Appendix A

Aquatic Invasive Species Programs and Activities: 50-State Summary

Methods

We inventoried AIS-related management actions in all 50 states to determine what information may be needed to allow AIS managers to consider and incorporate predicted global change impacts into their programs, . For each state we documented the status of AIS management plans, state programs and activities, climate change concerns, climate change actions, and research activities and needs. We reviewed publicly available documents, publications, and online materials. For further clarification, when appropriate, ELI discussed AIS programs, research needs, and management strategies with AIS managers, scientists, and decision-makers. Each state summary was sent to both state agency and EPA regional staff for review and comment in November and December of 2006. Comments were disposed and summaries were finalized in January 2007.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
ALABAMA

AIS Management Plan

Plan under development.

AIS Programs & Activities

- **Aquatic Plant Management Control Program, Alabama Department of Conservation & Natural Resources (DCNR) - Division of Wildlife and Freshwater Fisheries (DWFF) and U.S. Army Corps of Engineers - Mobile District.** The program conducts surveys to determine presence of aquatic nuisance plants and control for aquatic nuisance plants using herbicides.
- **Private Waters, Alabama DCNR - DWFF.** The program provides technical guidance to private pond owners for aquatic nuisance species removal.
- **Mobile Bay National Estuary Program, Alabama-Mississippi Rapid Assessment Team (AMRAT).** This program conducts a 3-5 day survey of all aquatic invasive species present in the coastal waters of Alabama and Mississippi to establish a baseline. It was launched in 2003 with 50 scientists surveying Mobile Bay and targets the Mississippi Sound and adjacent waters. The 2004 survey was conducted by more than 100 scientists from about 26 organizations and constituted the largest rapid assessment of living resources ever held in the Gulf of Mexico.

Climate Change Concerns

- A lack of a cold winters in recent years has allowed invasive plants and fish (e.g., Nile tilapia) to overwinter and move farther north than before, which may or may not be attributed to climate change.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- In determining where to undertake control work, the DCNR-DWFF looks for areas with significant impacts to fisheries, as well as detrimental impacts to boating access and angler usage.
- Identification of areas to survey is based on prior knowledge of areas with plant problems.

Research Needs

- More effective herbicides, with better long-term control.
- More information and an enhanced strategy for emergent control.
- Experts on non-native species to conducts surveys, as well as funds to secure their services.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT ALASKA

AIS Management Plan

Aquatic Nuisance Species Management Plan (2002). The plan, developed by the Alaska Department of Fish and Game, includes six management goals: (1) Coordinate all ANS Management Programs in Alaska and collaborate with regional, national, and international programs; (2) Prevent the introduction of new ANS into Alaska waters; (3) Detect, monitor, contain, reduce, or eradicate populations of ANS as quickly as possible with minimum environmental impact; (4) Educate the public and appropriate resource user groups about the importance of preventing ANS introductions and how the harmful impacts of ANS can be reduced; (5) Identify, develop, conduct, and disseminate research on ANS of concern in Alaska; and (6) Take appropriate steps to ensure that federal and state regulations promote the prevention and control of ANS. The plan includes actions for Atlantic salmon management, green crab management, as well as additional preventative projects.

Alaska also has a Statewide Invasive Pike Plan. This plan will be updated during fiscal year (FY) '07 or FY '08.

AIS Programs & Activities

- **Kenai Peninsula Cooperative Weed Management Area, Homer Soil and Water Conservation District (SWCD), Alaska SWCD, and Kenai SWCD.** The SWCDs have established an advisory board and listed priorities for the Weed Management Area.
- **Noxious and Invasive Plant Program, Upper Susitna SWCD.** This program targets the local airport to prevent the transport (airplanes, luggage, and shoes) and spread of Orange hawkweed. Other activities include herbicide application and volunteer weed pulling in cooperation with the University of Alaska-Fairbanks' Cooperative Extension Service.
- **Weed Ranking Program, Alaska Natural Heritage Program, University of Alaska, Anchorage – Environmental and Natural Resources Institute.** The Alaska Natural Heritage Program, in cooperation with other federal and state agencies, developed the Weed Ranking Project, which lists and ranks non-native plant species.
- **Alaska Exotic Plant Information Clearing House (AKEPIC) Mapping Project, Alaska Natural Heritage Program, University of Alaska, Anchorage – Environmental and Natural Resources Institute.** The Alaska Natural Heritage Program also partners with USDA Forest Service - State and Private Forestry, National Park Service, and the U.S. Geological Survey - Alaska Science Center on the AKEPIC. The AKEPIC draws much of its information from surveys, includes cooperative weed management areas, and a rapid response program.
- **Alaska Committee for Noxious and Invasive Plants Management, University of Alaska, Fairbanks – Cooperative Extension Service.** This committee was established in 2003 to encourage and work towards a coordinated statewide effort to prevent and manage invasive and noxious species. It also works to improve awareness on the problems associated with invasive species.
- **Alaska Invasive Species Working Group.** This group was formed in 2006 to work towards an all-taxa, statewide invasive species cooperative effort. Members include state, federal, non-governmental organizations, and Alaska Native organizations. The group is currently working on an Alaska Invasive Species Needs Assessment.
- **Northern Pike Education Program, Alaska Department of Fish and Game (ADFG) – Sport Fish Division.**
- **Kachemak Bay Research and Reserve Green Crab Community Monitoring Program, Prince William Sound Science Center, ADFG, National Oceanic and Atmospheric Administration, and local communities.** This program provides a protocol for school children to learn the biology of green crabs in order to do monitoring work.

Climate Change Concerns

- Alaska's ANS plan predicts an increase in invasive species as warmer temperatures allow overwintering. Species of concern include the mitten crab, yellow perch, and walleyed pike.
- The state is conducting a risk assessment study for mitten crab because climate change will most likely result in the arrival of this species.
- Although it has not yet occurred, temperatures have warmed to the point where shellfish could survive through the winter, resulting in a shellfish outbreak.

- State officials are also concerned with species moving from one part of the state to another due to climate changes.

Climate Change Actions

- Alaska's ANS Management Plan focuses on prevention and identification of the most prominent threats. It recognizes that the Southern areas with "warmer climate, more developed lands, more disturbed habitat, and better road access" are areas of particular concern. It identifies ports with high traffic as posing greater risk.
- The Weed Ranking Project provides a way to prioritize work. It ranks not only non-native species present in the state, but also species not currently found in the state, but likely to invade due to climate change. A "climate match" program loosely associates species with one of Alaska's ecosystems (maritime, boreal, or arctic) to address these concerns.

Research Activities & Information Used

- Regional Alaskan groups are monitoring for green crab and, where found, setting traps as a control method.
- Proposed mapping and inventorying of reed canary grass.
- Research on the effects of rats on the ecosystem through local projects and case studies, including examining the effects of rats on intertidal invertebrates and soil composition and testing rodenticides.
- State officials are inventorying all exotic plant species. This collection includes about 130 species, of which approximately 20 are expected to be a problem. Of these 20, only a few are found in riparian areas.
- Statewide northern pike management plan to be completed by end of 2006 by ADFG. Upper Susitna/Copper River Pike Surveys to determine how widespread pike are in the area.
- Ballast water-related research will be funded in FY07/08 by NOAA Sea Grant and administered by ADFG.
- Risk assessment for aquatic sea lice to be funded in FY07/08 by NOAA SeaGrant and administered by ADFG.
- Ongoing shore zone mapping research to characterize the physical and biological attributes of each section of the shoreline.
- Ranking the invasiveness of non-native animals and fish.

Research Needs

- Better and more control techniques for pike (ideally, a vertebrate-specific pesticide). Control options are limited to netting and a few chemicals.
- Development of aquaculture systems that will not allow salmon to escape.
- Knowledge about how quickly green crabs are entering the state. In general, this species moves slowly, but officials must learn more about its migration in order to determine the scope of any potential problems.
- Development of pheromones and trapping methods for green crabs. Research questions include: Is it possible to develop techniques to trap them out completely? What are the best techniques for managing them at a low level, with compounds that will attract them quickly into traps? Also, what is the ideal type of trap?
- A better understanding of the different ecological needs of green crabs according to their location.
- An understanding of how reed canary grass affects water quality.
- An understanding of pathways to prevent invasion of colonial tunicates.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
ARIZONA

AIS Management Plan

Plan under development. The development of an invasive species management plan has been recommended by an Arizona Invasive Species Council, which is chartered by Governor Napolitano and co-chaired by the Arizona Game and Fish Department and the Arizona Department of Agriculture. An aquatic nuisance species plan and communication strategy has been drafted and is awaiting finalization.

AIS Programs & Activities

- **Invasive Species Council, Arizona Game and Fish Department (AZGFD) and Arizona Department of Agriculture (AZDA).** The council conducts a "Stop Aquatic Hitchhikers Program" and works with 100th Meridian to inform watercraft operators/owners and marina operators to take proper precautions. The Council also conducts monitoring.
- **Giant Salvinia Removal on the Colorado River, U.S. Department of Agriculture (USDA), Arizona, and Colorado.** Research and development of USDA biocontrol using weevils (not yet implemented). Under a statewide policy, landowners are required to deal with infestations themselves—agencies do not partake in control activities. These efforts are coordinated through the Giant Salvinia Task Force.
- **Giant Salvinia Task Force, U.S. Bureau of Land Management, US Bureau of Reclamation, U.S. Fish and Wildlife Service, Arizona Game and Fish Department, Arizona Department of Agriculture (ADA), California Department of Fish and Game, California Department of Food and Agriculture, Palo Verde Irrigation District, and others.** One of 20 statewide weed management area groups, each is responsible for a particular region, where they implement control efforts. This particular task force has used intensive inventory, mechanical control, and herbicide application since 2001. Biological control (Salvinia weevils) was implemented in 2004 and has been followed by supplemental releases. An early detection/rapid response program is in place for other exotic plants (a rapid response was undertaken recently for water hyacinth). The Task Force works closely with the State Department (IBWC) and Mexico.
- **Hydrilla Eradication, ADA.** The ADA and land owners continue treatment of two isolated populations of hydrilla in the Phoenix and Tucson areas as part of the regular enforcement of the state's noxious weed laws.

Climate Change Concerns Reported by State Personnel

- It is generally accepted that climate has a relationship to the distribution of species, natural or introduced, and that the state needs to anticipate ecosystem changes as a result of changes in water temperature and environmental conditions.
- The State Wildlife Action Plan recognizes both climate change and invasive species as identified threats.
- As plant populations increase heavily during the summer, significantly warmer temperatures may generate more plant growth.

Climate Change Actions

- The "Stop Aquatic Hitchhikers Program" and the 100th Meridian inform watercraft operators/owners and marina operators to take proper precautions.

Research Activities & Information Used

- Animal and Plant Health Inspection Services (APHIS) has conducted a programmatic environmental assessment for the weevil.
- USDA has used research from the University of Arizona concerning new attempts at biological control, as well as methods currently used in other countries.
- U.S. FWS, U.S. Bureau of Reclamation, and AZGFD have sponsored preliminary investigations into genetic biological control.
- AZGFD and AZDA have conducted some monitoring.

Research Needs

- Develop effective control methods for crayfish. The University of Arizona is undertaking some research into crayfish life histories to identify vulnerabilities for control.
- Determine advantages and disadvantages of biological, mechanical, and chemical control options for hydrilla, salvinia, and other aquatic nuisance plants.
- Information on how to coordinate activities of multiple state agencies with overlapping jurisdiction.
- Research on the effectiveness of weevils for biocontrol, though this is hampered by a lack of funding.
- The Giant Salvinia Task Force is monitoring the spread and attempting to document efficacy.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
ARKANSAS

AIS Management Plan

Plan under development.

AIS Programs & Activities

- **Noxious Weed Programs (Purple Loosestrife, Giant Salvinia, and Water Hyacinth), Arkansas State Plant Board.** The board implements regulations pertaining to invasive species.
- **Hydrilla Control, State of Arkansas in cooperation with the U.S. Army Corps of Engineers.** At Lake Ouachita, officials are trying to reduce the infestation by providing grass carp as a biological control.
- **Arkansas River Study, Arkansas Game and Fish Commission.** Ongoing large river sampling of many species, including Asian carp.

Climate Change Concerns

- Officials believe that new invasive species will survive the winter and persist in the state. Species already established may be allowed to spread into northern areas.
- Invasive species may enter the state as a result of increased interstate commerce and boating.

Climate Change Actions

- The state recently enacted regulations targeting water hyacinth due to overwintering concerns.
- The state is beginning to formulate a state ANS plan, and will include measures that consider warming temperatures.
- Regulation of the aquaculture industry.

Research Activities & Information Used

- Purple loosestrife surveys.
- Giant salvinia surveys.
- Monitoring of zebra mussels, hydrilla, and Asian carp, as well as documentation of the occurrence and magnitude of the infestation.

Research Needs

- Information on the Asian carp, including its abundance, impacts, and pathways.
- Information on zebra mussels, including their impacts and pathways.
- Information about species that may potentially enter the state as a result of interstate commerce.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT CALIFORNIA

AIS Management Plan

Plan under development.

AIS Programs & Activities

- **Aquatic Pest Control Program, California Department of Boating and Waterways (CDBW).** This Program focuses on control of water hyacinth, *Caulerpa taxifolia*, and *Egeria densa*. The CDBW also uses annual hyperspectral aerial survey to monitor changes in infestations over time. The CDBW uses short and long term methods of water hyacinth control, involving chemical, mechanical and biological control measures. The department also works with the California Department of Fish and Game on *Caulerpa* eradication efforts in southern California under the direction of the Southern California Caulerpa Action Team. Officials are also trying to educate aquarium owners on *Caulerpa*. The *Egeria densa* Control Program for the Delta focuses mainly on herbicide control.
- **Hydrilla Eradication Program, CDFA Integrated Pest Control Branch.** The program conducts annual surveys and eradication efforts for hydrilla. Eradication consists of physical, biological, and chemical methods.

Climate Change Concerns

- Aquarium owners as vectors for *Caulerpa* spread.
- Increased interstate transport.

Climate Change Actions

- Using annual hyperspectral aerial survey to monitor changes in infestations over time.
- Educating aquarium owners about *Caulerpa*.
- Implementing prevention methods including quarantine regulations, inspection program to ensure compliance with quarantine regulations, and border inspection stations to screen incoming traffic.
- Working to detect invasive species using insect traps, manual inspections for exotic weed species, and/or surveys to determine size and boundaries of population.

Research Activities & Information Used

- Using annual hyperspectral aerial survey to monitor changes in infestations over time.
- Surveying annually for hydrilla.
- Monitoring invasions with insect traps and manual inspections.

Research Needs

- Additional research on the biology/DNA of *Caulerpa* and how it would adapt in Southern California, as well as research on eradication methods. Officials would also like to undertake greater surveillance.
- Additional outreach and public education regarding *Caulerpa*. Individuals (hobbyists) need to learn how to handle *Caulerpa* (it is important to teach people how to look out for it in the natural environment).

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
COLORADO

AIS Management Plan

No plan available.

AIS Programs & Activities

- **Aquatic Plants Management Program, Colorado Department of Agriculture (CDA).** The program operates several projects throughout the state. Work consists of some manual removal and chemical treatments. Presently, the focus is on the Rio Grande Watershed, upper part of Colorado River, North Platte River, San Miguel River, and the Republican River watershed. (The main coordinator for the San Miguel Project is The Nature Conservancy.) There are also control efforts under way for Siberian Elm, including mechanical removal, herbicide application, and cut stump treatment. There are plans to implement biological control for tamarisk as well.
- **Biocontrol of Tamarisk, CDA.** The Department's Insectary in Palisade, Colo., is the clearinghouse for the project. Officials are working in collaboration with USDA and Colorado State University to release beetles in Colorado, Wyoming, South Dakota, Montana, Oregon, Kansas and Idaho to control tamarisk. About 60,000 tamarisk leaf beetles have been released in seven states with additional releases planned. In August 2005, beetles were released at three Colorado sites: Adams, Mesa and Yuma Counties. In 2006, beetles were released at Dinosaur National Monument in Moffat County and several additional sites in Colorado and the West.
- **Aquatic Animal Management Program, Department of Natural Resources – Division of Wildlife (CDOW).** Major activities of the Division on aquatic invasive species include: (1) angler education; (2) hatchery maintenance; (3) activities to detect location of New Zealand mud snails (NZMS); and (4) participation in the Western Regional Panel of the Aquatic Nuisance Species Task Force. Colorado State Parks is cooperating with CDOW by providing them with GIS/GPS training, ANS mapping access/support and collaborating on various education projects, control methods and statewide planning efforts.
- **Eurasian Watermilfoil (EWM) activities, Colorado State Parks.** The Stewardship Section of Colorado State Parks is the central coordinator and GIS clearinghouse for EWM efforts in Colorado. The program is actively working towards several short and long term objectives that include coordination, mapping, data collection, grant writing, planning, early detection/rapid response, partnering with local universities on research, education campaigns, convening stakeholders, studying economic impacts, and implementation of boat washing stations.

Climate Change Concerns

- Species that can not overwinter in Colorado, such as giant salivinia or water hyacinth, may persist if climate changes occur and water temperatures increase. This depends on whether the water is hot or spring fed and the location of the species within the state.

Climate Change Actions

- Angler education program focuses on prevention through outreach, including posting angler alert signs at trout fishing locations and live fishing tackle stores.
- Hatchery maintenance program ensures that fish production units remain free of invasive species.

Research Activities & Information Used

- Involvement with the tamarisk biocontrol program. One of the first field sites used to test the biocontrol beetles in North America was located near Pueblo, Colorado. The CDA Insectary has been involved in the project for several years and received a permit to store up to one million beetles for use in biocontrol in 2005.
- Weed researchers are studying aquatic invasives, including the use of biocontrol. They are also collaborating with federal agencies such as U.S. Geological Survey.
- Maintaining records of the location of newly-discovered species in the inventory program.

Research Needs

(None reported—too numerous to note.)

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT CONNECTICUT

AIS Management Plan

Connecticut Aquatic Nuisance Species Management Plan. Connecticut's Department of Environmental Protection (DEP), Sea Grant College Program and Institute of Water Resources served as the lead agencies for the development of the plan, in coordination with a diverse array of agencies and organizations. The plan provides a statewide approach for prevention, detection, monitoring, control and management of existing and potential aquatic nuisance species. The plan has been approved by DEP and will be sent to the Federal Aquatic Nuisance Species Task Force for final approval. As of December 2006, Connecticut will be eligible to apply for U.S. Fish and Wildlife funds that may be used to establish an aquatic nuisance species program at DEP.

AIS Programs & Activities

- **Non-Native Invasive Plant Species Program, Connecticut Department of Environmental Protection (DEP).** The program conducts the following activities: (1) Rapid response and eradication of newly-introduced aquatic plants, including water chestnut (the DEP Fisheries Division and Wildlife Division and the Office of Long Island Sound are working with U.S. FWS to carry out eradication projects and surveys); Restoration of coastal habitats, including *Phragmites* control in saltwater tidal marshes; and implementation of a Rapid Response Plan for *Hydrilla verticillata* that was prepared by Wildlife Division staff.
- **Invasive Plant Council (IPC).** Established in 2003 under state law (CGS Sec. 22a-381), membership includes representatives from state agencies, universities, Invasive Plant Atlas of New England, non-profit conservation groups, and the Connecticut Nurseryman's Association. To date, a total of 81 non-native invasive plant species have been listed with prohibitions on importation, moving, sale, purchase, transplantation, cultivation or distribution. The IPC is currently working on obtaining funding to create a non-native invasive plant program that will focus on early detection, rapid response, education and prevention.
- **Wetlands Habitat and Mosquito Management (WHAMM) Program, DEP - Wildlife Division.** The control of *Phragmites australis* has been a major component of recent wetland restoration efforts. In the future, the Wildlife Division hopes to amend regulations to allow aerial application of herbicides for *Phragmites*, which would result in fewer chemicals applied to wetlands and reduce costs by 90%. The WHAMM Program also plans to research new alternative herbicides for *Phragmites* control.
- **Water Chestnut Harvesting Program, DEP - Fisheries Division and Wildlife Division, Office of Long Island Sound Programs, U.S. FWS - Connecticut River Coordinator's Office (Connecticut River Fisheries Program)**. The program conducts water chestnut management (surveys, removal, education) and monitoring for undiscovered water chestnut populations.
- **Lakes Management Program, DEP - Bureau of Water Management, Division of Planning and Standards.** The program conducts the following activities: dredging of Silver Lake in Meriden/Berlin to hinder growth of Eurasian watermilfoil; funding to control variable watermilfoil in Bashan Lake with 2-4D; spot-treatment of Eurasian watermilfoil with limited amounts of herbicides; inventory and vegetation surveys of aquatic invasive plants, including listing of management options; partnerships with communities to perform winter draw down, dredging, weed harvesting, and herbicide use.
- **Invasive Plant Atlas of New England (IPANE), New England Wildflower Society (NEWS), University of Connecticut, Silvio O. Conte National Fish and Wildlife Refuge.** The Invasive Plant Atlas of New England (IPANE)'s mission is to create a comprehensive web-accessible database of invasive and potentially invasive plants in New England that will be continually updated by a network of professionals and trained volunteers. The database will facilitate education and research that will lead to a greater understanding of invasive plant ecology and support informed conservation management. An important focus of the project is the early detection of, and rapid response to, new invasions.
- **Connecticut Sea Grant College Program, Sea Grant, University of Connecticut.** The program is: working with Connecticut and New York agencies and organizations to develop an ANS Management Plan for the Long Island Sound; working with DEP to develop a state aquatic nuisance species management plan; conducting outreach and education; participating on the Northeast Aquatic Nuisance Species regional panel; and supporting research on red alga (*Grateloupia turuturu*), colonial tunicate (*Didemnum sp*), baitworms and associated packing materials; and the economic impact of fouling organisms on marine aquaculture operations.

- **The Silvio O. Conte National Fish and Wildlife Refuge Invasive Plant Control Initiative.** The Refuge developed an Invasive Plant Control Initiative in response to the threat to natural diversity posed by invasive plant species. This initiative examines the problem of freshwater invasive plants from a regional perspective and identifies tasks that will enhance the capability within the region to address identified issues. Also, in cooperation with a number of partners, the Refuge used a grant from the National Fish and Wildlife Foundation to develop a strategic plan discussing the current invasive plant situation, outlining future actions for the Connecticut River Watershed and Long Island Sound, and recommending funding for high-priority invasive plant control projects in 1998. As part of the initiative, a partnership of federal, state, municipal, business and non-profit groups formed to control water chestnut, a recent invader to the watershed. Components of the strategy include mechanical harvesting of the source population and organizing volunteers to monitor water bodies for satellite populations within the watershed, and to hand-pull populations when found.
- **Research, Connecticut Agricultural Experiment Station (CAES).** CAES is researching control methods for nuisance aquatic plants, mapping their distribution and documenting the water conditions in which they are likely to occur. Studies are being conducted on control with herbicides and the effects of these products on nontarget plants. Water samples from treatment sites are being tested for herbicides to determine how concentrations change with time, where the herbicide may migrate, and what concentrations are necessary to achieve control with minimal impacts on desirable plants. Water from nearby wells is often tested to determine if aquatic herbicides can contaminate groundwater. Studies on the effectiveness of mechanical removal by methods including hydroraking and cutting are also in progress. Biological control strategies, including studies on the distribution and preferences of the milfoil weevil (*Euhrychiopsis lecontei*) and a search for plant pathogens, are underway. A continuing statewide surveillance and mapping program of aquatic vegetation began in 2004. From 2004-2006, 126 lakes, including small private ponds, have been surveyed using global positioning system technology and GIS. Reference plants are being obtained from each water body and are being cataloged at herbaria CAES and the University of Connecticut. Plant samples are also being frozen at -80 C for future molecular identification. Water chemistry and sediment data are being gathered from each lake to assess the preferences of nuisance plants and determine the potential for other lakes to become infested.

Climate Change Concerns

- Residents release water hyacinth and water lettuce from their water gardens into state waters. With a warming trend, these species could overwinter and set seed. There is no evidence of overwintering yet.
- If the growing season is longer, water chestnut could sprout earlier, persist longer into the fall, and produce more seeds. The plants produce seeds more than once, flowering through the summer and fall before they start decomposing. A warmer climate would make for a longer growing period. The plants might also grow faster with more light.
- Lists of potential "new invaders" need to be developed and updated as new information becomes available. ED/RR programs need to be developed and made operational for all taxonomic groups as the potential for new non-native invasive species may increase due to climatic changes.

Climate Change Actions

- Restoration of coastal habitats, e.g., *Phragmites* control in saltwater tidal marshes. This includes restoring tidal flows and reintroducing saltwater, which result in a gradual replacement of *Phragmites* by native vegetation.

Research Activities & Information Used

- *Phragmites* control methods include restoring tidal flows, mowing, herbicide application, and herbicide application with mowing, before selecting the herbicide glyphosate.

Research Needs

- For aquatic plants, need a better systematic survey of the location of aquatic species in the state, including in small private ponds, as well as trials on effective control methods for ANS.
- For water chestnut, need to better understand: germination of seeds based on temperature (whether a very cold winter would cause more seeds than usual to germinate at once in the following spring); salinity limits; and biological controls.
- Because correct identification of species is critically important to determining rapid response plans, there is need for the development and use of genetic markers that will allow positive identifications.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
DELAWARE

AIS Management Plan

No plan available. (The state's invasive species management plan includes small section on AIS, in addition to terrestrial species.)

AIS Programs & Activities

- **Survey and inventory of aquatic vegetation in Delaware ponds, Department of Natural Resources and Environmental Control (DNREC) – Division of Fish and Wildlife (DFW).** This program has two components: (1) control of aquatic nuisance species in public ponds, and (2) survey and mapping of aquatic vegetation in public ponds (invasive and rare species). Species surveyed and mapped range from open water species to the emergent shoreline vegetation. The department uses the maps to calculate the acreage figures, which can be used to document the species changes over time.
- **Delaware Landowner Incentive Program (DELIP), DNREC – DFW.** DELIP provides grant assistance to private landowners for habitat restoration, including invasive species control projects.
- ***Phragmites* Control Program, DNREC – DFW.** The program uses helicopter application of herbicides to control *Phragmites* in state wildlife areas and private lands (cost-share arrangement between landowners and the state).
- **Technical assistance to pond owners, DNREC – DFW.** The division provides assistance with invasive weed control, including recommendations on herbicides, manual control, or biocontrol and dissemination of best management practices such as riparian buffer strips and nutrient control.
- **Delaware Invasive Species Tracking System, Delaware Natural Heritage Program, Delaware Invasive Species Council, and U.S. Geological Survey – Leetown Science Center.** The system is a prototype for invasive species reporting and tracking. The goal is to develop an online tool for mapping and cataloging locations of invasive species in the state.
- **Wildlife Habitat Incentives Program, USDA Natural Resources Conservation Service and DNREC.** This is a cost share program for private landowners who control *Phragmites* on their property. The DNREC provides a share of the cost (30 percent) and conducts the spraying. The USDA and the landowner also provide shares of the cost (58 percent and 12 percent, respectively.
- **Delaware River Invasive Plant Partnership, States of Delaware, New Jersey, New York, and Pennsylvania.**

Climate Change Concerns

(None reported.)

Climate Change Actions

- DNREC surveys and maps species ranging from open water to emergent shoreline vegetation. The department uses maps to calculate the acreage figures, which can be used to document species changes over time.

Research Activities & Information Used

- The Delaware Invasive Species Tracking System is being developed as an online tool for mapping and cataloging locations of invasive species within the State of Delaware.
- DNREC conducts surveying and mapping of aquatic vegetation in the ponds (invasive and rare species).

Research Needs

- Map of areas with high populations of invasive species.
- Watershed approach in working with landowners in order to better prevent invasive species spread.
- A database of effective control methods for invasive species.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT FLORIDA

AIS Management Plan

Plan under development. (An online citizen's guide is available at http://www.dep.state.fl.us/lands/invaspec/2ndlevpgs/Aquaticplnts.htm).

AIS Programs & Activities

- **Aquatic Plant Management Program, Florida Department of Environmental Protection (FL DEP), Bureau of Invasive Plant Management.** The program designs, funds, coordinates, and contracts invasive non-native aquatic plant control efforts in Florida's 1.25 million acres of public waters.
- **Annual survey for new infestations, FL DEP.** Each year, 16 field biologists, each responsible for a particular region, conduct inventories in all 460 public waterbodies (containing most of the state's surface water).
- **Hydrilla maintenance control, FL DEP.**
- **Plant management services, FL DEP.** Regional biologists are available to provide plant management services such as consultation and guidance to private and public landowners or managers.
- **Aquatic invasive species control, South Florida Water Management District.** Activities include a weekly treatment schedule and water use restrictions for aquatic herbicides.
- **Maintenance, Southwest Florida Water Management District (SWFWMD).** Aquatic plants including invasive species are controlled to maintain the flow capacity of flood control systems.
- **Surface Water Improvement Program (SWIM), SWFWMD**. This restoration project is primarily geared towards preserving or restoring habitat and water quality. As part of restoring the natural hydrology of certain wetlands, the district plants a number of upland and aquatic native plants and also manages invasive plants in estuarine areas and lakes.
- **Mitigation Program, Florida Department of Transportation (FL DOT) and SWFWMD.** FL DOT funds a wetland mitigation program to compensate for road construction damage. The program involves preservation and restoration of native habitats, including invasive plant management and replanting of native vegetation.
- **Aquatic Plant Control (APC) Program, US. Army Corps- Jacksonville District.** This is a cost-share program with the state for control efforts in public water bodies.
- **Non-Native Fisheries Laboratory / Non-Native Fish Research Lab, Florida Fish and Wildlife Conservation Commission.**

Climate Change Concerns

- Climate change may cause more hurricanes, which decreases the likelihood for hydrilla to grow. Significant amounts of rain and floodwater hinder the growth of hydrilla due to resulting reduced sunlight.

Climate Change Actions

- An annual inventory may allow the state to observe and understand changes in invasive species populations over time.

Research Activities & Information Used

- The Non-Native Fish Research Lab is responsible for assessing the role of 32 exotic fishes with reproducing populations in Florida as of January 2003. These fish include the illegally introduced walking catfish and swamp eel from Southeast Asia, tilapia from Africa, the Mayan cichlid from Central America, and the legally introduced butterfly peacock from South America.

Research Needs

- Information to improve the efficacy of herbicides and timing of treatments.
- Further investigation of selectivity issues. The SWFWMD tries to be as selective as possible in targeting invasive plants and protecting/promoting the recovery of native plant communities by adjusting the timing of treatments, application rates, and treatment techniques to maximize treatment selectivity.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT GEORGIA

AIS Management Plan

Plan under development.

AIS Programs & Activities

- **AIS management activities, Georgia Department of Natural Resources (DNR) - Wildlife Resources Division, Fisheries Management.** The department responds to problematic invasive species with monitoring, containment, and removal. Giant salvinia, a primary problem, is being controlled with chemical treatments. Apple snail control and management includes surveys, destroying egg masses, and initiation of a apple snail task force in December 2005.
- **Rice eels management, DNR - Wildlife Resources Division, Fisheries Management; University of Georgia; U.S. Fish and Wildlife Service; and National Park Service.** Officials have been periodically surveying for the eel since its discovery in the late 1980s in artificial ponds at a nature center. The surveys in these ponds have occurred once a month since 2004. The next step will be to develop control recommendations.
- **Flathead catfish control program.** In 2006 the Georgia legislature allocated funding to control and manage invasive flathead catfish in Georgia. The increase in funding allowed for a fisheries biologist and two fisheries technicians to be hired to work on eradication and control methodologies.
- **Survey of lakes and reservoirs, Georgia Power (a regional utility) and DNR - Wildlife Resources Division, Fisheries Management.** Georgia Power surveys its lakes and reservoirs three to four times a year for aquatic invasive plants and applies spot treatments of herbicides when they are found. DNR assists with these activities.

Climate Change Concerns

- Climate change is a potential threat to apple snail control efforts. If climate change results in warmer temperature at higher latitudes, the snail may have the potential to expand its habitat.

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Interstate communication to prevent travel across borders with illegal exotic species.
- Access to taxonomists to correctly identify and learn about species.
- Official state program on invasive species that includes a systematic control approach and organized response.
- Development of better ways of communicating with the public about invasive species.
- More information about control and capture methods and the ecological impacts of invasive species.
- More herbicide options and ways to expedite the registration process for new herbicides.
- Investigation of human dimension of ANS introductions (i.e. intentional actions such as aquarium dumping, sticking or relocation and unintentional actions such as escapes of water garden species or use of invasives in landscaping and ornamental projects).
- Evaluation of the effectiveness of ANS outreach and education efforts as a means of modifying behavior (i.e. decreased releases and increased reporting).
- Evaluation of ecological and economic impacts of invasive non-native aquatic plant species in Georgia.
- Biological or alternative control methods for flathead catfish in south Georgia.
- Efficacy of containment, control or eradication activities for Asian swamp eels.
- Early detection and surveillance plans coupled with response protocols.

- Database and GIS system development with emphasis on interagency/interstate data sharing and user-friendly public access or report generation capabilities.
- Efficacy of channeled apple snail (CAS) control methods and techniques.
- CAS risk assessment and thermal and salinity tolerance studies.
- Tilapia risk assessment; temperature and salinity tolerance research pertaining to culture activities

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
HAWAII

AIS Management Plan

Aquatic Invasive Species Management Plan (2003). The plan was developed by the Hawaii Invasive Species Council (HISC) and the Department of Land and Natural Resources (DLNR) - Division of Aquatic Resources (DAR). The purpose of the plan is to develop a comprehensive statewide invasive species prevention and control program. Five working groups have been established under the HISC: (1) Interagency Working Group; (2) Working Group on Pests Not Present in Hawaii; (3) Working Group on Established Pests; (4) Resources Working Group; and (5) Public Outreach Working Group. The management plan highlights three incipient invasive species projects: (1) addressing alien algae in Oahu Harbor; (2) removing small isolated groups of mushroom anemone; and (3) eradicating snowflake coral on commercial piers in Kauai. Research and control activities are taking place through a partnership between The Nature Conservancy, the University of Hawaii, and DNLR to use a super sucker vacuum to remove algae biomasses in Kaneohe Bay (Oahu), to implement a vacuum technique and hand removal methods at Koloa Honokohau Historical Park to remove prickly seaweed, and develop a project to remove an invasive sponge from Kaneohe Bay (and other major harbors).

AIS Programs & Activities

- **Aquatic Invasive Species Response Team, DLNR– DAR.** The Team conducts the following activities (often in partnership with other agencies, universities, and organizations): surveys on Lake Wilson for *Salvinia molesta*; control of Gorilla Ogo Algae; snowflake coral control, *Actinodiscus sp.* control, mapping the distribution of invasive algae statewide; participating in hull fouling surveys of vessels traveling to the Northwest Hawaiian Islands Marine Sanctuary.
- **Coordinating Group for Alien Pest Species (CGAPS)**, **multi-agency partnership.** This coordinating body facilitates communication among agencies, conducts public outreach, and increases awareness through various media campaigns. A marine outreach specialist has coordinated eight public clean-up events to manually remove the invasive algae *Gracilaria salicornia* on Waikiki Beach.
- **Invasive Species Committees (ISCs) for island-based rapid response.** The ISCs are voluntary partnerships of private groups, government agencies, non-profit organizations, and concerned individuals working to protect each island from the negative impacts caused by invasive species. The overall goal of the ISCs is to prevent, eradicate or control priority incipient invasive plant and animal species that threaten Hawaii's most intact federal, state, and private conservation lands. ISCs are almost exclusively terrestrial based and are not involved in most AIS programs.
- **Plant Quarantine Branch, Department of Agriculture – Plant Industry Division.** This Division works with community groups who help to police the Central Oahu Lake by manually removing plants, or by spot spraying using Aquamaster.
- **Hawaiian Ecosystems at Risk (HEAR), Hawaii Cooperative Studies Unit (HCSU), U.S. Geological Survey (USGS).** This project provides internet technology, methods, and information to decision-makers, resource managers, and the general public to help support effective science-based management of harmful non-native species in Hawaii and the Pacific. Currently funded by the National Biological Information Infrastructure/Pacific Basin Information Node through USGS/Pacific Islands Ecosystem Research Center.
- **Aquatic Invasive Species Advisory Group.** Works with the DLNR/ DAR AIS Coordinator to help set priorities in AIS management. It is composed of members of federal, state and other organizations involved in AIS issues.

Climate Change Concerns

- Climate change is linked to the increase in mosquito populations (which have an aquatic life stage), which reduces the population of local forest birds.
- Increased levels of greenhouse gases may negatively impact corals. A recent study conducted by a coral reef biologist from the Hawaii Institute of Marine Biology found that coral does not produce as much calcium carbonate under increased levels of carbon dioxide.

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Implementation of effective quarantine methods for incoming organisms.
- Efficient detection methods for the newest invasive species.
- Better understanding of species range, including whether or ranges are expanding. Officials have GIS capabilities, but it is difficult to get people to update range maps and do the field work (staff shortage).
- Information about how to smother the mushroom anemone.
- Officials are developing a proposal for a literature review and research on effective control chemicals that will not harm coral reefs.
- Mechanisms to predict incoming invasive species.
- More information on control methods, including biocontrols.
- Technology on cleaning hulls easily and safely.
- Information and technology for the control of aquaculture releases (while the supersucker is being tested on algae, it is not practical for all areas, especially shallower reefs).
- Collection limits on sea urchins, as they are used to control invasive seaweed.
- Chemical control methods for apple snails, which escaped from aquaculture ponds and invaded taro wetlands. The use of copper is too damaging.
- More effective control methods for giant reed. Glyphosate is not effective enough. Arsenal is another option, but officials are unsure if it can be used in water. They need to know more about the non-target effects. Giant reed is harder to kill than many plants because of the depth of the root system. Another problem is locating existing populations. A developing method of thermal location would be very helpful, but it is still in the trial and error stage.
- Better techniques for surveillance and detection. Officials rely strongly on the general public to report unusual events. Hiking groups and fishermen report such events often, but without this information the state would have no way to know what is happening. There are not enough staff to carry out surveillance.
- Mechanisms to keep aquarium releases from occurring.
- *Salvinia molesta*, *Pistia*, and *Eichhornia* control and prevention.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
IDAHO

AIS Management Plan

Plan under development. (Idaho's Invasive Species Council is currently developing a state plan.)

AIS Programs & Activities

- **Noxious Weeds Program, Idaho State Department of Agriculture (ISDA) – Cooperative Weed Management Area.** A Cooperative Weed Management Area (CWMA) is a distinguishable hydrologic, vegetative, or geographic zone based upon geography, weed infestations, climatic or human-use patterns. CWMAs are formed when the landowners and land managers of a given area come together and agree to work cooperatively to control weeds. Idaho has 40 CWMAs, which are part of the ISDA cost-share program (the majority of the funding comes from federal sources). There are currently several cost-share participants that are working to deal with aquatic species in Idaho. The ISDA is responsible for administering the CWMA program in Idaho.
- **Eurasian Watermilfoil Control Program, ISDA.** In response to the continuing economic and environmental crises created by Eurasian watermilfoil in Idaho's waters, the Idaho State Legislature appropriated $4 million to the ISDA for eradication and control of the aquatic weed. The Legislature directed these funds to be expended over a two-year period beginning July 1, 2006, and ending June 30, 2008.
- **Invasive Species Council, Governor's Office.** The Idaho Invasive Species Council was established by a Governor's Executive Order in 2001. This Council is completing an inventory of Eurasian watermilfoil and conducting a public awareness campaign for boaters. The Invasive Species Coordinator is housed within ISDA.
- **Eurasian Watermilfoil Task Force, Invasive Species Council.** The Eurasian Watermilfoil Task Force was formed in 2002 to assist the Council in surveys and other Eurasian Watermilfoil activities. The major activities of the Task Force include: (1) physically surveying all waters in the state; (2) developing a survey for all counties to prioritize actions and activities based on susceptibility factors; (3) engaging in multiple research projects with the University of Idaho (including research on control technologies; and (4) researching different herbicide combinations and exploring the use of new products.
- **Purple Loosestrife Control Efforts, University of Idaho.** This effort uses biological control for purple loosestrife. Also, outreach programs both distribute insects (~40,000 distributed) and educate land managers on how to use them.

Climate Change Concerns

- There are some programs that have discussed climate change.
- In conducting the initial assessment for the Aquatic Invasive Species Action Plan, officials considered latitude, longitude, temperature bands, elevation, and rainfall.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Genetic analysis of *Myriophyllum* species and potential hybrids in Idaho.
- Physical surveys and mapping.
- Northern Idaho lake surveys to determine the densest areas of Eurasian watermilfoil. These are then targeted with appropriate control methods. The less-dense areas are targeted by divers using hand-pulling techniques (removal of plants by the roots followed by vacuuming).

Research Needs

- Information on biological control methods is needed. This may require visits to the country of origin to examine the species under consideration.
- Reliable and continual funding.
- Effective controls based on population size and the presence of other species.

- Information on the effects (economic and ecosystem-related) of specific aquatic invasive species.
- An effective herbicide with less environmental impact and that can be applied in smaller amounts (researchers are currently looking for this type of herbicide).
- Bottom barriers—researchers are assessing the duration of placement for effective control and the potential for growth of aquatic plants after sediments have settled on the barriers.
- Soil-mix company who will recycle the milfoil into a soil mix.
- Better ways and more state partners for educating the public about why it is important to control Eurasian watermilfoil. National or statewide database that would provide up-to-date information on current research being done for each invasive species would be helpful.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT ILLINOIS

AIS Management Plan

State Comprehensive Management Plan for Aquatic Nuisance Species (1999).

AIS Programs & Activities

- **Permanent Electric Dispersal Barrier, Illinois Department of Natural Resources (IDNR).** This barrier was initially designed to stop the round goby, but is now being used to target other fish such as the big head silver carp.
- **Evaluation of Barriers, IDNR - Illinois Natural History Survey (INHS).** This effort involves an evaluation of barriers to prevent the spread of bighead carp into the Great Lakes. Assessment of multiple barrier components, including sonic technology, bubble arrays, and hydro-acoustic generators. INHS is also conducting field monitoring for the potential impacts of steel-hulled barges on movement of fish across an electric barrier to prevent entry of invasive carp into Lake Michigan.
- **Field Assessment of Electric Barrier in Chicago Sanitary and Ship Canal, IDNR-Fisheries.** IDNR is conducting monitoring of the existing electric demonstration barrier, including stocking and subsequent monitoring of radio and acoustic tagged fish (common carp) near the electric dispersal barrier in order to determine if they can move back and forth across the barrier.
- **Early Detection/Rapid Response Planning, IDNR-Fisheries.** IDNR is developing rapid response strategies for control of Asian carp in various situations at critical control points and has educated their biologists and law enforcement officers on identifying various aquatic invasive species. If they find a species that is either new to the state or new to a particular waterway/area, they are to fill out a standardized form and report it. This option is also available for the public in northern Illinois to track the Asian carp. If a species is detected, IDNR follows up with a rapid assessment.
- **Bighead Carp Competition Studies, IDNR-INHS.** This effort involves field monitoring, including examining bighead carp competition with native filter feeding fish to assess the potential threat for Great Lakes fish (salmon and trout). IDNR is also examining bighead carp feeding on alewife and gizzard shad (food sources for salmon and trout).
- **Intensified Field Monitoring for Asian carp, IDNR-Fisheries.** This intensified field monitoring examines bighead and silver carp near Lockport and Brandon Road Pools at confluence of Des Plaines River.
- **Upper Illinois River habitat mapping, IDNR – INHS.** INHS is conducting field monitoring to evaluate Asian carp habitat.
- **Technical assistance for market development, IDNR-Fisheries and Illinois Department of Economic Opportunity (DCEO).** The harvest program provides technical assistance for required analytical data to establish markets for Asian carp. Illinois' DCEO has provided implementation costs for start-up and phase 1 of an intensified harvesting program.
- **Contaminant analysis for market development, IDNR - INHS and University of Illinois.** The effort provides additional contaminant analysis for market development.
- **Goby round-up/Carp Corral, a joint program with IDNR, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and the Metropolitan Water Reclamation District.** The program monitors the spread and expansion of round goby and bighead/silver carp populations in the Illinois River System toward Lake Michigan.
- **Eradication, IDNR.** IDNR conducts eradication of Eurasian milfoil using Chemical- 2-4 D and sonar. The agency is also experimenting with treatment timing and dosage for better long-term effects. A new project will target curly-leaved pondweed.
- **Permanent Electric Dispersal Barrier, IDNR.** An electric barrier has been implemented in the Chicago Sanitary and Ship Canal to deter the inter-basin transfer of invasive fish between the Great Lakes and Mississippi River. It will be operated and funded by the IDNR upon completion; in the interim, U.S. Army Corps of Engineers maintains management of the barrier.

Climate Change Concerns

- Climate change may have an indirect impact by allowing some species to expand into new ranges where they have not historically been found. If certain regions warm up (or cool down), they may be colonized by species that were only marginally adapted to the cooler (or warmer) temperatures.
- Illinois' ANS Plan includes vectors that are exacerbated by climate change: "As use of the Great Lakes intensified as a transport route for commerce, the rate of introduction of aquatic nuisance species also increased. More than one-third of the organisms have been introduced in the last 30 years, a surge coinciding with the opening of the St. Lawrence Seaway. Other human activities contributing to the transport and dispersal of aquatic nuisance species in the Great Lakes and inland state waters include the release of organisms from the ballast water of ships, transport and release from the bottoms of ships, movement or intentional release of aquaculture and sport fishery species along with their associated (free living and parasitic) organisms, release of organisms associated with pet industries or pest management practices, recreational boating, bait handling, water transport and ornamental and landscape practices." *See* Illinois State Comprehensive Management Plan for Aquatic Nuisance Species (1999).

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Research on Asian carp—IDNR needs a good understanding of their specific reproduction requirements, biomass and population estimates, preferred habitats, and the effects of competition with Great Lakes native fish. Officials would like to know how many invasive fish exist, their size, and where they are located, in order to better target them.
- Examination of the consistencies and inconsistencies between different state laws is needed. Many state laws are changing and, if the National Aquatic Invasive Species Act is passed, it will be important to know what the states are all doing in this area.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
INDIANA

AIS Management Plan

Indiana Aquatic Nuisance Species Management Plan (2004). The plan identifies feasible, cost-effective management practices and measures to be conducted by state and local programs over a five-year period to prevent and control aquatic nuisance species (ANS) infestations in a manner that is environmentally sound. Development of the plan was mandated by the state's Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 (P.L. 101-646). Universities, industries, non-governmental organizations, and citizens interested in aquatic nuisance species control contributed ideas toward development of the statewide plan. The ANS Task Force approved the plan on November 5, 2004, allowing for federal cost-share support for implementation of the plan.

AIS Programs & Activities

- **Early Detection & Rapid Response, Indiana Department of Natural Resources - Division of Fish and Wildlife (IDNR - DFW).** The Division is conducting treatment of Brazilian elodea in Griffy Lake, as well as a survey and development of an aquatic vegetation management plan. Whole-lake herbicide treatment began in 2006 and will continue in 2007. Access restrictions were implemented in the spring of 2006 to prevent the movement of Brazilian elodea to other waters. The Division is also conducting rapid response for hydrilla, first discovered in 2006 at Lake Manitou. Response included an herbicide treatment and access restrictions in the fall of 2006. Large scale aquatic herbicide treatments are planned for the spring of 2007.
- **Lake and River Enhancement Program, IDNR-DFW.** The Program provides grants to lake associations for the control of aquatic invasive plants.
- **Yellow Perch Research, IDNR-DFW and Ball State University.** Research examines the impacts of AIS such as zebra mussels and round goby on yellow perch and other native species in Lake Michigan.
- **Management of sport fisheries, IDNR – DFW.** The Division is responding to aquatic invasive species' threats to sport fisheries through the following actions: (1) eradicating fishery altogether; (2) stocking predators; and (3) manipulating habitat (e.g. lake drawdowns to reduce aquatic invasive fish and plants).
- **Emergent aquatic plant control, IDNR – Division of Nature Preserves.** The Division is controlling purple loosestrife, *Phragmites*, and reed canary grass on Indiana's nature preserves. A purple loosestrife biological control program has been implemented using beetles on Nature Preserve properties as well as other areas that contain large areas of purple loosestrife. *Phragmites* and reed canary grass have been sprayed with glyphosate-based herbicides, though the Division uses some plant specific herbicides for reed canary grass. The Division has also performed some herbicide control for the narrowleaf cattail and hybrid cattail, though there is some debate about whether narrowleaf cattail is native to North America.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Development of effective ballast water treatment technologies for the Great Lakes.
- Research on biocontrol for *Phragmites* or reed canary grass. There is an active research program to develop biocontrol for *Phragmites* at Cornell University, but more research should be devoted to developing herbicides that are highly selective for these plants to reduce damage to non-target wetland plants.
- Further investigation of biological controls for Eurasian watermilfoil, curlyleaf pondweed, hydrilla, and Brazilian elodea.
- Continued refinement of herbicides and timing of applications to reduce non-target plant damage.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
IOWA

AIS Management Plan

Plan for the Management of Aquatic Nuisance Species (ANS) in Iowa. Iowa's plan addresses prevention, management, control, public education, laws, and funding both for ANS already established in the state, as well as those with invasive potential. Species of primary concern are Eurasian water milfoil, Asian carp, purple loosestrife, and zebra mussels.

AIS Programs & Activities

- **Iowa Invasive Species Working Group.** This group of federal, state, county, and University staff hold regular meetings to discuss invasive species issues and plans.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- More information on zebra mussels, including a way to control them in the environment.
- More information on Asian carp, including control methods, biological information about the species, and documentation of their impacts.
- Information on aquatic invasive species not yet found in northern climates that are capable of surviving in colder climates or may expand their ranges due to climate changes.
- Faster rapid response systems and funding mechanisms to implement them.
- Increased public awareness about invasive species.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
KANSAS

AIS Management Plan

Kansas Aquatic Nuisance Species Management Plan (April 2005).

AIS Programs & Activities

- **Plant Protection and Weed Control Program, Kansas Department of Agriculture.** The agency has regulatory authority to deal with aquatic invasive weeds and conducts quarantines on purple loosestrife, tamarisk, and all federal noxious weeds, including the 19 aquatic species.
- **Aquatic Nuisance Species (ANS) Program, Kansas Department of Wildlife and Parks.** The program is designed to protect residents of Kansas and aquatic resources from the effects of ANS. The program focuses on preventing the accidental introduction of new ANS, limiting the spread of existing ANS, and controlling or eradicating ANS where environmentally and economically feasible. The intentional introduction of non-indigenous species for aquaculture, commercial, or recreational purposes are managed to insure that these beneficial introductions do not result in accidental ANS introductions. The program also seeks to improve information sharing among those agencies responsible for regulation of intentional introductions.

Climate Change Concerns

- New invasive species threats to Kansas' aquatic resources may emerge as a result of a shift in the climate.

Climate Change Actions

- State officials consider climate change by communicating with colleagues to the north and south about species that are moving into the state and comparing response activities.

Research Activities & Information Used

- Boater movement surveys.
- Risk assessments.
- Research on zebra mussels: movement via live-wells and bilges (veliger stage) and population dynamics.

Research Needs

- Research on the effects of AIS on water quality.
- Research on Asian tapeworm presence.
- Research on zebra mussel eradication techniques.
- Identification of AIS vectors and exclusion techniques.
- Research on effective public outreach tools and rapid response.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT KENTUCKY

AIS Management Plan

Plan under development.

AIS Programs & Activities

- **Integrated Roadside Vegetation Management (IRVM) Program, Kentucky Department of Highway - Roadside Branch.** The program controls noxious weed species along highway rights-of-way through herbicides and mowing. Fertilization is also conducted to encourage rapid root growth of other plants.
- **Control Program, Kentucky State Nature Preserves Commission (KSNPC), The Nature Conservancy and Northern Kentucky University.** KNSPC works to systematically control and contain invasive plants on the nature preserve system statewide. Control mechanisms include cutting and removal, as well as herbicide applications. Fire is also being tested as a tool to control the plants.
- **Control Program, University of Kentucky/Lexington-Fayette Urban County Government (grant funds from the Columbus Advisory Board).** The program removes invasive plants from Arboretum Park.
- **Control Program, Kentucky Department of Fish and Wildlife Resources (KDFWR).** The Department controls populations of big head and silver carp by allowing a commercial fisherman to harvest the fish.
- **Monitoring and research program, KDFWR.** The Department is conducting research on cormorants to understand how they live, what they eat, and the impacts they have on habitats.
- **University of Kentucky Invasive Species Initiative.** The program, initiated in 2006, is using an interdisciplinary approach to monitor, model, prevent, mitigate, and eradicate aquatic and terrestrial invasive species in Kentucky.
- **Tracy Farmer Center for the Environment at University of Kentucky.** Using a hands-on approach, this youth outreach program teaches students about invasive species. They work to incorporate invasive species awareness into secondary school science curriculums across the state.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Research on how to limit fish populations, including bighead and silver carp.

Research Needs

- More information on the commercial value/uses of big head and silver carp. Because fishermen only receive 10-20 cents per pound of fish, it is not profitable to sell the meat. More research on other uses for the species, including cat food and oil would be useful.
- General research on the Cormorant.
- Development of a Kentucky aquatic biodiversity database to track distribution of aquatic organisms (native and invasive) across the state.
- Assessment of AIS impacts on endangered and threatened flora and fauna (especially mussels) and on fisheries.
- Assessment of potential biological controls on native flora and fauna.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
LOUISIANA

AIS Management Plan

State Management Plan for Aquatic Invasive Species in Louisiana (completed in July 2005, adopted by the ANSTF in May 2006).

AIS Programs & Activities

- **The Louisiana Aquatic Invasive Species Task Force, chaired by the Louisiana Department of Wildlife and Fisheries (LDWF) and composed of state and federal agencies, stakeholders, and industry groups.** The Task Force completed a draft aquatic invasive species plan in 2005 and advises the Louisiana Aquatic Invasive Species Council, a permanent working partnership charged with implementation of the state AIS management plan.
- **Aquatic Plant Control Fund.** The fund was created by the state legislature for the control of nuisance aquatic vegetation. At present, the fund is derived solely from an increase in boat trailer registration fees.
- **Aquatic Plant Management Program, LDWF.** This program maintains boating and fishing access through herbicide applications to nuisance aquatic vegetation.
- **Aquatic Animals Management Program LDWF.** LDWF has posted a bounty on the tails of nutria. The goal is to obtain 600,000 tails per year. The department is also monitoring to see if marshes are recovering.
- **Outreach activities, conducted by many organizations that use some state funds in addition to other funds, including Louisiana Sea Grant College Program, Barataria-Terrebonne Estuary Program, and The Nature Conservancy, among others.** Outreach is focused on target audiences (i.e. recreational fishers, water gardeners, and aquaculture groups) and elementary school children.

Climate Change Concerns

- Climate change will make conditions more suitable for some species and less suitable for other species.
- Land being lost to rising sea levels in the state.

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Satellite technology to determine the location of invasive species.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
MAINE

AIS Management Plan

State of Maine Action Plan For Managing Invasive Aquatic Species: A Report to the Land and Water Resources Council From the Interagency Task Force On Invasive Aquatic Plants and Nuisance Species (October 10, 2002).

AIS Programs & Activities

- **Invasive Aquatic Plant Prevention Program, Maine Department of Environmental Protection (MDEP).** This program inspects watercraft, trailers, and outboard motors at or near the state borders and at boat launching sites for the presence of invasive aquatic plants. The program also provides educational materials to the public and to watercraft owners on invasive aquatic plants and funds control work by some private lake associations. The Department is also conducting plant control work on three small lakes (one with populations of Eurasian water milfoil, one with hydrilla, and one with curly-leaved pondweed) to try to prevent the spread of these plants to other water bodies. Finally, the agency is also undertaking plant removal on lakes with variable milfoil located close to boat ramps in order to reduce spread.
- **Invasive Aquatic Plant Prevention Program, Maine Department of Inland Fisheries & Wildlife (MDIFW)**. MDIFW has a warden service to patrol waters and roads and enforce violations like launching a boat or transporting a vehicle on public roads with plants attached.
- **Lake and River Protection Sticker, MDEP and MDIFW.** As of 2002, all motorized watercraft on inland waters in Maine are required to display the Lake and River Protection Sticker ("Preserve Maine Waters"). No sticker is required for operating a boat in tidal waters. Motorized watercraft includes any boat with any type of motor, including canoes with electric motors and personal watercraft. Dedicated funds raised through this program are used to support Maine's prevention and early detection/rapid response efforts. The state raises approximately $1 million a year through this program.
- **Courtesy Boat Inspection Program, MDEP.** The program involves voluntary boat inspections, focusing on boat ramp inspections in particular. Last year, there were 30,000 inspections (10,000 more than in 2003).
- **Early Detection - Invasive Plant Patrol Program, MDEP.** MDEP contracts with the Volunteer Lake Monitoring Program (VLMP), which, through the Maine Center for Invasive Aquatic Plants (MCIAP), conducts training programs for volunteers, state agency personnel, professionals, teachers, students and others. Since the program began in 2001, nearly 1,400 individuals have been trained. The basic workshop teaches participants how to recognize the invasive plants on Maine's "eleven most unwanted" list and how to distinguish these invaders from the native species they resemble. A variety of advanced training opportunities are also offered. The number of Maine waterbodies being screened for the presence of invasive aquatic plants has increased several hundredfold since MCIAP began its training effort. Surveys conducted by volunteers now account for more than half of all surveys being conducted in the state. Maine inspects watercraft, trailers, and outboard motors and provides educational materials to the public. In order to decide which ramps to target, MDEP conducts a rough risk assessment to determine which ramps are used most often. The Department uses paid inspectors for the high-use hours, to keep any invasive plants from spreading. Officials have completed a vulnerability assessment (remotely, using GIS) to assist the analysis, examining the distance from infested waterbodies to highways and whether they are hydrologically connected to other waterbodies.
- **Draft Rapid Response Plan, MDEP and MDIFW.** The Commissioners of the MDEP and the MDIFW have agreed to direct their respective agencies' response to new infestations of invasive aquatic species under the auspices of a single, coordinated rapid response plan. Species covered by the 172-page plan include invasive plants and fish already in some Maine waters and other exotic organisms not yet established in Maine such as zebra mussels.
- **Integrated Pest Management Strategy (for purple loosestrife), Maine Department of Agriculture.** This program works to avoid water drawdown and site disturbance during the growing season to avoid exposing mudflats where seeds can germinate. The program surveys all wetlands at least every three years to pinpoint infestations and every year, stems at "active" wetland sites are sprayed with the herbicide glyphosate and counted at selected sampling sites. Park authorities are beginning to work with landowners on sites adjacent to park boundaries to enact similar preventative strategies.

Climate Change Concerns

- Aquatic Invasive Species Management Plan states that "with global climate change, [AIS] may spread even further as freshwater and ocean temperatures moderate."

Climate Change Actions

- The AIS Management Plan has a category entitled "No Action at This Time," which emphasizes the need to "[l]earn more before acting" (p. 14). The category lists climate change as an issue. Specifically, the plan states that "Maine's cold climate and ocean temperatures now limit warm water species. But warming temperatures and fluctuating weather patterns may in time be more favorable to their introduction. At the same time, changing conditions may become less favorable for coldwater species, thus contributing to an overall shift toward warm water assemblages. Taking the long view, Maine will monitor climatic conditions to provide early warning of potential infestations."

Research Activities & Information Used

- A two-year research project studying the relative effectiveness of various manual methods for controlling variable water milfoil, as well as the viability of variable milfoil fragments under various conditions, has recently been completed. This research will be continued in the future and will focus on the impacts of variable water milfoil on native ecosystems.
- Professor Dan Buckley, University of Maine at Farmington, routinely involves his students in invasive aquatic plant surveys, assessments, and mapping projects in Maine, as well as research on fragment regeneration.

Research Needs

- Research to find a native organism that can function as a safe, effective biological control for variable water milfoil.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT MARYLAND

AIS Management Plan

No plan available.

AIS Programs & Activities

- **Maryland Marsh Restoration/Nutria Project Partnership, led by Maryland Department of Natural Resources (MDNR) and U.S. Fish and Wildlife Service in partnership with 24 additional federal, state, and private organizations.** The project involves behavioral/population research, reproductive research, testing of trapping methods, population control strategies, and marsh restoration.
- **Mute Swan Management, MDNR – Wildlife and Heritage Service.** MDNR manages the mute swan population through: (1) public outreach and education; (2) population management and resource protection (e.g., reducing recruitment by egg oiling, humane removal of adult swans, establishment of Swan-Free Areas); (3) regulating the possession of mute swans; (4) relief of human safety and nuisance conflicts; and (5) population monitoring and research.
- **Zebra Mussel Prevention, MDNR.** This program educates boaters and divers about zebra mussels. The goal is to prevent mussels from becoming established in the state.
- **Water Chestnut Harvesting, MDNR – Division of Tidewater Ecosystem Assessment.** Water chestnut, recently rediscovered in the Upper Chesapeake Bay, is pulled by hand by officials during Submerged Aquatic Vegetation surveys.
- **Snakehead Prevention, MDNR – Fisheries Service.** The service seeks to prevent the spread of snakeheads by conducting the following activities: circulating posters that ask anglers to kill and report all snakeheads; compile regional data (database is maintained by VDGIF) for captures in the Potomoc River (these include MDNR, VDGIF, USFWS and public captures); and annual monitoring that includes seine, electrofishing, and gillnet surveys.
- **Snakehead Control and Management Plan, U.S. Fish and Wildlife Service.** The creation of the Snakehead Control and Management Plan is a collaborative effort among industry, non-governmental organizations (NGOs), state and federal agencies, and citizens. The goal is to create a management plan that identifies action items to guide agency activities and funding priorities, in addition to goals for industry, citizens, and NGOs. The plan will focus on control priorities for the Potomac/Northeast U.S. region, as well as general prevention, early detection/rapid response, research and outreach/education priorities in other regions the snakehead could potentially invade.
- **Purple Loosestrife Control, MDNR.** State biologists will pull purple loosestrife out by hand if encountered in the field. The state has also used biological controls for several years.
- **Cooperative Giant Hogweed Eradication, MDNR and Maryland Department of Agriculture (MDA).** MDNR works to eradicate giant hogweed by using a combination of hand-pulling, herbicide application, burning, and bagging techniques each summer.
- **Plant Pest Survey and Detection, MDA, Plant Protection & Weed Management Section.**
- ***Phragmites* Control Cost-Share Program, MDNR and private citizens.** This program supplies private landowners with herbicides for *Phragmites* control, and private landowners incur remaining costs. MDNR or MDA can apply the herbicides and bill landowners, or the landowner can use a private applicator.
- **Aquatic Weed Control with Herbicides, MDA – Plant Protection and Weed Management Section.** MDA staff consider timing, permitting, organism's effect on ecosystem, expense and level of effort required for control in deciding which herbicides to use and when to use them.

Climate Change Concerns

- Climate change may affect the nutria problem.
- A rise in sea level may place additional stress on marshes, which are highly sensitive to changes in water level. Marsh resources, if any remain, will migrate landward. Marsh loss is caused by a combination of nutria and sea level rise and subsidence of the general terrain in the area.
- Significant warming may result in habitat changes, causing species such as the Bulls-Eye Snakehead in Florida to become an issue in Maryland.

Climate Change Actions

- An ongoing nutria study will be used by the U.S. Army Corps of Engineers to implement a four-year marsh restoration project, potentially covering 150 acres of marsh in the Blackwater National Wildlife Refuge. The Corps is using sediment spraying to raise the level of the marsh, which helps to restore the marsh grass.

Research Activities & Information Used

(None reported.)

Research Needs

- Research on nutria pheromonal attractants and weaknesses in reproductive biology.
- Zebra mussels and their control techniques in lakes and rivers.
- Fish species-specific control techniques.
- Innovative control techniques for snakeheads that would allow officials to apply a lethal control.
- Information on chemicals that would either attract fish or exclude them from areas.
- A contained area to study snakeheads in order to develop innovative techniques to sample and control them.
- Information on better *Phragmites* control methods, other than herbicides (e.g. biocontrol).

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT MASSACHUSETTS

AIS Management Plan

Massachusetts Aquatic Invasive Species Management Plan (2002). The five-year plan, created by the Massachusetts AIS Working Group, is a comprehensive set of management strategies intended to minimize the impacts of AIS in Massachusetts waters.

AIS Programs & Activities

- **Boat Ramp Monitor Program, Massachusetts Department of Conservation and Recreation (MDCR) – Office of Water Resources (OWR) – Lakes and Ponds Program (LPP).** Boat ramp monitors are positioned at lakes and ponds statewide to inspect boats and ensure that no plant fragments are attached to the boat, trailer or gear. Boaters are given informational brochures and asked to participate in a voluntary boat inspection and complete a survey. LPP posts AIS posters in kiosks and metal reflective boat ramps at public access points to remind boaters to check their boats and trailers before entering or leaving a water body.
- **Weed Watchers Program, MDCR – OWR – LPP.** LPP schedules weed watcher training for any interested lake groups or associations. This program teaches groups how to check key areas such as inlets, outlets, and shallow areas. The training also teaches volunteers how to eradicate species. This program is modeled after New Hampshire's weed watcher program.
- **Multi-lingual Education, MDCR – OWR – LPP and Massachusetts Office of Coastal Zone Management (MOCZM).** Lead by MOCZM with participation from LPP, this outreach effort developed multi-lingual brochures to distribute to specific groups (e.g. participants in the seafood trade who are Chinese).
- **Rapid Response Protocols, MDCR – OWR – LPP.** MDCR paid a contractor to develop rapid response protocols for new and unknown aquatic invasive species.
- **Aquatic Invasive Species Program, MOCZM.** Recent projects by MOCZM include developing resources for early detection/rapid response to new invasions in Massachusetts, developing a website to provide a single outlet for AIS information and resources in the state, and developing a marine invasive species monitoring network. The monitoring network uses a standardized protocol and identification resources developed with funding by MOCZM. The Office partnered with Massachusetts Institute of Technology (MIT) Sea Grant to develop a centralized marine invasive species data management system, as well as Massachusetts Bays National Estuary Program in an effort to train citizens to monitor along the coast. MOCZM has also taken steps to establish memoranda of understanding with state agencies to coordinate management and launched efforts to engage the seafood and pet store industry.
- **Massachusetts Bays National Estuaries Program.** The Program coordinated the 2003 rapid assessment survey of non-native and native marine species of floating dock communities with MIT Sea Grant. Another rapid assessment is scheduled for summer 2007. This program has also sponsored research and developed publications related to AIS.
- **MIT Sea Grant Program.** This program is leading the development of a centralized marine invasive species data management system. The database includes information from many groups, including volunteer monitors and divers. MIT Sea Grant also develops informational publications to help minimize new introductions through several vectors.
- **Water Chestnut Eradication, U.S. Fish and Wildlife Service (USFWS), Silvio O. Conte National Fish and Wildlife Refuge, in partnership with a number of other groups.** This program's control component consists of mechanical harvesting and some herbicide application around the edges of the water body. Participants hand pull the plant at six sites including Holyoke, Hadley, East Hampton, South Hadley, as well as a few sites in Connecticut. The plant is almost completely eradicated from sites where hand-pulling has been employed for the past four years.
- **Giant Hogweed control, Massachusetts Department of Agricultural Resources – Division of Regulatory Services.**

Climate Change Concerns

- As the climate warms, certain plants that pose problems in the south could move into Massachusetts. For example, water hyacinth, which is being sold in nurseries for people with water gardens, is not considered a

problem in the state. In contrast, water chestnut cannot be legally possessed and is not traded in the marketplace. If the climate warms up enough to allow water hyacinth to overwinter, it could be a threat.

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

(None reported.)

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT MICHIGAN

AIS Management Plan

Aquatic Nuisance Species (ANS) Management Plan (2002). The plan, developed by the Michigan Department of Environmental Quality, Michigan Department of Natural Resources, and Michigan Department of Agriculture, outlines educational programs, possible legislative actions, objectives for implementation, and strategies on cooperating for the control of aquatic nuisance species spread and the prevention of new introductions.

AIS Programs & Activities

- **Aquatic Nuisance Species Council**, **Michigan Department of Environmental Quality (MDEQ), Michigan Department of Natural Resources (MDNR), Michigan Department of Agriculture(MDOA), National Wildlife Federation, Michigan United Conservation Clubs, Michigan Education Association, and Michigan State University – Department of Fisheries and Wildlife.** The Council implements the ANS Management Plan and does planning and strategy for member agencies and associations. As of 2006, council members are considering rapid response plan. The Council monitors AIS and promotes control, but not eradication (the state does not spend money to eradicate AIS where it is impossible). The Council also focuses on measures to prevent further introductions and spread of ANS.
- **Invasive Species Advisory Council**, **MDEQ, MDOT, MDNR, and MDOA.** The Council is responsible for overseeing all management of nuisance species in the state (aquatic and terrestrial).
- **Education and Outreach, MDEQ Office of the Great Lakes.** MDEQ officials conduct outreach on how to prevent the spread of ANS. The agency also offers removal and control training for local governments, conservation groups, citizens, and associations and isssues permits for the use of chemicals for ANS removal.
- **Status and Trends Surveys, MDNR - Fisheries Division.** When habitat biologists encounter ANS during their annual fish Status and Trend Surveys, they kill and preserve it for later identification. Any recurrence is noted in the files. Officials will occasionally eradicate on a case-by-case basis, but this is rare.
- **Purple Loosestrife Program, Michigan State University and Michigan Sea Grant College Program.** This program introduces biological control agents (natural insect enemies) to existing purple loosestrife populations.

Climate Change Concerns

- MDEQ is concerned about ANS expansion as waters warm. Hydrilla and water lettuce are overwintering in northern areas.

Climate Change Actions

- Officials are addressing the overwintering of hydrilla and water lettuce in northern areas with outreach and education efforts.

Research Activities & Information Used

- The 2002 ANS Management Plan includes: research on treatment of ballast water; surveys of purple loosestrife throughout Michigan; research on whether practical round goby control actions can be taken through the use of pheromones; assessment of impacts of round gobies and collection of baseline data on ruffe; and testing for effects of zebra mussel on zoobenthos and the diet and growth of yellow perch.

Research Needs

- The 2002 ANS Management Plan includes: prevention, including monitoring, data for rapid response, probabilities for establishment, hot list of potential AIS, boater and angler survey regarding implementation methods; control, biocontrol, pesticides, physical control, social/political/economic acceptability of control, effectiveness and pathways; specific research and monitoring of aquatic nuisance species impacts; potential invasive risks of genetically modified aquatic plants and fish to Michigan's aquatic ecosystems and to aquaculture and sport fishing; capacity-building in Michigan for aquatic nuisance species data and quality scientific research by promoting data availability and collaboration among agencies, researchers, and industry.

- Research on impacts of controls (especially chemical controls). Officials wish to research the long term costs/benefits and evaluations of the environmental impacts of ANS. They are interested in whether long term studies will show the weevil to be an effective milfoil biocontrol, as well as the impacts of control methods on water quality and ecosystem stability.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT MINNESOTA

AIS Management Plan

Plan under development.

AIS Programs & Activities

- **Invasive Species Program, Minnesota Department of Agriculture.** The Department issues an annual report aimed at aquatic plants and all wild animals and funds AIS activities through watercraft surcharges and a water recreation account. The Department also has educational requirements for terrestrial species. The three primary goals of the program are to: (1) prevent introductions, (2) prevent spread, and (3) reduce impacts.
- **Eurasian Watermilfoil Management Program, Minnesota Department of Natural Resources (MN DNR).** This program: monitors milfoil growth; coordinates with government agencies, special purpose districts, and lakeshore associations to prevent spread; and coordinates with the University of Minnesota and other facilities to study the use of biocontrols and herbicides. It also provides grants to potential partners working on lakes with public water access and funds research on biocontrol. The program focuses on unintentional transport of milfoil on boat equipment and better cleaning of such equipment.
- **Purple Loosestrife Management Program, MN DNR.** This program seeks to reduce the environmental effects of purple loosestrife by integrating chemical and biological control and cooperating with local, state and federal groups.
- **Watercraft Inspection Internships, MN DNR.** Between April and October watercraft inspections are conducted at public water access sites on lakes and rivers infested with aquatic invasive species.

Climate Change Concerns

- Species requiring warmer climates, which cannot currently survive in Minnesota, will eventually be able to survive in the state.
- Warming could produce cooler and wetter springs, which would limit the growth of Eurasian watermilfoil. Historically, drought conditions caused the initial growth of watermilfoil.
- As temperatures warm over time, conifers may be replaced by oaks, followed by prairie grassland. However, with invasive species, such as buckthorn, oaks may never gain a chance to grab a foothold for growth, which will throw off the natural cycle.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Technology to deter the spread of Asian carp.
- Funding for construction of dispersal barriers for Asian carp.
- Weekly copper sulfate treatments to kill zebra mussels.
- Public awareness and watercraft inspection
- Technical assistance for curly-leaved management projects.

Research Needs

- Habitat recovery issues after eradication of an invasive species.
- A national framework or law on invasive species to deal with intrastate transportation, transportation on public roads, and interstate transpiration (Lacey Act is not sufficient).
- Current state actions with regard to risk assessments (states should be sharing more information on this issue).
- Information on effective herbicide and biological control methods.
- Lists—a stronger noxious weed list and injurious wildlife list, as well as a list of federal experts that states can contact if they have questions on a particular issue.
- More expertise in ecology, including more studies on the effects of Eurasian watermilfoil.
- More information on long-term impacts of invasive species on adjacent wildlife communities.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
MISSISSIPPI

AIS Management Plan

Plan under development.

AIS Programs & Activities

- **Control, Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP).** The Department chemically treats water hyacinth and common salvinia in state park waters and fishing lakes and stocks grass carp and salvinia beetles.
- **Monitoring and control, Mississippi Department of Agriculture and Commerce (MDAC) – Bureau of Plant Industry and USDA Animal and Plant Health Inspection Service (APHIS) – Plant Protection and Quarantine (PPQ).** MDAC is assisting APPHIS-PPQ to monitor and control an infestation of giant salvinia in a private lake. Officials check the lake every three months and release salvinia weevils when necessary.
- **Coastal Preserve Program (giant salvinia), Mississippi Department of Marine Resources (MDMR).** Officials are assessing the possible use of the salvinia weevil to control giant salvinia, which has recently emerged as an AIS in the area. Officials are also addressing tallow tree and cogongrass through active surveys for the species and the use of herbicides and mechanical removal for control.
- **Alabama-Mississippi Rapid Assessment Team (AMRAT).** State scientists conduct a 3-5 day survey of all aquatic invasive species present in the coastal waters of Alabama and Mississippi to establish a baseline for further analysis.

Climate Change Concerns

- A recent document from MDMR (Dale A. Diaz & Jeff Clark, *Mississippi Department Of Marine Resources Efforts Related To Aquatic Invasive Species*, PROCEEDINGS OF THE 14TH BIENNIAL COASTAL ZONE CONFERENCE, New Orleans, Louisiana, July 2005), states that aquatic invasive species "[are] a problem because there are many elements in place that make the state susceptible to aquatic invasions," including: abundant pathways, including commercial shipping, heavy recreational watercraft usage, aquaculture and the ornamental plant trade industry; a subtropical climate with abundant aquatic habitat that is naturally hospitable to nonindigenous aquatic species; increased coastal development, which can enhance the establishment of invasive species in areas where habitat has been altered.

Climate Change Actions

- The MDMR document (see above) also states: "[the plan will] include sections on the pathways of introduction, education/outreach, prevention, control, eradication, restoration, early detection and rapid response for aquatic invasive species;" the state will work with a regional panel to coordinate its activities; and the state will be involved in AMRAT 3.

Research Activities & Information Used

(None reported.)

Research Needs

- Database of taxonomists who can identify invasive species.
- Assessing the use of salvinia weevil and potentially negative impacts of its introduction.
- More information on the potential long-term negative effects of control methods.
- More information/expertise on esoteric species.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT MISSOURI

AIS Management Plan

Aquatic Nuisance Species Management Plan (August 2005).

AIS Programs & Activities

- **Invasive Species Program, Missouri Department of Conservation (MDC) – Fisheries Program.** The program provides public information and officials are currently enacting the 2005 AIS Plan. In addition, regulations have been enacted recently that prohibit the use of live bighead and silver carp as bait, create a prohibited species list, and require registration for all sellers of live fish or crayfish as bait. The program is also in the process of developing regulations related to invasive species management (not yet approved).
- **Protect Our Waters Project, MDC – Resource Science Division.** This project, outlined in the state AIS Plan, involves joint work among inter-agency experts on invasive species.
- **Alternate use of redear sunfish for control of snails in aquaculture, MDC – Resource Science Division.** The division is evaluating the use of redear sunfish to control snails in aquaculture ponds as a substitute for Asian black carp.
- **Asian carp heuristic modeling, MDC – Resource Science Division and University of New Orleans.** The project is evaluating a modeling technique to predict the expansion of Asian carp in the Middle Mississippi River system and associated tributary streams.
- **Reeds Canarygrass Management, MDC – Resource Science Division.** The division is evaluating control of Reeds Canarygrass in wetlands that uses a combination of mechanical and herbicide treatments.
- **Statewide Crayfish Conservation and Management Program, MDC – Resource Science Division.** This program has several components, including: *Systematic Monitoring Project* – monitors invasions and is seeking to set up a long-term monitoring project; *Consulting* – encourages the public to use native species for sale food or bait, advocates for the addition of the Australian and Rusty Crayfish to the prohibited species list, works with law enforcement officers to track invasive crayfish, particularly their transport to and from other states; *Stream resource management* – researches inter-species breeding, competition for resources, takeovers of breeding grounds, etc.; *Education* – produces videos, brochures, and articles, gives presentations to school groups, and operates a booth at Earth Day; *Working with the bait industry* – built a database of every bait shop in the state (about 400 shops) and found that 90 of these sell crayfish, and working on a brochure for the bait and culture industry that shows shops how to identify the five legal crayfish species; *Permits for species collection* – issues permits, usually to teachers, with a requirement that species be released at the same location from which they were obtained.
- **Zebra Mussel Educational Outreach and Monitoring,** MDC – Policy Division. As part of the 100th Meridian Initiative, MDC conducts statewide outreach, including assistance to marine operators who inspect boats for zebra mussels, publication of articles about zebra mussels, supply of information at fairs, outdoor events, and hometown festivals.
- **Missouri Stream Team, MDC, Missouri Department of Natural Resources (MDNR), and Conservation Federation of Missouri.** The stream team's volunteer water quality monitoring class teaches a chapter on zebra mussels.
- **Invasive Species Management Program, MDNR - Division of State Parks.**

Climate Change Concerns

- Effects of climate change on invasive species in general.
- Increased movement of AIS through interstate commerce and recreation.

Climate Change Actions

- Traveler Information Stations (TIS), boat ramp signs, and public-private partnerships address pathways.

Research Activities & Information Used

- Monitoring efforts to track zebra mussels.
- Discussion of markets for Asian carp as pet food, oil, consumption, and private use.

- Development of an ANS workshop on communication strategies for the 2007 North American Fish and Wildlife Conference in Portland, OR.

Research Needs

- Information on the effects of crayfish on other aquatic species.
- Methods to control crayfish.
- Adequate monitoring and inventories in order to understand the full spectrum of biodiversity in streams
- Monitoring in order to gauge changes and detect species as soon as they appear.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT MONTANA

AIS Management Plan

Montana Aquatic Nuisance Species (ANS) Management Plan (2002). The plan identifies six objectives to achieve an overall goal to "minimize harmful ecological, economic, and social impacts of [aquatic nuisance species] through prevention and management of introduction, population growth, and dispersal into, within, and from Montana." The six objectives are: (1) Coordinate and implement a comprehensive management plan; (2) Prevent the introduction of ANS into Montana; (3) Detect, monitor, and eradicate pioneering ANS; (4) Control and eradicate established ANS that have significant impacts, where feasible; (5) Inform the public, policy makers, natural resource workers, industry, and other groups about the risks and impacts of ANS; and (6) Increase and disseminate knowledge of ANS in Montana through compiling data and conducting research.

AIS Programs & Activities

- **Montana ANS Program, Montana Department of Fish, Wildlife, and Parks.** The Program consists of five key areas: coordination, education, prevention and control, monitoring, and rapid response. A primary goal of the program is collaboration and coordination with other agencies and other states. Within the program areas, various activities are being implemented:
  - *Education.* The program conducts education in schools, colleges and universities, with specialized groups such as Trout Unlimited, and through fishing tournaments, radio stations, and boat launches. The Program also has an education program for professionals. For example, firefighters are a targeted because much of the state's fire equipment is brought in from other states and can spread ANS.
  - *Prevention and Control.* The program operates a boat inspection program. This began in 2004, by targeting fishing tournaments on high use waters. In 2005, efforts expanded state-wide, with inspections at more high-use water areas and times. Officials set up angler check stations at major tournaments and water bodies, where anglers must fill out a questionnaire about where they are launching their boats. Cleaning equipment is available to remove debris and sediment, if necessary, before launching. The program also checks for live bait from outside the state and has a hatchery inspection program.
  - *Monitoring.* The monitoring program has inspected all major water bodies for invasive invertebrates and plants. Additionally, a whirling disease distribution study has been underway for several years. Officials also test fish for diseases and map its spread. There is also an ongoing distribution study of New Zealand Mud Snails, with plans to test all fishing access sites. The resulting information is entered into a national internet database.
  - *Rapid Response.* Officials have a rapid response plan in place for zebra mussels upon detection, with different plans based on general scenarios. They are also mapping national statistics to identify and monitor the most likely areas where mussels might be introduced.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

- ANS Program researched the effectiveness of ANS Program outreach tools.
- ANS Program completed a specific study in 2006 to examine the effectiveness of Traveler Information Systems on public outreach.
- ANS Program conducts surveys annually to identify transport patterns within the state to help identify bodies of water at highest risk of introduction.

Research Needs

- Risk assessments for the establishment of other aquatic invasives in Montana (which bodies of water are at highest risk of establishment and which species are most likely to become established).

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
NEBRASKA

AIS Management Plan

No plan available.

AIS Programs & Activities

- **Coordination, Nebraska Game and Parks Commission (NGPC) – Fisheries Division.** The division conducts education and outreach, as well as some control for the common carp.
- **Noxious Weed Program, Nebraska Department of Agriculture (NDA)– Bureau of Plant Industry.** This program conducts several activities, including: oversight of weed control superintendents around the state; training and education of personnel on the Nebraska Noxious Control Act, infestations, and control methods; dissemination of information and educational campaigns; designation of noxious weeds and their control measures; collection of information from counties regarding presence of noxious weeds; and cooperation with federal and state agencies.
- **Douglas County Noxious Weed Control Authority, Douglas County Environmental Services.**
- **Lancaster County Weed Control Program, Lancaster County Weed Control Authority.**
- **Lower Platte Weed Management Area, a partnership among the county weed control boards (Butler, Cass, Colfax, Dodge, Douglas, Lancaster, Platte, Sarpy, Saunders, Seward, and Washington), NGPC, and NDA.** This program conducts surveys, control, and monitoring of purple loosestrife in the Platte River Drainage. Officials have surveyed nearly 100 miles of the Platte River and treated nearly 75% of the infestations by chemical or insects releases. Continued monitoring and control is planned.
- **Twin Valley Weed Management Area (TVWMA), a partnership among the county weed control boards (Adams, Clay, Fillmore, Franklin, Furnas, Harlan, Kearney, Nuckolls, Thayer, and Webster counties), NDA, University of Nebraska Extension, and Board of Educational Lands and Funds.** TVWMA facilitates coordination among land managers and landowners to identify and manage noxious and invasive plant problems and conducts outreach and education.
- **Nebraska Weed Control Association.** This is a forum where superintendents can exchange information about noxious weeds.
- **Adopt-A-Stream program, Nebraska Wildlife Federation.** This program teaches local volunteers how to conduct chemical and biological monitoring.

Climate Change Concerns

- Increased drought caused by changes in climate may causes purple loosestrife and *Phragmites* populations to increase drastically.
- Warmer temperatures may affect some species, but not others.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Officials are developing a strategy to eliminate or reduce purple loosestrife through mechanical (digging), chemical (herbicides), or biological (insect) controls.
- Officials are conducting chemical experiments on *Phragmites* by spraying Habitat (via helicopter) over 80 acres along the river. Grazing cows and goats are also being used as a trial method to control *Phragmites*.

Research Needs

- Information about Asian carp.
- Identification of native and non-native species.
- New techniques for more effective or selective control and herbicides.
- An understanding of where will purple loosestrife seeds will be disseminated and where it may reappear.
- More knowledge about the anatomy and botany of invasive plants.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
NEVADA

AIS Management Plan

No plan available.

AIS Programs & Activities

- **Lake Tahoe Basin Weed Coordinating Group, Nevada Department of Agriculture and University of Nevada Cooperative Extension.** The group conducts and/or encourages the following activities: (1) Aquatic weed work at Lake Tahoe. The initial phase includes public education and outreach (posting signs and distributing information to boaters, asking for boat cleaning, and disseminating flyers at Forest Service leaseholders' homes to alert of potential spread). (2) Voluntarily removal of pondweed by landowners and managers (curly leaf pondweed is on the Tahoe Priority Weeds List). (3) Eurasian milfoil control at the south end of the lake through mechanical weed removal and induced water temperature changes to prevent spread and growth of weed. (4) California Department of State Lands has spearheaded a pilot project to use diver-assisted weed removal at the south end of the lake. A Bureau of Reclamation grant will allow the work to continue and expand through 2010. The use of bottom barriers is also being investigated.
- **Control of tall whitetop and tamarisk, Nevada Department of Conservation and Natural Resources, Muddy River Regional Environmental Impact Alleviation Committee, Southern Nevada Water Authority, and others.** Nevada uses inmate labor crews to control tall whitetop and tamarisk. The strategy consists of mechanical control (cutting down plants with chainsaws) and herbicide application to stumps. Many of the Nevada Cooperative Weed Management Areas (CWMAs) also participate in tamarisk and other aquatic invasive species removal.
- **Biological control of tamarisk, University of Nevada-Reno, in cooperation with U.S. Department of Agriculture.** The "Saltcedar Biological Control Consortium," a multi-agency and multi-partner effort that includes private interests such as the Cattlemen's Association and conservation groups such as The Nature Conservancy, conducts tamarisk research, including a biological control project using weevils.
- **Chemical removal of undesirable species, Nevada Department of Wildlife (NDOW).** The Department removes some non-native game fish to perpetuate native species (cutthroat trout, bull trout, and other trout species) that are currently or potentially threatened or endangered. NDOW treats the water body for two consecutive years with piscicides and then restocks with native fish.
- **Invasive Species Management Plans, NDOW – Wildlife Management Areas.** Each area is developing an Invasive Species Management Plan. The department continues to work closely with Cooperative Weed Managaement Areas to control invasive weeds on state-owned Wildlife Management Areas. Grazing, herbicidal spraying, and biological controls have been implemented in many of the areas.
- **Database of Invasive Plant Mapping Data, Nevada Natural Heritage Program.** Nevada Natural Heritage Program, in cooperation with the Nevada Department of Agriculture, is creating a database management and mapping position to keep track of all of Nevada's Invasive Plant Mapping Data, including aquatic plants. The data will be gathered by CWMAs and various agencies and organizations.

Climate Change Concerns

- Although weevils have effectively defoliated the tamarisk trees numerous times, they do not do well in southern Nevada. This may be linked to temperature (they may be heat-sensitive). Researchers may try to obtain more heat-tolerant weevils from their source location.
- Climate change could increase demand on water resources, and because invasive species such as tamarisk deplete the water supply, invasive species could become a greater problem as a result of climate change.

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Development of Cooperative Extension education and outreach.
- Identification of a tamarisk-eating weevil that is effective in the south.
- Development of more effective herbicides for treating tall whitetop and tamarisk.
- More information about the effect of chemicals on non-target species (macroinvertebrates and their recovery).
- More research on other biological controls for invasive species.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
NEW HAMPSHIRE

AIS Management Plan

No plan available.

AIS Programs & Activities

- **New Hampshire Exotic Aquatic Plant Program, New Hampshire Department of Environmental Services (NH DES).** The primary purpose of the program is to "prevent the introduction and further dispersal of exotic aquatic weeds and to manage or eradicate exotic aquatic weed infestations in the surface waters of the state." The program focuses on submerged exotic aquatic plants, including variable milfoil (*Myriophyllum heterophyllum*), Eurasian milfoil (*Myriophyllum spicatum*), fanwort *(Cabomba caroliniana*), Brazilian elodea (*Egeria densa*), Hydrilla (*Hydrilla verticillata*) and water chestnut (*Trapa natans*), among other species. The program has five focus areas: (1) Prevention of new infestations, (2) Monitoring for early detection of new infestations to facilitate rapid control activities, (3) Control of new and established infestations, (4) Research towards new control methods with the goal of reducing or eliminating infested areas, and (5) Regional cooperation. The program is funded through the collection of a $5 fee derived from New Hampshire boat registrations. For each $5 collected, $4.50 is dedicated to tasks and projects associated with exotic aquatic plants. The program's establishing statutes also list 27 prohibited aquatic plants and associated species.
- **Lake Host Program, NH DES and New Hampshire Lakes Association.** The New Hampshire Lakes Association, under a grant appropriation from NH DES, hires summer staff to inspect aquatic recreational gear, such as boats, trailers, and personal water craft, for aquatic weeds at public access water sites across the state. Staff also distribute information and maps on exotic aquatic plant infestations. If detected, AIS are sent to NH DES, which posts an online notice. The Lakes Association also educates boaters about self-inspections.
- **Weed Watcher Program, NH DES.** NH DES trains volunteers to monitor water bodies for any new growths of exotic aquatic plants. If volunteers find aquatic weeds, they are sent to NH DES. New infestations are assessed and removed using hand-pulling, bottom barriers, or herbicides following the principles of Integrated Pest Management. As of 2006, NH DES monitoring activities included surveys of over 300 lakes, with over 600 trained Weed Watchers actively monitoring waterbodies across the state.
- **Milfoil Control, Squam Lakes Association (SLA) and NH DES.** SLA organizes trained volunteers to conduct surveys, remove fragments, and pull rooted variable milfoil. Questionable specimens are sent to SLA for identification and NH DES is notified of new infestation sites. Control is possible but eradication is not an option. Since the discovery of milfoil, SLA has been working with the NH DES to develop management alternatives for the infestations. An ad hoc milfoil task force has been formed between SLA, the marina operators, and SLA's consulting ecologist. In 2006, NH DES granted research funds to Plymouth State University, which was working in partnership with SLA to conduct research projects in portions of Squam Lake. Research examined the impacts of a 2,4-D herbicide treatment on the benthic fauna of the lake (including macroinvertebrates).
- **Exotic Species Management, NH DES.** NH DES annually coordinates the management of exotic aquatic plants in 15-20 waterbodies. Variable milfoil, and more recently, fanwort, are the two plants that are most often the target of these control practices. Control measures for new, small infestations include hand pulling or benthic barriers, and may include designation of a Restricted Use Area in the vicinity of the infestation. Larger, established infestations are usually controlled with herbicides.
- **Milfoil Research (general & specific), NH DES.** (See *Research Activities & Information Used* below.)

Climate Change Concerns Reported by State Personnel

- Many species that NH DES is encountering are southern species from South America and Africa that are surviving. Plants may be adapting, or climate change may be lengthening the growing seasons. With recent mild winters, plants may have the opportunity to gain a foothold. Plants of concern because of climate change include giant salvinia, water hyacinth, and water lettuce. These are warm water southern species that can currently survive the summer but not the winter.

Climate Change Actions

- NH DES has just expanded the list of prohibited species to include a total of 27 plants. This was done to account for the northward migration of southern species. NH DES hopes that by listing plants as prohibited, they will not be circulated in the state through the aquatic plant industry, thereby lessening their likelihood of introduction through that avenue. Neighboring states to New Hampshire are also following suit.

Research Activities & Information Used

- Develop specific strategies for aquatic herbicide use that incorporate plant phenology, water quality, and treatment timing for optimal, cost-effective, and selective control of variable milfoil.
- Compare and characterize the plant and nematode communities, along the with water chemistry and sediment conditions, associated with variable milfoil in its native range and in New Hampshire lakes, and find possible plant-nematode association for biological control of variable milfoil.
- Evaluate the effects of chemical and physical properties on variable milfoil, develop an effective monitoring tool, and determine optimal aquatic habitat for milfoil establishment and growth. Conduct geophysical and vegetation surveys, water quality sampling, and integrate data.
- Identify lake attributes that influence distribution of native and non-native milfoils. Use multivariate statistics and logistic regression to determine whether invasive milfoil species are correlated with chemical, morphological, biological, and spatial characteristics of New Hampshire lakes. Results of this study will identify classes of lakes that may be susceptible to invasion.
- The Plant Replacement Program works to establish a native, non-nuisance assemblage dominated by low-growing species. This effort involves both removal of the current dominant milfoil population over a target area early in the growing season and planting or seeding with the desired species.
- Investigate the effects of water and sediment chemistry, sediment physical properties, number and size of contiguous wetlands, and watershed geology on variable milfoil abundance or presence/absence.
- NH DES is studying the effectiveness of the herbicide 2-4 D. NH DES did intensive GIS mapping of a lake and arranged 2-4 D pellets in a consistent manner to target plants exactly where they are growing and to ensure that the chemical goes directly to the plants. NH DES is monitoring to ensure effectiveness.
- NH DES partnered with Plymouth State University to conduct a research project on the effects of a 2,4-D treatment on the chemistry, biology, and ecology of a small portion of Squam Lake. Data from pre- and post-herbicide treatment are included in the study. Data from this study should be released in fall 2007.

Research Needs

- Variable milfoil research.
- Chemical and biological control methods.
- Research on the biology and ecology of plants and what makes them invasive, as well as the habitat characteristics that invasive plants favor.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
NEW JERSEY

AIS Management Plan

No plan available.

AIS Programs & Activities

- **Liberty State Park Project: Interior Restoration, New Jersey Department of Environmental Protection (NJDEP)**. This project derives from a legal settlement of a chromium case and restoration involves *Phragmites* control by tidal flushing. NJDEP flushes the species out by digging a meter plus of soil around the root system, cutting the plants, and filling the holes with "clean" sand.
- **Lower Cape May Meadows Environmental Restoration Project, NJDEP.** NJDEP controls *Phragmites* using fill and herbicides and controls purple loosestrife using beetles and tidal flushing.
- **Partners for Fish and Wildlife Program: purple loosestrife control, USFWS, New Jersey Department of Agriculture, NJDEP – Division of Fish and Wildlife - Endangered and Nongame Species Program.** The Program controls purple loosestrife on private lands.
- **New Jersey Invasive Species Council.** The council was created under a 2004 executive order to create a state invasive species management plan and to undertake a set of tasks to control and eradicate invasive species in the state. Representatives on the council come from the NJDEP, Department of Agriculture, Department of Transportation, Commerce and Economic Growth Commission, conservation organizations, agricultural sector, nursery and landscape sectors, New Jersey Agricultural Invasive Species Council, academia, and the general public.
- **Wetlands enhancement in the New Jersey Meadowlands, New Jersey Meadowlands Commission.** Wetland enhancement projects for three sites in the New Jersey Meadowlands area include control and management of numerous invasive species.

Climate Change Concerns Reported by State Personnel

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Establishing standardized monitoring protocols for restoration projects.

Research Needs

(None reported.)

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
NEW MEXICO

AIS Management Plan

Aquatic Nuisance Species Management Plan (currently under review by the New Mexico Department of Game and Fish; once internal review is complete, the plan will be circulated for stakeholder input in 2007).

AIS Programs & Activities

- **Lower Rio Grande Salt Cedar Control Project, New Mexico Association of Conservation Districts.** The project includes: eradication efforts; development of management and native vegetation restoration plans; hearings to receive public input on the plans; aerial spraying by helicopter or ground application with prior public notice; and monitoring and evaluation of the effects of control on wildlife, water quality, vegetation and soil health.
- **Salt Cedar Task Force, New Mexico Environment Department.**
- **Strategy for Long-Term Management of Exotic Trees in Riparian Areas for New Mexico's Five River Systems, New Mexico Interagency Weed Action Group (IWAG).** Efforts include prevention, early detection and mapping, timely control, and adaptive management. Control includes manual removal, selective mechanical grubbing, low-volume basal bark herbicide application, cut-stump herbicide application, foliar herbicide application, and aerial herbicide applications for Russian olive, salt cedar, and Siberian elm. This strategy considers ecosystem impacts, including stream bank stabilization, increased evapotranspiration, altered fire regimes, salt uptake, and decreased native biodiversity.
- **Native Trout Management, New Mexico Department of Game and Fish (NMDGF), USDA Forest Service, National Park Service, U.S. Fish and Wildlife Service (USFWS), New Mexico Interstate Stream Commission, and private groups.** The organizations together seek to halt and/or reverse the invasion of non-native trout and its effects on native cutthroat trout. Most work involves managing non-native trout populations through electrofishing or by physical removal. NMDGF also installs migration barriers to prevent the invasion of currently un-invaded streams. They also conduct chemical treatment and restoration of the gila trout, which is protected under both state and federal law.
- **Whirling Disease Program, NMDGF and USFWS**. The NMDGF has implemented a statewide monitoring program to track the status of whirling disease in infested and negative salmonid populations using GIS-based mapping. The program also tests for presence of whirling disease in hatchery stock and in native and managed trout populations.
- **Golden Algae Monitoring Program, NMDGF.** The NMDGF is conducting statewide monitoring of the golden algae to determine the effects of algal blooms on zooplankton, fish communities, and aquatic macroinvertebrates. The measurement of physicochemical parameters will serve to develop predictors for blooms and toxic events and to prescribe management actions to maintain sport fisheries, native fish communities, and aquatic macroinvertebrates.
- **San Juan River Non-native Fish Removal Program, NMDGF, USFWS, Bureau of Reclamation, and Utah Division of Wildlife Resources**. The program, a collaborative efforts since 2001, restores the native fish of the San Juan River, including physical removal of non-native piscivores and common carp.
- **Non-native Crayfish Survey, NMDGF.** Since 1991, the NMDGF has been actively documenting the statewide occurrence of non-native crayfish.
- **Zebra Mussel Monitoring, USFWS, U.S. Army Corps of Engineers, and New Mexico State Parks.** Zebra mussel monitoring was initiated in 2005 at three state parks (Conchas Lake, Heron Lake, Elephant Butte) and two sites on the Rio Chama.
- **Chytrid Fungus Monitoring, NMDGF, Western New Mexico State University, and Pisces Molecular (Boulder, CO).** Chytrid fungus infections, implicated in the decline of amphibians worldwide, are known to occur in four species of anurans and one salamander in New Mexico. Using molecular genetic techniques, collaborative efforts are ongoing to survey the state for incidence of occurrence in other amphibian taxa.

Climate Change Concerns

- Climate change could have significant effects on native fish. An increase of even a few degrees in water temperature would lead to loss of habitat and species. Non-native trout with higher tolerance to warmer water temperatures and degraded water quality would be at an advantage.

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Research on the upper temperature tolerance of fish, impact of varying degrees of water quality on fish, the mechanisms through which non-native trout out-compete or displace native trout; and knowledge about native trout's life history characteristics.
- More detailed studies on the effects of piscicides on amphibians and mollusks, particularly the early life stages of tadpoles and aquatic insects.
- Method for field detection of antimycin in streams.
- Research on antimycin's persistence time in waters of different qualities.
- Continue statewide surveys for non-native crayfish to develop a database and synthesize results for directing management strategies.
- Conducting research on the effects of non-native crayfish on aquatic ecosystems.
- Investigate influences of atmospheric conditions on golden algae blooms.
- Expand statewide survey of amphibians for chytrid fungus.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
NEW YORK

AIS Management Plan

Nonindigenous Aquatic Species Comprehensive Management Plan (1993). The plan has several objectives: (1) Reduce the potential for future introductions of nonindigenous aquatic species into New York waters; (2) Reduce the potential for nonindigenous aquatic species that have been introduced into New York waters to spread into uncolonized waters; (3) Minimize harmful ecological, economic, and social impacts resulting from nonindigenous aquatic organisms that have already been introduced or are proposed for introduction into the waters of New York State; (4) Educate the public on the importance of preventing nonindigenous aquatic species introductions, and how the harmful impacts of nonindigenous aquatic species can be reduced or mitigated.

AIS Programs & Activities

- **New York State Invasive Species Task Force.** The task force is composed of multiple state agencies and nongovernmental organizations and is jointly chaired by the New York Department of Environmental Conservation and the New York Department of Agriculture and Markets. The original function of the task force was to evaluate the spectrum of invasive species issues and to make recommendations to the legislature and Governor as to how the state should address the issue. The task force has completed this report and now works to implement the proposed recommendations.
- **Purple Loosestrife Biocontrol Program, Cornell University – Ecology and Management of Invasive Plants Program.** The program releases biocontrol insects at over 4,000 sites across the country. It is trying to determine why treatment has succeeded in some areas and not others.
- ***Phragmites*, water chestnut, Japanese knotweed biocontrol research, Cornell University – Ecology and Management of Invasive Plants Program.** Scientists are researching biocontrol options.
- **Lake Services Section, New York Department of Environmental Conservation (NYSDEC) - Division of Water.** The Division provides local assistance grants for aquatic plant control. It operates a volunteer program to teach plant identification and how to collect and submit samples, conducts plant research and surveys in Lake George, and engages in public outreach through conferences, lake association meetings, site visits, and management activities.
- **NYSDEC - Division of Fish, Wildlife, and Marine Resources.** The division undertakes local management, of AIS and is modifying regulations to prevent introduction of Chinese mitten crab. It also has a program for hand-harvesting water chestnuts, monitors ANS such as round goby, spiny water fleas, and zebra mussels, including the ecological effects of zebra mussels in 8 Finger Lakes. Finally, the division administers a $1 million grant program for aquatic invasive species eradication projects. (Thirty-two grants were funded in FY2005. The program will continued in FY 2006, but the funding will be shared with a terrestrial invasive species eradication grant program that is currently under development.)
- **Sea Lamprey Control, NYSDEC – Bureau of Fisheries.** The bureau undertakes sea lamprey control using chemicals and migration barriers.
- **Monitoring Program: zebra mussels, quagga mussels, and round goby NYSDEC – Bureau of Fisheries.** The bureau monitors for Type E botulism and collects dead bodies. Control is not feasible.
- **NYSDEC – Division of Fish, Wildlife, and Marine Resources, Region 5 and Region 6.** The Division protects ponds that are habitat for unique strains of native Adirondack brook trout from species such as yellow perch.
- **Aquatic Plant Harvesting, Finger Lakes-Lake Ontario Watershed Protection Alliance (FL-LOWPA).** The Alliance conducts mechanical harvesting in multiple counties at multiple sites for aquatic plants including Eurasian watermilfoil, muskgrass, and water chestnut. Some county programs have volunteer training and opportunities.
- **Invasive Species Initiative, FL-LOWPA - Hamilton County Soil and Water Conservation District.** The District distributes educational materials, including fact sheets, brochures and signs, and is developing and encouraging volunteer monitoring for invasive aquatic plants, providing assistance to several lake associations.
- **Evaluating Alternative Control Strategies for Invasive Aquatic Plants, FL-LOWPA - Madison County Planning Department, in conjunction with SUNY Oneonta and Cornell University.** With the goal of formulating a control strategy, the group is examining the impact of fish communities on Eurasian watermilfoil herbivores.

- **Zebra Mussel Monitoring in Eaton Brook Reservoir and Downstream Tributaries, FL-LOWPA - Madison County Planning Department.**
- **Monitoring and Research, FL-LOWPA - Steuben County Soil and Water Conservation District, in cooperation with Cornell University Experimental Ponds Program.** The district is conducting research on the presence and impact of the European aquatic moth (an exotic species that feeds on Eurasian watermilfoil).
- **The Milfoil Project (Weevil Control Program), Lake Bonaparte Conservation Club.** The club is conducting milfoil control using weevils.
- **Milfoil Control, Upper Saranac Lake Foundation.** The town contracted with divers to hand-pull milfoil in the Upper Saranac Lake.
- **Research, Cornell University – Research Ponds Facility.** Researchers are monitoring and managing aquatic plant communities throughout the northeast and New York State and demonstrating physical, biological and chemical control methods for aquatic nuisance species.
- **Research, Cornell University – Aquatic Research Facility.** Researchers are contributing to a 50+ year long-term data set on Oneida Lake, New York that includes information on invasives and an aquatic foodweb ranging from nutrients to top predators. An experimental facility examines foodweb impacts of New York invasives in research settings ranging from small scale aquaria to large scale mesocosms.
- **Water Chestnut Control, State University of New York Oneonta Biological Field Station in cooperation with state agencies, nongovernmental organizations, and private stakeholders.** Focus on nutrient export associated with control activities.
- **Japanese Knotweed Initiative, Delaware River Invasive Plant Partnership (DRIPP).** DRIPP develops educational brochures and works with local community volunteer sites to provide best scientific guidelines and demonstration control sites (showcasing repeated cutting to keep knotweed under control and prevent it from spreading).
- **Japanese Knotweed Study, New York City Department of Environmental Protection, in conjunction with Green County Soil and Water Conservation District.**
- **Delaware River Invasive Plant Partnership, States of Delaware, New Jersey, New York, and Pennsylvania.**

Climate Change Concerns

- With climate change, purple loosestrife could move further north, where biocontrol insects may not survive. The range of plants and insects may shift and southern invasive species could move into New York.
- Water hyacinth is sold all over the state. Currently, it does not survive the winter in New York. However, this could change with climate change.
- Climate change could cause changes in the native vegetation and, depending on the rate at which that happens, could lead to more pest problems.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Comparing the dynamics of decomposition for invasive weeds (*Phragmites*) and native cattails (*Typha*) to determine the benefit of restoration efforts.
- Examining how nutrient level changes and exotic mussels affect the Lake Erie food web and fish community.
- Developing a genetic probing technique to quickly screen water samples for zebra mussel veligers.
- Studying role of embayments and inshore areas as nursery grounds for alewife and other species.
- Assessing the role of zebra mussels in influencing metal cycling in freshwater ecosystems and evaluating whether zebra mussels may serve as bioindicators for the presence of toxic metals in freshwater systems.
- Studying the effects of zebra mussels on the spawning shoals of walleye and lake trout.
- Japanese knotweed study of treatment and monitoring plots to test 3 control methods: (1) repeated cutting; (2) herbicide injections; and (3) limited excavation with replanting.
- Researching aquatic vegetation, biocontrol of Eurasian watermilfoil, and alewife.
- Identifying a non-herbicide approach for treatment of knotweed.

Research Needs

- Research on plants not currently targeted for biocontrol, such as curly-leafed pondweed.
- More information about how to restore wetlands after the biocontrol.
- Determine whether biocontrol organisms identified overseas are specific enough for the species that are being targeted (Knotweed, Water Chestnut, and *Phragmites*), and whether they can be introduced safely into North America.
- Demonstrate economic and agricultural impacts of invasive species.
- Information on biocontrol (predators, pests, diseases) for sea lampreys.
- Research on mussel control methods, especially the quagga mussel.
- Information about how knotweed affects aquatic species.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
NORTH CAROLINA

AIS Management Plan

No plan available.

AIS Programs & Activities

- **Aquatic Weed Control Program, North Carolina Department of Environment and Natural Resources (NC DENR) - Division of Water Resources.** The Division conducts on-the-ground removal of invasive species, including: (1) physical - water level manipulation, deepening near-shore areas; (2) mechanical - removal of weeds with hand tools; (3) biological - herbivorous fish or insects that attack specific weeds; and (4) chemical - herbicides approved by the U.S. EPA for aquatic use. The Division assists local governments by: (1) providing cost-share grants for qualifying projects (municipalities, counties, soil and water conservation districts, government agencies, and public utilities are eligible for assistance); (2) assessing sites and providing recommendations when control efforts are needed; and (3) Identifying aquatic weed infestations. The Division also assists the general public by providing free evaluations of aquatic weed problems in private waters and conducting public outreach and education on invasive aquatic weeds. The Division's species-specific work includes: (1) Salvinia - experimenting with the host-specific Brazilian weevil (*Cyrtobagous salviniae*) to control giant salvinia and herbicides; (2) Hydrilla - control using sterile grass carp (only sterile "triploid" grass carp may be legally introduced into state waters); herbicides; water draw-downs; and mechanical removal; (3) Alligatorweed - control using herbicides and flea beetles; (4) Parrotfeather - control using triploid grass carp; (5) Creeping water primrose - control using herbicides; (6) Eurasian watermilfoil - biological control and herbicides. (Note - parrotfeather, water lettuce, and water hyacinth were added to NC DENR list of noxious aquatic weeds in 2006.
- **Weed Regulatory Services, North Carolina Department of Agriculture and Consumer Services (NCDA&CS) - Plant Industry Division - Plant Protection Section.** Giant salvinia-related work includes active surveys; physical removal; and experimentation with biological control (releasing salvinia weevils) in cooperation with the Giant Salvinia Task Force. *Lythrum salicaria* (semi-aquatic) work includes surveys and physical and chemical removal. The Commissioner of Agriculture may also regulate the importation, sale, use, culture, collection, transportation, and distribution of a noxious aquatic weed as a plant pest under Article 36 of Chapter 106 of the General Statutes of North Carolina.
- **Giant Salvinia Task Force (GSTF), a cooperative effort by state, local, and federal agencies and private landowners.** The GSTF conducts the following activities: (1) Uses chemical and biological controls in areas where giant salvinia has established (herbicides account for 95 percent of control efforts); (2) Surveys areas adjacent to infestation for evidence of giant salvinia establishment; (3) Responds to reports from around the state of giant salvinia establishment. Within 24 hours of a call, they assess the site and arrange for control treatments if salvinia is found.
- **North Carolina State University Aquatic Weed Management Program.** This program conducts research and outreach activities related to invasive plant management on aquatic and non-cropland sites. Activities include: (1) Evaluation of chemical, biological, physical, mechanical, and other methods of controlling invasive plants; (2) Determination of biological and ecological characteristics of invasive plants that contribute to spread, establishment, and management; (3) Dissemination of current information to managers, government employees, and others related to management of invasive plants; and (4) Interaction with government agencies and private entities to improve management of invasive plants.

Climate Change Concerns Reported by State Personnel

- Using a biological control for alligatorweed works better in warmer winters.
- Water hyacinth is a problem only in the southeast corner of the state (the warmest region).
- Monitoring air and water temperatures at some sites shows that giant salvinia is surviving at much colder temperatures than the literature reports.

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- More information on the best way to control hydrilla (herbicides vs. grass carp).
- More information on the biology and ecology of invasive species (i.e. seed longevity) that would help improve control methods.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
NORTH DAKOTA

AIS Management Plan

North Dakota Aquatic Nuisance Species (ANS) Management Plan (2005). The plan's goal is to "prevent the harmful ecological, economic, and social impacts from ANS being introduced into North Dakota." Seven objectives address this goal: (1) Coordination of ANS activities and preparing/implementing a comprehensive management plan; (2) Prevention of ANS introductions in North Dakota; (3) Detection of pioneering ANS and monitoring of existing populations of ANS; (4) Education to prevent the spread of ANS; (5) Where feasible, control and eradication of pioneering or established ANS that have significant impacts on native or desirable species; (6) Informing of policy makers about the risks and impacts of ANS; and (7) Increasing the ANS knowledge base in North Dakota by compiling data, conducting research, and publishing information.

AIS Programs & Activities

- **Lake Oahe Salt Cedar Task Force and Lake Sakakawea Salt cedar Task Force.** These Task Forces are federal, state, and local partnerships that conduct surveys along Yellowstone River and Lake Sakakawea. Thousands of acres have been surveyed and hundreds of acres have been treated. Early detection/rapid response is the policy of all agencies and organizations for combating salt cedar in the state. Because of this, infested acres have remained low due to the herbicide treatments.
- **Western North Dakota Weed Management Group (encompasses the Little Missouri River from the South Dakota border to Lake Sakakawea, the Lake Sakakawea Saltcedar Task Force, and the recently formed Lake Oahe Saltcedar Task Force).**
- **Purple Loosestrife Weed Management Groups, county/ state/ federal agencies and private individuals and organizations**. The Lower Sheyenne Purple Loosestrife Project has surveyed and treated the species in the Sheyenne River, from the Bald Hill Dam to the Red River through Fargo. The project has also conducted plant exchanges (garden purple loosestrife for Liatrus), as well as developing, printing, and distributing table place mats, table tents, and invasive ornamentals brochures. These items have been shared and distributed statewide in an effort to control and prevent the spread of purple loosestrife and other ornamental invasives. The Souris River Purple Loosestrife Weed Management Group has surveyed and treated the species from Minot, ND to the Canadian Border. They have also had exchange programs. Both working groups have also utilized biocontrol insects and actively surveyed for salt cedar while surveying and treating purple loosestrife.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Research on the length of seed viability of salt cedar at northern latitudes and climates. This information would be invaluable in making salt cedar management plans. Field observations by weed managers show that seed is viable much longer in our colder climates than where prior seed viability research was conducted.
- Research on the mechanism of spread of salt cedar. Anecdotal evidence points towards waterfowl and wind as being primary means of salt cedar spread. This research data would assist weed managers in concentrating their survey efforts and dollars in those areas most likely to be infested.
- Research on ability of ANS to be transported to North Dakota and the likelihood that they will become established in state waters. The study should include a risk assessment based on pathways information, frequency of movement into the state, and suitable habitat availability.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
OHIO

AIS Management Plan

Ohio Comprehensive Management Plan. The plan has three goals: (1) Preventing new introductions of non-indigenous aquatic nuisance species (ANS) into the Great Lakes and inland waters of the state; (2) Limiting the spread of established populations of non-indigenous ANS into un-infested waters of the state; (3) Abating harmful ecological, economic, social and public health impacts resulting from infestation of non-indigenous ANS.

AIS Programs & Activities

- **Aquatic Nuisance Species Program, Ohio Department of Natural Resources (ODNR) - Division of Wildlife**. The Division conducts control efforts for *Phragmites*, purple loosestrife (including biocontrol), reed canary grass, and flowering rush on its wildlife areas statewide. The Division is also developing a comprehensive AIS webpage and operates a monitoring program to survey for new AIS introductions as well as existing populations.
- **Invasive Species Control and Management, ODNR - Division of Parks and Recreation.** The Division engages in control of invasive species, including *Phragmites*, purple loosestrife, and milfoil. Control methods vary based on area, need, and funding and include: herbicides for *Phragmites* and loosestrife (spraying Rodeo and mowing); disking certain dry areas to destroy roots and reseed with native marsh grasses; and water drawdown to flood out *Phragmites* (however, this can lead to invasions from exposed dirt).
- **Invasive species control in state preserves, ODNR - Division of Natural Areas and Preserves.** The Division has management plans for each site. Each plan has a policy statement regarding treatment of problematic non-native flora. Guidelines call for manual removal, burning, and herbicide treatment. Plans also include provisions for monitoring and assessment to determine the extent of growth and nature of the disturbance. Plans are tailored to the specific preserve or area and prescribe the treatment appropriate for each species depending upon the habitat type, extent of invasion, and management goals for the area.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Research on control methods and the most up-to-date and effective information on how to control invasive plants. It is difficult to get an herbicide or a method that is selective enough to kill invasives but not native plants.
- Restoration methods after applying herbicides.
- Research on the effectiveness of installing a rinsing station at lakes, costs and benefits of installing stations, and how to effectively design them.
- Research on the impacts on recreational boat flow and traffic.
- Development of an AIS rapid response plan to address new or expanding AIS species.
- Revision of Ohio's State Management Plan for AIS to incorporate up-to-date information.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT OKLAHOMA

AIS Management Plan

Plan under development.

AIS Programs & Activities

- **Sport Fish Restoration Project, Oklahoma Department of Wildlife – Fisheries Division (ODW-FD).** The division conducts monitoring and outreach. Outreach programs include posted signs to inform users of the presence of aquatic nuisance species such as white perch, zebra mussels, and hydrilla and explain how to avoid moving them from one body of water to the next. The division also conducts native aquatic vegetation introductions in several reservoirs to improve nursery habitat for juvenile sport fishes.
- **Oklahoma Golden Alga Response Team, ODW-FD.** The division is working to devise efficient and effective plans to respond to golden alga fish kills, as well as proactive solutions to potential golden alga blooms.
- **Spring Creek Lakes Alligatorweed Biocontrol Program, ODW-FD.** The division is conducting biocontrol through the release of an alligatorweed flea beetle.
- **Aquatic Vegetation Control, ODW-FD.** The division used grass carp to control vegetation in some of the state fishing lakes, as well as in some of their fish hatcheries. Some municipalities have also used grass carp to control vegetation in city water supply lakes. A recently formed multi-agency Hydrilla Task Force will address recent infestations of the exotic weed in three reservoirs.
- **Oklahoma Zebra Mussel Task Force.** The multi-agency team, which includes the ODW-FD, shares information on agency activities related to zebra mussel monitoring. The division as developed Hazard Analysis and Critical Control Point (HAACP) plans to avoid spreading AIS through hatchery and management activities.

Climate Change Concerns

- Zebra mussels may be able to inhabit warmer environments successfully.
- Temperature changes may contribute to golden alga blooms.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- After white perch were discovered in the Kaw Reservoir in 2000, the division began a four-year research project to investigate the problem. Results showed white perch never reached high levels. Although reproductive success was high each year, recruitment to age 1 individuals was low. The white perch population primarily consisted of young of the year fish. No adverse effects on other native fish species in Kaw Reservoir were identified during the research period.
- The Oklahoma Department of Wildlife has provided funding to Oklahoma State University for the following research projects:
    - Determining the impacts of zebra mussels on biodiversity on selected rivers within the Tallgrass Prairie Ecoregion.
    - Monitoring water quality parameters and alga abundance at Lake Texoma to determine triggers for golden alga blooms.
    - Determining the toxicity of golden alga toxins to selected species of Lake Texoma fishes and what physical and biological parameters trigger toxin production.

Research Needs

- Controls for white perch, zebra mussels, and hydrilla.
- Research on golden alga (prediction and eradication).
- Restoration, including introduction of native aquatic plants in ponds, lakes, and reservoirs with a variety of herbivores (carp, turtles), fluctuating water levels, and turbidity issues.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
OREGON

AIS Management Plan

Oregon Aquatic Nuisance Species (ANS) Management Plan (2001). The plan has six main objectives: (1) Coordinate and implement a comprehensive management plan; (2) Prevent the introduction of ANS into Oregon; (3) Detect, monitor, and eradicate pioneering aquatic invasive species; (4) Where feasible, control established nonindigenous species that have significant impacts; (5) Inform the public, policy makers, natural resource workers, private industry, and user groups about the risks and impacts of ANS; and (6) Increase and disseminate knowledge of ANS in Oregon through the compilation of data and by conducting research.

AIS Programs & Activities

- **Invasive Species Council.** The Council focuses on preventing the new introductions of species, outreach and education programs, and coordinating all agencies involved in aquatic species management.
- **Oregon Clean Safe Boating Program, Oregon Marine Board (OMB).** The Oregon Marine Board (OMB) conducts a clean boating and invasive species awareness campaign. It develops brochures, illustrated panels, and demos of specimens for trade show exhibits. It maintains a website and produces a newsletter that goes to every registered boater in the state. As of December 2006, OMB is working on a Clean Marina Program that will develop an incentive to encourage good housekeeping, conduct training for law enforcement, and create best management practices for facilities development.
- **Lake Lytle Milfoil Control Project, Oregon State Weed Board (OSWB).** The OSWB developed the *Integrated Aquatic Vegetation Management Plan for Lake Lytle.* The plan's first year included application of aquatic herbicide Sonar, as well as pre- and post-treatment vegetation sampling, quality sampling, and an information/education component.
- **Noxious Weed Program, Oregon Department of Agriculture.**

Climate Change Concerns

- Climate change raises the question of whether working on aquatic invasive species is fruitless. Species will move because of changes in climate, which may be part of a natural cycle. Certain species in Oregon are more prevalent or less prevalent with El Niño and La Nina patterns, for example.

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Demographic information, e.g., the 100th Meridian Program is doing surveys on the mobility of boaters to determine where to put out signs.
- Scientific information on how to best sanitize boats.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
PENNSYLVANIA

AIS Management Plan

Aquatic Invasive Species Management Plan (October 2006). (Plan completed, signed by Governor, and pending ANSTF approval as of December 2006.)

AIS Programs & Activities

- **Stream ReLeaf Program, PA DEP.** PA DEP holds riparian plant identification classes for staff from regional offices, county conservation districts, and watershed groups. The classes cover the importance of riparian buffers and restoration projects, as well as biodiversity and native and invasive plants.
- **Delaware River Invasive Plant Partnership, States of Delaware, New Jersey, New York, and Pennsylvania.**
- **Zebra Mussel Control, private water suppliers.** The water suppliers apply chemicals, like chlorine, to intake screens on public water supplies to control zebra mussels.
- **Pennsylvania Sea Grant.** Sea Grant has conducted Hazard Analysis and Critical Control Point Trainings (HACCP) for state and federal agencies and developed outreach materials on specific AIS, including materials for AIS prevention among boaters.
- **Zebra Mussel Monitoring, PA DEP.** PA DEP is tracking the distribution and spread of zebra mussels in the Great Lakes region. The agency originally set up ~170 monitoring stations across the state and alerts contacts for adjacent water bodies when there is a new discovery.
- **Invasive plant species control, Pennsylvania Department of Conservation and Natural Resources (PA DCNR).** PA DCNR controls invasive plant species on the lands and in the associated waters it manages with systemic herbicides, mechanical and biological controls.
- **Pennsylvania Invasive Species Council.** The council, established by executive order in 2004, advises the Governor on invasive species issues in Pennsylvania. The council is also charged with developing and implementing a comprehensive invasive species management plan for the state, providing guidance on the prevention and control of nonnative invasive species and rapid response to new infestations, and facilitating coordination among federal, regional, state, and local initiatives and organizations engaged in the management of nonnative invasive species. The council is comprised of seven state agencies and ten at-large members.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Pennsylvania Sea Grant has funded the following AIS research projects (more information available at http://pserie.psu.edu/seagrant/research/ais.htm):
  - Round Goby (*Neogobius melanostomus*) Diet, Habitat Preference, and Reproductive Strategies in Presque Isle Bay
  - Population Assessment of Rudd (*Scardinius erythrophthalmus*) in Presque Isle Bay, Lake Erie
  - Distribution of the Invasive Red-Eared Slider Turtle (*Trachemys scripta elegans*) in the Lower Delaware River Basin
  - A Benthic Survey of the Natural Lakes of Northwestern Pennsylvania
  - Effect of Non-Native Mollusk Species on Common Map Turtles, *Graptemys geographica*
  - Impact of the Round Goby (*Neogobius melanostomus*) on Tributary Streams of Lake Erie
  - A Sampling of Presque Isle Bay for the Exotic Cladoceran: *Bythotrephes cederstroemi*
  - Characterization of the Microplanktonic and Microbenthic Communities of Near-Shore Lake Erie
  - Monitoring Zebra Mussel Invasion of Edinboro Lake, Conneauttee Creek, and French Creek

- Pennsylvania Sea Grant and partners conducted a pilot study on the distribution and sensory biology of the flathead catfish in order to develop strategies to prevent its spread.

Research Needs

- Economic impacts of AIS in Pennsylvania.
- Species-specific control technologies.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
RHODE ISLAND

AIS Management Plan

Plan under development.

AIS Programs & Activities

- **Mute Swan Management Program, Rhode Island Department of Environmental Management (RIDEM) - Division of Fish and Wildlife (DFW).** The Division identifies nests and destroys eggs by addling or puncturing them during the swan nesting season.
- **Permit reviews for herbicide application, RIDEM - Division of Fish and Wildlife and Rhode Island Department of Agriculture.** RIDEM-DFW issues permits for landowners wishing to use chemical treatments to exterminate aquatic invasive species on private or public waters.

Climate Change Concerns

- Mute swans may expand their range because of climate change.
- Narragansett Bay ecosystem may respond to warming trend, including changes in nutrient cycling.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Two rapid assessment surveys (2001 and 2003) have taken place through the MIT Sea Grant.
- Several species-specific studies of aquatic invasives in Rhode Island have been conducted are currently used by the research community and used as baseline data for the state management plan.

Research Needs

- Research on public perception of swan euthanization and methods for public education and outreach to overcome public discontent.
- Research on swan control methods (e.g., capturing birds during molting season when they cannot fly).
- Better product information and data about the half lives of herbicides and the effect of their residues. It will be necessary to conduct assay tests to better determine the effects of pesticides on water quality.
- Further baseline studies are necessary for the bay ports of Providence, Quonset, and Newport.
- Baseline studies beyond RAS floating dock studies, including those that capture information on sub-tidal benthic and rocky intertidal communities.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT SOUTH CAROLINA

AIS Management Plans

South Carolina Aquatic Invasive Species Management Plan (under development). The South Carolina Department of Natural Resources, in coordination with the newly formed South Carolina Aquatic Invasive Species Task Force, is preparing the plan, which should be available in 2007. The plan will identify management goals and objectives to help minimize problems created by non-native aquatic species that could adversely affect the ecology or economy of state waters. The plan's short-term objective is to reduce the abundance of aquatic plants at specific sites where they interfere with water use activities. Long-term management objectives are as follows: (1) Reduce the Statewide distribution and abundance of invasive aquatic plants in public waters; (2) Prevent water use impairment by aquatic plants in currently unimpaired waters; (3) Maintain aquatic plant populations at levels that are beneficial to water use, water quality protection, and to fish and wildlife populations; (4) 4) Prevent the introduction and distribution of invasive exotic plant species through enforcement of existing laws and regulations; (5) Promote the use of environmentally sound aquatic plant management practices; (6) Promote the development of improved aquatic plant management methods; (7) Promote public education in aquatic plant management matters; and (8) Inform owners of private waters of currently available sources of aquatic plant management advice and assistance (State and Federal funding would be provided for management of private waters only if plant populations in these waters were a threat to public waters).

AIS Programs & Activities

- **Aquatic Nuisance Species Program, South Carolina Department of Natural Resources (SCDNR) and the South Carolina Aquatic Plant Management Council.** SCDNR, in coordination with the Council, develops and implements an annual management plan for the state, which includes identification of problem areas, a management strategy for the problem areas, and a budget. Management strategies include chemical controls, environmental controls (e.g., water draw-down in lakes, nutrient loading), surveys for invasive species, biological controls, and mechanical harvesting. The annual management plan is submitted for a 30-day public review period in which all comments received are addressed and modifications are made to the plan.
- **Analytical and Biological Services, Santee Cooper (South Carolina Public Service Authority, a quasi-public entity).** Santee Cooper actively surveys for aquatic invasive plants on Lakes Marion and Moultrie. All control operations are approved by and coordinated through the state Aquatic Plant Management Plan. The Water Quality Monitoring Program tests the water 2-3 times a week and will report invasive species and conducts aerial aquatic plant surveys of the lake system annually. Control efforts for hydrilla include the stocking of sterile grass carp. For water hyacinth, herbicides are sprayed from a helicopter or airboats as needed. For alligatorweed and water primrose, spot chemical treatments are applied as needed.

Climate Change Concerns Reported by State Personnel

- Some plant species that are sensitive to cold weather, such as water hyacinth and water lettuce, have started to move north and inland in recent warm years.

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Statewide mapping of the range of invasive species or a "census" of invasive species, so that control programs can map their progress in controlling and eradicating pests.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
SOUTH DAKOTA

AIS Management Plan

No plan available.

AIS Programs & Activities

- **South Dakota/Nebraska Purple Loosestrife Management Committee, Wildlife Management Institute and South Dakota Department of Agriculture (SDDA), as well as counties, federal agencies, local agencies, universities, and other South Dakota and Nebraska state agencies).** The Committee developed a large-scale purple loosestrife biocontrol rearing and redistribution facility and several satellite locations that are being managed by local county weed and pest personnel. Control is conducted using purple loosestrife biocontrol beetles and aerial and ground spraying with Round-Up.
- **Tamarisk Mapping, SDDA – Office of Agricultural Services.** The Office of Agricultural Services conducts a mapping project and a cooperative management program for tamarisk control and, where possible, eradication. There is a tamarisk task force for Lake Oahe. The Office has released bio-control agents and placed Tamarisk on the South Dakota noxious weed list.
- **Western Zebra Mussel Task Force**, **South Dakota Game Fish and Parks Department (SDGFP).** The Department provides dock signage describing how boaters can prevent spread of zebra mussels and other aquatic exotics and is monitoring Lewis and Clark Lake. Education efforts focus on prevention. Biologists and private citizens sample and monitor for zebra mussels.
- **Western Regional Panel, SDGFP, U.S. Fish and Wildlife Service (U.S. FWS) Regional Fisheries Program.** The Program has carried out a variety of activities: (1) Hosted the Missouri River Basin/Lewis & Clark Bicentennial ANS workgroup meeting that discussed information/education and outreach strategies to prevent the introduction and spread of ANS in the Missouri River basin; (2) Revised bait regulations in the South Dakota Fishing Handbook to limit the type and amount of bait that may be transported into South Dakota (it is working on regulating the harvest of bait below Gavin's Point Dam on the Missouri River where Asian carp have become well-established); (3) Working on the installation of at least two Traveler Information Systems (TIS) along the Missouri River. A TIS station would broadcast a message regarding ANS and some other topic of interest (boat ramp condition, Lewis & Clark events); (4) Installation of ANS sign at boat ramps; (5) Working with an SDGFP information specialist to send out a mailing packet to all state resident fishing license holders (including information regarding ANS, ANS ID cards, adhesive tape measures with ANS prevention message, etc.); and (6) Research and monitoring on Asian Carp movement.
- **Influence of an introduced diatom (*Didymosphenia geminata*) and directed control measures on the biological community composition of Rapid Creek, SDGFP.** A study is currently being developed to examine the impact of *Didymosphenia geminata* on benthic and fish community composition of Rapid Creek below Pactola Dam. Research will also study the effects of control measures (localized nutrient enrichments) on *Didymosphenia geminata* distribution and overall stream biological community composition.

Climate Change Concerns

- Originally the state did not think tamarisk could survive in warm temperatures, but it seems to be adapting.
- The state's five-year drought has led to a severe increase in the population of tamarisk. When water shrinks back from the edge of lakes or rivers, tamarisk is able to grow in this habitat.

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- More on-the-ground surveys and more plant recognition capability.

- Monitoring efforts to identify rise in mussel activity.
- Distribution of information to those that use the water bodies. Outreach and education is currently on a project-by-project basis (lack of capacity is a big problem).
- Understanding of curly leaf pondweed biological impacts on lake ecosystems.
- Targeted monitoring for ANS presence in lakes throughout South Dakota.
- Development of a rapid response strategy for ANS detection and management in South Dakota.
- An overall strategic plan for ANS, extending beyond the responsibilities of SDGFP and which incorporates involvement from federal, state, local and private interests throughout the state.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
TENNESSEE

AIS Management Plan

No plan available.

AIS Programs & Activities

- **Aquatic plant management, Nickajack Reservoir, The Tennessee Valley Authority (TVA) and Marion County.** Aquatic plants are managed in near-shore areas along developed shorelines and to maintain access lanes to open water. Management is primarily for hydrilla and in accordance with a stakeholder-developed plan that prescribes the use of herbicides in near-shore areas (with a state permit), mechanical and manual harvesting.
- **Aquatic plant management, Chickamauga Reservoir, The Tennessee Valley Authority (TVA) and private homeowners.** Aquatic plants (spinyleaf naiad and other species) are managed in near-shore areas along developed shorelines and to maintain access lanes in accordance with a stakeholder-developed plan that prescribes private shoreline property owners to use herbicides in near-shore areas (with a state permit) and TVA to mechanically harvest aquatic invasive plants.
- **Monitoring and eradication, Obed Wild and Scenic River.** Authorities monitor for purple loosestrife and eradicate (harvesting, chemical) as needed. They also monitor for exotic mussels, including zebra mussels.
- **Fish monitoring, University of Tennessee.** The University is collecting fish for a project that involves mapping species communities in rivers and streams across the state, including all non-native or invasive species.
- **Eradication and restoration, Warner Parks (Metro Park System), Tennessee Department of Agriculture, Cumberland River Compact Association, Harpeth River Watershed Association, Natural Resources Conservation Service, Friends of Warner Park, and the Eagle Scouts.** The group is conducting in a restoration project along Harpers River, where heavy traffic causes riparian buffer damage. Activities include: rebuilding the buffer, stopping mowing, fencing off the area, removing invasives, and transplanting native species. Monitoring, removal, and replanting will likely continue as needed.
- **Monitoring and control, Metro Park System, Belmont University.** Monitoring and manual removal of garlic mustard plant is being conducted around the Shelby Bottoms section of the Cumberland River.
- **Species removal and restoration, Great Smoky Mountains National Park, National Park Service, U.S. Environmental Protection Agency, Tennessee Wildlife Resources Agency, North Carolina Wildlife Resources Commission, Tennessee Department of Wildlife and Conservation, Trout Unlimited National, Federation of Fly Fishermen, and others.** Rainbow trout populations in select stream segments above natural barriers are being removed with the fish toxicant antimycin or using backpack electrofishing. Monitoring continues for 1-2 years and then, if rainbow trout have not returned, brook trout (native) are reintroduced.
- **Eradication, Big South Fork National Recreation Area.** Riparian invasive plants are treated chemically.
- **Eradication Program, Oak Ridge National Laboratory (ORNL).** The ORNL manages non-native invasive plants in the riparian zones of streams within the Oak Ridge Reservation. Control methods include application of various herbicides, cutting, and mowing. Target species include privet, autumn olive, kudzu, lespedeza, princess tree, mimosa, and tree of heaven. ORNL also monitors fish and aquatic invertebrates in the streams, recording abundance and distribution of native and non-native species. The National Park Service and The Nature Conservancy conducted a complete vascular plant inventory at the park, which formed the basis of which species should be targeted for removal. The Tennessee Exotic Pest Plant Management Manual was also consulted.

Climate Change Concerns

- Barrens Top Minnows usually live in springs, but the mosquito fish is invading. This mostly concerns the effects of altered habitat as springs have been opened up to sunlight and other waterways as a result of humans.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Investigation of the effects that the western mosquito fish is having on efforts to reintroduce the barrens top minnow in Western Tennessee. Researchers want to determine the relationship between the two species and what they can do to alleviate some of the problems.

Research Needs

- Research on the ozone effects on Barrens Minnow.
- More research on the hemlock wooly adelgid, a potentially problematic species for native hemlock and fish populations.
- More monitoring.
- Assistance with the current EPA re-registration of antimycin.
- More information on burning as a control method.
- More information on interactions between chemicals and other native animals/plants in the area.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
TEXAS

AIS Management Plan

***Aquatic Vegetation Management in Texas: A Guidance Document*, Texas Parks and Wildlife Department – Inland Fisheries.** (A draft *Texas State Comprehensive Management Plan for Aquatic Nuisance Species* is under review and awaiting approval by the Governor.)

AIS Programs & Activities

- **Golden Alga Task Force/Kills and Spills Team, Texas Parks and Wildlife Department – Inland Fisheries.** The program responds to fish and wildlife kills and pollution incidents, minimizes environmental degradation, conducts compensation, repair, and restoration for environmental damage, and monitoris golden alga levels. The program also provides education on the relationship between water quality, habitat, and living organisms.
- **Aquatic Habitat Enhancement Program, Nuisance Vegetation Control, Texas Parks and Wildlife Department – Inland Fisheries.**
- **Texas Invasive Species Coordinating Committee is being formed as of December 2006 and will involve eight state agencies.**

Climate Change Concerns

- Warmer winters and lack of freezing winter temperatures may contribute to the persistence and spread of introduced invasive aquatic vegetation species such as water hyacinth, giant salvinia, and common salvinia.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Research on golden alga, including the use of clay treatments to control golden alga blooms, economic impacts of golden alga fish kills on the Possum Kingdom area, monitoring of water quality during a bloom on Lake Whitney, examination of genetics and developing diagnostic determinations for events using genetic markers, the use of barley straw to control outbreaks, and determination of nutrient and water quality parameters that influence bloom and toxin formation.
- Research to determine the viability of a bio-control agent (*Cyrtobagous salviniae*) for giant salvinia (*Salvinia molesta*). Research will examine propagation, reproduction, dispersal rates, and potential of bio-control in long-term control and management.
- Research to evaluate the effects and duration of an extended summer and fall drawdown on invasive aquatic vegetation species on BA Steinhagen Reservoir in East Texas.
- Tracking of grass carp in Lake Austin, Lake Conroe, and the Rio Grande.
- Evaluation of giant salvinia weevil in Toledo Bend Reservoir and Lake Conroe.
- Evaluation of impacts of *Arundo donax* on fishes of the Rio Grande.
- Research on applesail (*Pomacea spp.*) in southeast Texas, including the geographic range of the apple snail invasion in southeast Texas, taxonomy, and ecology.

Research Needs

- Research on golden alga control techniques and toxin production, analytical methods to define toxins, and frequency and regularity of its occurrence.
- Research on the effects of golden alga on the recruitment of fish, soil conditions and runoff, and nutrient loading.
- Testing of natural algaecide compounds.
- Transferable methods to estimate the economic impacts of fish kill events on communities.
- Research on hydrilla and flooding.
- Research on the impact of drought on water hyacinth and hydrilla.
- Research on the physiology and pathways of the grass carp, and how it relates to hydrilla control.

- Research on evapotranstiration rates for *Arundo donax* and salt cedar, as compared to native vegetation rates.
- Research on the impacts of *Arundo donax* infestations on channelization and stream fishes.
- Remote sensing and acreage estimations for *Arundo donax*, salvinia, water hyacinth, waterlettuce, saltcedar, etc.
- Research on the impacts of Eurasian watermilfoil weevils on *Myriophyllum spicatum* in the Rio Grande.
- Research on apple snail infestations of Texas rice crops and native riparian vegetation.
- Evaluation of Chinese tallow control efforts.
- Research on the impacts of grass carp on the Galveston Bay Ecosystem.
- Research on the impacts of *Arundo donax* wasps on giant reed populations.
- Research on the conditions for hydrilla expansion.
- Monitoring and tracking of aquatic invasive species in freshwater and estaurine systems to facilitate early detection and rapid response.
- Research on the ecological, social, and economic impacts of emerging aquatic invasive species in Texas' coastal watersheds, bays and estuaries.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
UTAH

AIS Management Plan

No plan available. (The state has adopted a memorandum of understanding with objectives to "[d]evelop a strategic plan to prevent the introduction and spread of ANS within Utah Waters;...[i]mplement the approved action plan;…[coordinate] a cooperative program of long-term ecological monitoring, assessment, and control of ANS in water bodies under the jurisdiction of the individual Cooperators;…[and] [m]eet annually and provide a forum.")

AIS Programs & Activities

- **Monitoring Program, Utah Department of Natural Resources – Division of Parks and Recreation and Division of Wildlife Resources.** The program inventories 15-20 waters annually for zebra mussels, educates drivers of vehicles from areas of known zebra mussel infestations, encourages boat washing at the Division's expense, and inspects ten percent of boats for infestations. The program also posts public alert signs at major recreational waters, includes aquatic nuisance (ANS) information inserts in boat re-licensing packets, and prints and distributes ANS brochures to major boating information centers, boat dealers, and sporting goods outlets. New Zealand mud snail brochures have also been printed. The Program also surveys docks and buoys at the end of each summer season for signs of mussels, snails, and Eurasian watermilfoil. Finally, the program maintains kiosks and posts information about anglers' responsibilities in keeping boats clean.
- **Recovery Program, State of Colorado, State of Utah, U.S. Fish and Wildlife Service, and Colorado State University.** The Program conducts research, removal and relocation to area fishing ponds wherever appropriate and practical, as well as euthanization of invasive fish.
- **Biosecurity Measures, Utah Division of Wildlife Resources.** Biosecurity measures have been standardized for all aquatic personnel conducting surveys and sampling within Division in order to prevent the movement of aquatic nuisance species between habitats.
- **Hatchery Monitoring, Utah Division of Wildlife Resources**. In addition to monitoring public and private waters for ANS, the Division has been actively engaged in monitoring state-owned hatcheries for ANS. Whirling disease is a particular concern as there have been three infected hatcheries. Mammoth Creek Hatchery has been reconstructed and disinfected. Reconstruction on Midway Hatchery will begin in the winter of 2007. The Division also has submitted a proposal to construct sand filtration and UV exposure systems for water sources that feed into the Springville Hatchery.
- **New Zealand Mud Snails Cooperative Studies, Utah State University.** An on-going study at Utah State University is focusing on interactions between the New Zealand mud snail and trout in the Green River. Recent reports indicate that trout may help spread the snail.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

- Research on the New Zealand mud snail.
- Research on ways to prevent the spread of the zebra mussel.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
VERMONT

AIS Management Plan

No plan available.

AIS Programs & Activities

- **Aquatic Nuisance Control Program, Vermont Department of Environmental Conservation (VT DEC).** The program's goal is "to prevent or reduce the environmental and socio-economic impacts of nuisance (primarily non-native) aquatic plant and animal species." The program's seven sub-programs include:
  (1) The Aquatic Nuisance Species Watchers Program – includes training for interested volunteers to assist in early detection (species identification, lake searches, and communication of the status of nuisance species);
  (2) The Purple Loosestrife Biocontrol Program – includes on-the-ground management and control activities such as: leaf-eating beetles (*Galerucella spp.*), a biocontrol; selection of sites; obtaining landowner permission; monitoring; increasing public knowledge; raising and releasing beetles; and compiling and summarizing activities and findings;
  (3) The Water Chestnut Management Program – includes on-the-ground management and control activities such as: mechanical harvesting, hand pulling, surveying, education, and outreach;
  (4) The Eurasian Watermilfoil Biocontrol Program – includes on-the-ground management and control activities such as: weevil introductions and augmentations as a biological control agent for Eurasian watermilfoil;
  (5) The Grant-in-Aid Program – provides financial assistance to municipalities and agencies for the control of Eurasian watermilfoil, as well as ANS spread prevention, mechanical control of nuisance native plant populations, and management of purple loosestrife;
  (6) The permitting program for mechanical and chemical control of invasive species; and
  (7) Spread prevention.
- **Alewife Monitoring, Vermont Department of Fish and Wildlife (VT DFW).** Since the discovery of this aquatic invasive fish species in Lake Champlain in 2004, monitoring activities on Lake St. Catherine and downstream waters has ceased as has research on control or eradication measures. Instead, activities now focus on monitoring the spread and increase of alewife in Lake Champlain. Emphasis is on AIS public education and outreach.
- **Regulatory Development, VT DFW - Aquatic Nuisance Species Team**. The VT DFW ANS Team works to create new rules and regulations or amendments to existing rules and regulations that work to prevent or reduce the risk of aquatic exotic species introductions. In the past, existing rules pertaining to the baitfish industry were revised and included the creation of a permitting program for the importation, harvesting, and sale of baitfish. A baitfish identification booklet was also published. Currently, two regulations are being drafted—one pertains to general fish importation where the intent is to stock the fish and the second adopts prohibited, restricted, and unrestricted fish species lists and a permitting requirement on the importation of fish species regardless of intent. This rule will also pertain to the aquarium trade.
- **Public education and outreach, VT DFW.** Efforts to increase public awareness of exotic species issues, concerns, and risks are ongoing. Activities include work with the baitfish industry to write and adopt HACCP planning protocols into their daily operation.
- **Sea Lamprey Control Program, VT DFW, New York Department of Conservation, and U.S. Fish and Wildlife Service.** The program uses a variety of methods to control sea lamprey, including trapping adults in smaller spawning streams, constructing and maintaining barriers on certain streams to prevent sea lampreys from reaching spawning areas, and periodically using chemical lampricides to kill young sea lampreys in larger streams and rivers.
- **Lake Champlain Zebra Mussel Monitoring Program, VT DEC and Lake Champlain Basin Program.** Project activities include: (1) Monitoring the distribution and abundance of zebra mussel larvae, juveniles, and adults; (2) Determining the occurrence of new colonization in Lake Champlain, tributaries, and inland lakes and incorporating this information into a database; (3) Determining appropriate management responses and assessing the effectiveness of spread prevention or control measures; (4) Informing the public, water treatment facility operators, and marina managers about zebra mussels so that appropriate spread prevention and control measures are taken; (5) Providing technical assistance on the design and operation of zebra mussel monitoring

programs; (6) Documenting water quality parameters pertinent to zebra mussel survival; (7) Producing a report that documents the findings of the Lake Champlain Zebra Mussel Monitoring Program; and (8) Maintaining the Lake Champlain Zebra Mussel Monitoring Program website.

- **Lake Champlain Basin Aquatic Nuisance Species Management Plan, VT DEC and New York Department of Environmental Conservation, in cooperation with state and federal agencies, regional bodies, and nongovernmental organizations.** The plan focuses on facilitating the coordination of ANS management efforts, providing opportunities for federal cost sharing, and implementation.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Research continues to develop new non-chemical control methods to reduce reliance on lampricides.

Research Needs

- Research is needed on the following: current distribution of specific species; specific impacts of ANS on ecosystems and native species; economic impacts of ANS; appearance of *Phragmites* where beetles have reduced the presence of purple loosestrife; impacts of ANS in other states and effectiveness of control programs; time and resources needed to review applications and monitor for new aquatic species; sea lamprey control technology; using pheromones to lure lampreys; and densities of mussels throughout its life stages and the effect of filtering on plankton populations.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
VIRGINIA

AIS Management Plan

No plan available. (State invasive species management plan includes section on AIS in addition to terrestrial species.)

AIS Programs & Activities

- **Cooperative Project, Virginia Department of Conservation and Recreation (VDCR) and Virginia Native Plant Society.** The project seeks to: identify alien plant species that have the potential to become invasive; document threats; coordinate with other agencies and organizations to identify mutual concerns; develop solutions; and develop and implement sound practices for the control of invasive alien plants in natural areas.
- **Snakehead Sampling (monitoring program), VDIGF.** The program involves intensive sampling in one to two small creeks or streams.
- **Legislation, Virginia Legislature.** The Aquatic Invasive Species Act increased criminal and civil penalties and gave the Board authority to add additional aquatic nuisance species. The law applies to any species with the potential to cause statewide impact.
- ***Phragmites* Control, VDCR, in conjunction with VDIGF, U.S. Fish and Wildlife Service, The Nature Conservancy, National Park Service, U.S. Department of Defense, and Virginia Institute of Marine Science.** VDCR has mapped the distribution of *Phragmites* and targets certain areas for control efforts, which include the aerial application of herbicides.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Snakehead research, including the identification of sampling areas, testing of sampling methods, and study of population genetics.
- Mapping of *Phragmites* distribution.

Research Needs

- Research on pathways and incentives (i.e., why people introduce invasive species) in order to educate the public and influence behavior.
- Research on natural diseases or parasites for the snakehead, as well as methods to capture, control, and/or eliminate the species.
- Research on habitat and existing herbicides.
- Research on how wildlife use *Phragmites*.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT WASHINGTON

AIS Management Plan

Aquatic Nuisance Species (ANS) Management Plan (October 2001). The 2001 plan has six objectives: (1) Coordinate all ANS management programs within Washington and collaborate with regional, national and international ANS programs; (2) Prevent new ANS introductions into Washington waters; (3) Detect, monitor, control, or eradicate of nonnative invasive species; (4) Educate appropriate resource user groups about the importance of preventing the introduction and spread of ANS and how their harmful impacts can be reduced; (5) Research ANS priority species in Washington to better understand the risks and threats associated with invasions; and (6) Create Washington State ANS rules and regulations to ensure that legislation efficiently promotes the prevention and control of ANS in coordination with federal regulations. The Aquatic Nuisance Species Committee recently initiated a complete plan revision and update and anticipates having the final updated version available by October 2007.

AIS Programs & Activities

- **Aquatic Weeds Program, Washington Department of Ecology (Ecology).** The agency provides education, technical assistance, and financial assistance to governments and local lake groups to help them manage the problems caused by invasive non-native freshwater plants. The agency offers grants as "seed" money to initiate freshwater invasive plant species eradication and control projects. Several eradication and control strategies are used, including: hand pulling and bottom barrier installation, aquatic herbicide treatment (2,4-D, fluridone, triclopyr, imazapyr, glyphosate, endothall, diquat), triploid grass carp, diver dredging, harvesting, rotovation, and water level drawdown. Eurasian Watermilfoil, Brazilian elodea, hydrilla, fragrant water lily, yellow flag iris, purple loosestrife, and many other state-listed noxious weeds are eligible for grant-funded projects. As a result of this program, Eurasian watermilfoil has been eradicated from seven water bodies and many lake groups are keeping milfoil at such low populations that it no longer is posing a threat to recreation and the environment. Ecology is also funding research into the impacts of aquatic herbicides on salmonids (University of Washington), conducting research on "test" lakes after herbicide treatment, and has an ongoing project on biological control for Eurasian Milfoil (weevils).
- **Prevention Program, Washington Department of Fish and Wildlife (WDFW).** The Program focuses on prevention activities for (1) ballast water, (2) recreational watercraft, and (3) aquatic plant and animal suppliers. The *Recreational Watercraft Program* (Bill 5679) puts a fee on recreational boats. The *Aquatic Plant and Animal Suppliers Program* classifies species into three categories: Prohibited, Regulated, and Unregulated. Activities include sending enforcement officers to inspect pet stores and issue tickets to regulate the release of invasive species and regulating the importation of prohibited species. Washington has list of aquatic invasive species that cannot be sold.
- **Control programs, WDFW.** This program focuses on controlling and eradicating invasive tunicates found in several locations around Puget Sound.
- **Early Detection and Rapid Response Program, WDFW.** An Early Detection and Rapid Response Plan has been developed by the Aquatic Nuisance Species Committee. A Memorandum of Agreement (MOA) is currently being drafted between all the natural resource agencies in the state that will be implementing the program. In the case of new species introduction, the MOA will designate a lead agency, funding source, and process for managing the new species.
- **Invasive plant control programs, Washington Department of Agriculture.** The Department leads the state's effort to monitor for and eradicate invasive Spartina infestations. The WDFW and Department of Natural Resources also participate in this program. The Program also monitors other invasive plants including purple loosestrife and various non-native invasions of knotweed. The department also controls the introduction and spread of invasive plants and disease organisms through its quarantine program.
- **State Noxious Weed Control Board.** The Board lists state noxious weeds and works with local weed boards and landowners to control and eradicate invasive aquatic plants infesting private property.
- **Puget Sound Action Team**. The team's staff coordinates and supports a number of activities, including staffing the state Ballast Water Committee, and coordinating the state's response to eradicate invasive tunicates recently found in Puget Sound. In 2006, the Governor and the Legislature provided emergency and supplemental funds to eradicate invasive non-native tunicates. In addition, the Action Team and its advisors on

the Puget Sound Council develop a two-year plan and budget to protect and restore Puget Sound, including actions to prevent and control invasive aquatic plants and animals. The plan and budget became part of the Governor's budget to fund activities in the Puget Sound basin.

- **Invasive Species Council.** The 2006 Legislature created this policy level Council to coordinate among state agencies on aquatic and terrestrial invasive species issues. The Office of the Interagency Committee staffs this Council. The Council will prepare a long range strategy for managing invasive species in the state.

Climate Change Concerns

- Climate change will likely expand the range of some of AIS.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Ecology is funding the University of Washington to conduct research into the sub-lethal impacts of aquatic herbicides on salmonids.
- Washington State University is conducting herbicide field trials for parrot feather, yellow flag iris, and hairy willow-herb.

Research Needs

- Information on the types of legislation that may be enacted and on possible funding sources. For example, a state that wants to take a pathway approach for recreational watercraft could benefit from a list of programmatic approaches and a list/summary of state laws, so that states can understand their options.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
WEST VIRGINIA

AIS Management Plan

No plan available.

AIS Programs & Activities

- **Monitoring and Control, West Virginia Department of Agriculture (WVDA).** The department surveys and maps hydrilla in selected locations and monitors a beetle released to combat the hemlock wooly adelgid.
- **Control, USDA Forest Service, WVDA, and The Nature Conservancy (with grant funds from West Virginia Advisory Board)**. The program focuses on control of non-native, invasive species.
- **Appalachian Highlands Invasive Species Project, The Mountain Institute (with grant funds from West Virginia Advisory Board).** The project includes research, education, and a demonstration site to develop control methods that may then be used to grow native plants and restore the area.
- **Monitoring, Control, and Eradication, U.S. Fish and Wildlife Service (U.S. FWS), USDA Natural Resources Conservation Service, West Virginia Department of Forestry, West Virginia Department of Environmental Protection, West Virginia Division of Natural Resources (WVDNR), as well as county and city councils, local garden clubs, and volunteers.** The program identifies and monitors species, educates volunteers, and manages and eradicates purple loosestrife by spraying chemical herbicides.
- **Control and Monitoring, WVDNR, USDA, and various states.** The program breeds and releases Garacella Beetles, which act as a biological control for purple loosestrife. Data on breeding, release, plant counts, and spread is collected bi-annually.
- **Monitoring, WVDNR (with grants from the USDA Cooperative Annual Pest Survey).** The program includes general monitoring and weed surveys of pest plants across the state. Field scouts are trained to search for the invasive species, which are then mapped.
- **Monitoring, U.S. FWS and WVDNR.** The program conducts quantitative monitoring for zebra mussels and sampling to estimate biomass and populations.
- **Monitoring amd Research, WVDNR.** The program maps the distribution of invasive crawfish in state rivers.
- **Regulation, WVDNR.** The agency requires a permit to stock triploid grass carp in private ponds and any warm water species of fish into public waters.

Climate Change Concerns

- Effects of climate change on species.

Climate Change Actions

(None reported.)

Research Activities & Information Used

- Mapping and monitoring.

Research Needs

- Further development of control and eradication methods.
- More specific information on the distribution of hydrilla in the state.
- Information on invasive plants (mile-a-minute, Japanese knotweed) and biocontrols.
- More effective plant mapping.
- More cooperation between agencies to pool information.
- Comprehensive ways to determine if a plant is invasive.
- Better understanding of methods to pursue once mapping is complete (e.g. eradication, control of species, etc.)

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT WISCONSIN

AIS Management Plan

Wisconsin's Comprehensive Management Plan To Prevent Further Introductions and Control Existing Populations of Nonindigenous Aquatic Nuisance Species (2003). The plan focuses on the following priority species: purple loosestrife, Eurasian water milfoil, curly leaf pondweed, zebra mussels, ruffe, rainbow smelt, common carp, rusty crayfish, round goby, reed canary grass, and *Cylindrospermopsis raciborski* (a blue green algae). The plan has three major goals: (1) Implement procedures and practices to prevent new introductions of aquatic invasive species into Lakes Michigan and Superior, Wisconsin's boundary waters (the Mississippi and St. Croix Rivers), and the inland waters of the state; (2) Establish management strategies to limit the spread of established populations of aquatic invasive species into un-infested waters of the state; and (3) Abate harmful ecological, economic, social and public health impacts resulting from infestation of aquatic invasive species, and where possible, eliminate those impacts.

AIS Programs & Activities

- **Aquatic Plant Management Program, Wisconsin Department of Natural Resources (WDNR).** The program seeks to control efforts for Eurasian watermilfoil and curlyleaf pondweed through weed harvesting or spot chemical treatment, as well as some biological control for Eurasian watermilfoil.
- **Aquatic Invasive Species Program**, **WDNR.** The program conducts the following activities: (1) *Watercraft Inspection*, including the dissemination of information to anglers and boaters that identifies aquatic invasive species and what precautions to take, visual inspection and demonstration of the proper steps to clean boats and equipment, and the installation of signs informing boaters of infestation status, state law, and steps to prevent spreading aquatic invasives; (2) *Monitoring* for zebra mussels (including collection of samples for veliger analyses and deployment of substrate samples), Eurasian watermilfoil (including inspection of watercraft or shorelines for invasive plants), spiny waterfleas, rusty crayfish, and curlyleaf pondweed; (3) *Clean Boats, Clean Waters Volunteer Program* (in cooperation with the University of Wisconsin-Extension and the Wisconsin Association of Lakes), which offers training on how to organize a watercraft inspection program, how to inspect boats and equipment, and how to interact with the public and encourages volunteers to help monitor for aquatic invasives; *Purple Loosestrife Biological Control* (in cooperation with the University of Wisconsin-Extension), which is a citizen-based project that emphasizes the use of two beetle species for biocontrol, in combination with traditional methods, and conducts some mechanical harvesting and monitoring of impact; and (4) *Information and Education* (in cooperation with the University of Wisconsin-Extension and Wisconsin Sea Grant), with a focus on working with resource professionals and citizens statewide to teach water users the steps to prevent transporting aquatic invasives, as well as addressing aquarium pet release and water gardening (educational tools include brochures and publications, watch cards and wild cards, public service announcements, and displays at parks, sport shows, state fair, conventions and symposiums).
- **Invasive Species Awareness Month (June), WDNR in cooperation with various nongovernmental organizations.** Workshops, field trips, lectures, and work parties are held statewide in June as part of Invasive Species Awareness Month for Wisconsin. Activities include AIS displays with handouts and experts on site.
- **Citizen Lake Monitoring Network (formerly Self-Help Citizen Lake Monitoring), WDNR, University of Wisconsin- Extension and Wisconsin Lakes Partnership.** With over 1,200 trained citizen volunteers statewide, project goals are to collect high quality data, to educate and empower volunteers, and to share data and knowledge. Volunteers learn to identify exotics and are the eyes for water biologists in helping to monitor the state's 15,081 lakes. Volunteers monitor for Eurasian water-milfoil, curly-leaf pondweed, purple loosestrife, rusty crayfish, zebra mussels, and waterfleas.
- **Wisconsin Invasive Plants Reporting & Prevention Project, WDNR, University of Wisconsin, Wisconsin State Herbarium, and others.** The initiative focuses on early detection/rapid response. Special public recognition is given to those who are among the first to find new invasive species in Wisconsin. In addition, collected specimens become part of the permanent collection of the Wisconsin State Herbarium.
- **Aquatic Invasive Species Grants, WDNR.** This program awards grants to local municipalities, on a 50 percent cost-share basis, for AIS control, including prevention, eradication of pioneer populations, planning and education, and restoration.

Climate Change Concerns

- Over the next century many species found in northern Illinois could survive in Wisconsin. New species may take over with any shift in climate, particularly if native species cannot adapt. Fish are especially vulnerable. For example, trout have a narrow tolerance range for temperature; if the temperature in headwater streams rises by three to five degrees, those trout may be threatened and niches may open up for AIS such as Asian carp.

Climate Change Actions

- John Magnuson, Emeritus Professor at the Center for Limnology, has been funded to study climate change impacts.

Research Activities & Information Used

- Studies have been conducted on biocontrol (native beetles) for Eurasian Watermilfoil.
- Pilot tests have been conducted on a dozen or more lakes to lessen the impact from AIS.
- Database management captures all monitoring data and watercraft inspection. Research on building a system is ongoing.
- Model predictions are being conducted to determine which lakes are more vulnerable to AIS.

Research Needs

- Research on hybrid watermilfoil. WDNR has discovered a hybrid of Eurasian watermilfoil (a cross between Eurasian and northern milfoil) and associated implications regarding control methods. The effects of chemicals on the hybrid are not fully understood. Research on the physical identification of the hybrid strains would also be useful. Because hybrids closely resemble Eurasian watermilfoil, currently the only way to identify is through genotyping, which is very expensive. Research on the origin of the hybrid would also assist in understanding how it is generated.
- Research on infestation. Determining how to predict which waters would be most vulnerable to infestations by AIS would help focus monitoring efforts. For instance, low calcium and Ph levels can hinder establishment and reproduction of zebra mussels.
- Management research on successful rapid response methods, i.e., trapping out crayfish to allow native species to rebound, control of rainbow smelt by dumping in more walleyes, and introducing bass to control crayfish.

SUMMARY OF AQUATIC INVASIVE SPECIES MANAGEMENT
WYOMING

AIS Management Plan

No plan available.

AIS Programs & Activities

- **Evaluation of the Efficiency and Efficacy of Non-Native Fish Eradication and Exclusion Techniques for Native Fish Restoration (2004-2005), Montana Fish, Wildlife, and Parks, Wyoming Game and Fish Department, U.S. Fish and Wildlife Service, and Yellowstone National Park – Wild Fish Habitat Initiative.** The project entails construction of fish barriers to prevent passage of non-native trout (particularly Brook Trout), as well as chemical treatments using the pesticides Animiasin and Rotenone.

Climate Change Concerns

(None reported.)

Climate Change Actions

(None reported.)

Research Activities & Information Used

(None reported.)

Research Needs

(None reported.)