at any AGFC regional office.

Holiday Island fishing pier dedicated

HOLIDAY ISLAND – A portion of an old, outdated highway bridge at Holiday Island got a new lease on life recently. The Arkansas Game and Fish Commission used a portion of the decommissioned bridge to build fishing piers on Table Rock Lake in Carroll County.

A new bridge was built near the old structure. The older bridge had its center span removed which left two ends that worked ideally as piers for a handicapped accessible fishing spot.

The Holiday Island Improvement District asked the AGFC to consider utilizing the old bridge as a fishing pier. State Sen. Randy Laverty secured \$10,000 in state grants to help with the project. The project started earlier this year and was completed in March at a cost of just over \$29,000.

The Holiday Island Fun Fishermen also added brush and Christmas trees around the pier to help improve the fish habitat.

Camp Robinson produces new state record tilapia

LITTLE ROCK – It seems the Arkansas record for tilapia falls each year around as summer time rolls around. This time it's Jerry Tindall of Little Rock who caught a tilapia weighing 2 pounds, 10 ounces on May 31.

Tindall caught his prize on Lake Jewitt at Camp Robinson while bottom fishing with red worms. The fish was over 14 inches long. The old record was 2 pounds, 7 ounces caught by B. F. Glover of Guy on Win Meadow Lake.

The tilapia was verified by fisheries biologist Andrea Daniel and was weighed on certified scales at the Arkansas Game and Fish Commission Headquarters.

Tindall was fishing with friend Mary Mathis when he landed his prize. Tindall said that Mathis was the first to see the fish. "I tried to catch it one time and missed, so I tried again." When Tindall got the fish close to the edge of the water he told Mathis to "get the net"—he knew he had it.

Tilapia is a non-native fish to Arkansas, according to Andrea Daniel, an AGFC Fisheries Staff Biologist. Daniel said, "We routinely stock two lakes, Lower Lake Hogue and Mallard Lake, in spring or early summer. Tilapia are used as forage fish for bass and during the summer can reach a weight of one or two pounds."

"African panfish," as some people call them, were first introduced by the AGFC in Arkansas during spring 2001. These fish cannot survive when water temperatures drop below 45 degrees for a continued amount of time, and their immune system stops functioning at about 55 degrees.

During cold winter months these fish die-off and can be collected with a dip net. Lakes are restocked during the warmer spring months.

Tindall said, "Records are made to be broken and I am certain it won't last too long."

Arkansas Big Bass Bonanza set for June 22-24

LITTLE ROCK - Registration is open for the Arkansas Big Bass Bonanza, the country's largest amateur big bass tournament, which will be held on the Arkansas River for the eighth consecutive year, with this year's dates June 22-24.

Fishermen can register online at www.arkansasbigbass.com.

The angler who lands the largest fish in the three-day tournament will take home \$100,000, with other cash prizes available throughout the weekend. Approximately 3,000 fishermen are expected to compete in the event. Total prize money will be determined by the total number of registrants in the tournament. In 2006, tournament officials distributed nearly \$275,000 in total prizes.

The tournament begins at 6 a.m. on all three days, with the first hourly weigh-in at 8 a.m. and subsequent weigh-ins at the top of each hour until the final 1 p.m. weigh-in. Cash prizes will be awarded for the biggest fish in each pool each hour.

Big Bass Bonanza is sponsored by the Arkansas Hospitality Association, and the contest spans 300 miles of eligible fishing from Fort Smith to Dumas - the entire length of the Arkansas River within the state's borders.

The entry fee for each day of the tournament is \$80 until June 8, when the fee increases to \$90 per day.

Bat-O-Rama is on tap at Devil's Den Park

WEST FORK – Bat-O-Rama, an annual feature at Devil's Den State Park near West Fork and Winslow, is scheduled for Friday through Sunday, June 8-10.

Participants can take in a variety of programs, including a talk on bats by Michael Ray Taylor, a Henderson State University professor. Taylor has explored bat caves around the world. His program will start at 8:45 p.m. on Saturday.

There will be a program on building bat houses, and a crevice cave walk is scheduled Sunday night.

For more information, phone the park at (479) 761-3325.

Boating education class schedule

Click here for boating education information:

http://www.agfc.com/education/boater_education_details.html

Hunter education class schedule

Click here for hunter education information: <http://www.agfc.com/huntereducation/index.html>

What's open for hunting

Current and approaching seasons in Arkansas:

Squirrel:

Statewide – May 12-June 10 and Sept. 1-Feb. 29.

Raccoon Hunting:

Night only – July 1-Aug. 31.

Spotted Skunk, Weasel Hunting:

Closed.

Deer Archery:

Oct. 1-Feb. 29 statewide.

Deer Muzzleloader:

Oct. 13-21 and Dec. 15-17 for zones 1, 2, 3, 4A, 5A, 6, 7, 8, 10, 11, 13, 14 and 15.

Oct. 13-21 and Dec. 29-31 for zones 9, 12, 16, 16A and 17.

Closed in zones 4 and 5.

Deer Modern Gun:

Nov. 10-18 and Nov. 22-Dec. 2 for zones 1, 2, 3, 6, 7, 8, 10 and 11

Nov. 10-11 for zone 4.

Nov. 10-11 and Nov. 17-18 for zone 5.

Nov. 10-Dec. 9 for zones 4A, 5A, 13, 14 and 15.

Nov. 10-Dec. 16 for zones 9 and 12.

Nov. 10-Dec. 25 for zones 16, 16A and 17.

Christmas holiday modern gun deer hunt is Dec. 26-28 statewide

The special modern gun youth deer hunt is Nov. 3-4 statewide excluding certain WMAs where a modern gun or muzzleloader permit is required to hunt.

Bear Archery:

Oct. 1-Nov. 30 for zones 1 and 2 all other zones closed.

Bear Muzzleloader:

Oct. 13-21 for zones 1 and 2 all other zones closed.

Bear Modern Gun:

Nov. 5-30 for zones 1 and 2.

Dec. 8-16 for zone 5 but may close earlier if quota is reached.

Dec. 1-16 for zone 5A but may close earlier if quota is reached.

All other zones closed.

Special Youth Modern Gun Bear Hunt:

Nov. 3-4 for zones 1 and 2 all other zones closed.

Turkey Archery:

Oct. 1-Feb. 29 statewide.

Turkey Firearms:

Oct. 22-28 for zones 1, 2, 3, 6, 7 and 17.

All other zones closed.

Elk:

Sept. 24-28 for zones 1, 2, 3, 4, and A.

Dec. 3-7 for zones 1, 2, 3, 4 and A and the youth elk hunt for zone 3.

Dec. 3-5 for zone B.

Quail:

Nov. 1-Feb. 10 statewide.

Crow:

Sept 1-Feb. 17 Thursdays thru Mondays only statewide.

Furbearers:

Furbearer trapping Nov. 17-Feb. 17 excluding coyote, beaver, muskrat and nutria.

Coyote trapping Aug. 1-March 31.

Beaver, muskrat, nutria trapping Nov. 17-March 31.

Gray fox, mink, opossum, red fox, striped skunk hunting Sept. 1-Feb. 29.

Raccoon day or night hunting Sept. 1-March 31.

Raccoon night hunting July 1-Aug. 31.

Bobcat and coyote hunting Oct. 1-Feb. 29.

River otter hunting Nov. 17-Feb. 29.

Muskrat, nutria and beaver hunting Sept. 1-March 31.

Badger, spotted skunk and weasel hunting is closed.

Coming up in the outdoors

June 7 – Advanced catfishing clinic featuring Keith “Catfish” Sutton , AGFC Central Office Auditorium, 2 Natural Resources Dr. in Little Rock, 6-8 p.m. Free admission. Learn about the biology of catfish, proven techniques for fishing with kids as well as advanced techniques or catching more and bigger fish. For more information, call (501) 223-6377.

June 9 – Deer management advisory plan meeting, Harrison Comfort Inn, 6:30 p.m.

June 9 - Talkin' Outdoors at the Corner Café with Steve "Wildman" Wilson, 9 a.m. on KARK Channel 4. Topic of the show will be "Becoming and Outdoors Woman" with special guest Phyllis Speer.

June 11 – Deer management advisory plan meeting, Ozark Franklin County Fair Building, 6:30 p.m.

June 12 – Deer management advisory plan meeting, Mt. Ida High School Auditorium, 6:30 p.m.

June 14 - Deer management advisory plan meeting, Hope Fair Park Community Center, 6:30 p.m.

June 15 – Deer management advisory plan meeting, Camden Fairview High School Little Theater, 6:30 p.m.

June 16 - Dutch oven cooking seminar, War Eagle Mill east of Rogers, 9:30 a.m. Classes taught by experienced educators, the AGFC's Phyllis Speer and Luann Waters. The cost is \$30 and includes all materials and lunch. Classes are limited so call now to register at (479) 789-5343 or (866) 4-WarEagle.

June 16 – Deer management advisory plan meeting, UAM College of Technology at McGehee, 6:30 p.m.

June 16 - Michelle Short Scholarship Fund fishing tournament on Lake Dardanelle. The fund is a fully endowed, privately funded scholarship for full-time freshmen, entering the University of Central Arkansas women's softball program as walk-on players. For more information, contact Kevin Short at (501) 539-0597.

June 16 - Talkin' Outdoors at the Corner Café with Steve "Wildman" Wilson, 9 a.m. on KARK Channel 4. Topic of the show will be "Pass It On" with special guests Charles and Charlie Wilson.

June 18 – Deer management advisory plan meeting, Brinkley Convention Center, 6:30 p.m.

June 19 - The Arkansas Game and Fish Commission is hosting a meeting of the Arkansas Aquatic Nuisance Species Task Force at 9 a.m. at the Arkansas Cooperative Extension Service Building, Classroom 1, 2301 S. University, Little Rock, 72204 (501-671-2000). The task force will produce an aquatic species plan for the state. The focus of this meeting is the identification of aquatic nuisance species and the pathways by which they enter the state. The public is invited.

June 19 – Deer management advisory plan meeting, Jonesboro Old Hunting Church Building, 6:30 p.m.

June 21 – AGFC Commission monthly meeting, 2 Natural Resources Dr., Little Rock, 9 a.m.

June 21 – Deer management advisory plan meeting, UA Community College in Batesville, 6:30 p.m.

June 22 – Deer management advisory plan meeting, Ferndale 4-H Center, 6:30 p.m.

June 22-23 – Arkansas Youth Shooting Sports State Tournament, Remington Gun Club in Lonoke. The junior division will be held on June 22 with the senior division on June 23.

June 23 - Talkin' Outdoors at the Corner Café with Steve "Wildman" Wilson, 9 a.m. on KARK Channel 4. Topic of the show will be "All About Alligators" with special guest Kelly Irwin.

June 29-30 - Buffalo River Elk Festival in Jasper.

June 30 - Talkin' Outdoors at the Corner Café with Steve "Wildman" Wilson, 9 a.m. on KARK Channel 4. Topic of the show will be "Boating Safety" with special guest Bob Cushing.

July 7 - Talkin' Outdoors at the Corner Café with Steve "Wildman" Wilson, 9 a.m. on KARK Channel 4. Topic of the show will be "Butterflies" with special guest Lori Spencer.

July 14 - Talkin' Outdoors at the Corner Café with Steve "Wildman" Wilson, 9 a.m. on KARK Channel 4. Topic of the show will be "Zig Giggling for Trout" with special guest Richard Cross.
July 21 - Talkin' Outdoors at the Corner Café with Steve "Wildman" Wilson, 9 a.m. on KARK Channel 4. Topic of the show will be "What's New for You" with special guest Dale Gunter.

**For the latest in Arkansas Game and Fish Commission information go to www.agfc.com or call the
Wildlife Information Hotline, (800) 440-1477.**



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