

Invasive Species of Aquatic Plants and Wild Animals in Minnesota

**Annual
Report
2009**

*for the year
ending December 31*



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Invasive Species Program
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Preface

Each year, by January 15, the Department of Natural Resources (DNR) is required to prepare a report for the Legislature that summarizes the status of management efforts for invasive species (aquatic plants and wild animals) under its jurisdiction. Minnesota Statutes, Chapter 84D.02, Subd. 6, specify the type of information this report must include: expenditures, progress in, and the effectiveness of management activities conducted in the state, including educational efforts and watercraft inspections, information on the participation of others in control efforts, and an assessment of future management needs. Additional sections have been added to this report to provide a thorough account of DNR's Invasive Species Program activities and other activities related to invasive species of aquatic plants and wild animals.

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Invasive Species of Aquatic Plants and Wild Animals in Minnesota: Annual Report for 2009

Summary

The Problem

Invasive species have the potential to cause serious problems in Minnesota. Evidence from numerous locations in North America and from around the world demonstrates that these non-native species are a threat to the state's natural resources and local economies that depend on natural resources.

Status of Invasive Species in Minnesota: 2009

Aquatic Plants

Eurasian watermilfoil was discovered in 12 additional water bodies during 2009. The total number of milfoil infested water bodies is 232.

Purple loosestrife was found in 15 new sites in 2009, bringing the total number of known infestations to 2,394.

Curly-leaf pondweed is known to occur in 759 lakes in 70 Minnesota counties.

Flowering rush was found in three additional locations—Lake Minnetonka and Minnehaha Creek in Hennepin County and Sauk Lake in Todd County.

Brazilian waterweed was found in Powderhorn Lake in Minneapolis in 2007 and was treated with an herbicide. No plants were found here in 2008 or 2009.

Wild Animals

Zebra mussels were discovered in eight new inland lakes in 2009 (see Regional Updates for more information). They are currently found in 16 inland lakes, isolated areas of Lake Superior, the Mississippi River from Crow Wing County to the Iowa border, the St. Croix River from Stillwater downstream, Pelican Brook, and the Zumbro River downstream from Lake Zumbro (Figure 1).

No new **New Zealand mudsnail** infested waters were discovered in 2009.

Spiny waterfleas were discovered in Lake Mille Lacs and continue to spread along Minnesota-Canada border waters.

Chinese and banded mystery snails are being reported in Minnesota waters—more than 90 occurrences of the Chinese mystery snail and 60 occurrences of the banded mystery snail have been reported.

Faucet snails are currently found in three lakes including Winnibigoshish (Cass County), Upper Twin (Hubbard County) and Lower Twin (Wadena County), in the Shell River (Wadena County) and the Mississippi River near La Crosse, WI.

Mute swans were found at 12 locations in 2009. A total of 14 birds were reported in the wild.

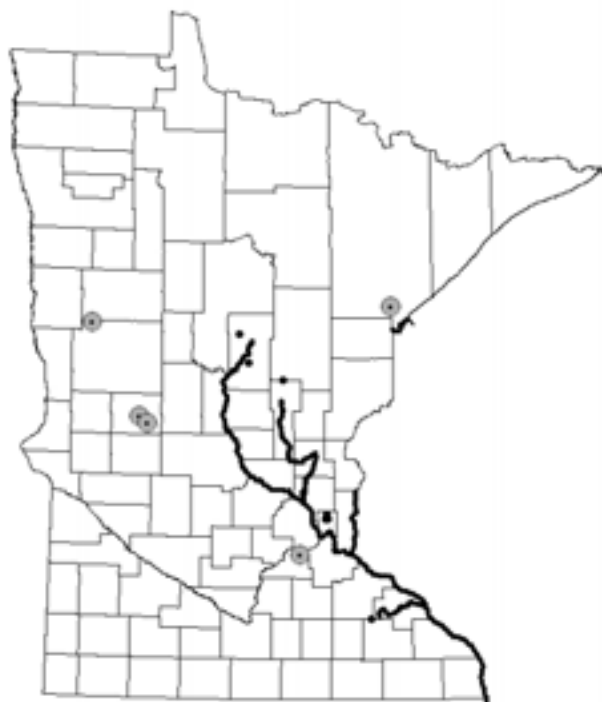


Figure 1. Zebra mussel infested rivers and lakes in Minnesota as of November 2009. Gray circles indicate new infestations in 2009.

The Response

To address the problems caused by invasive species, the 1991 Minnesota Legislature directed the Department of Natural Resources (DNR) to establish the Invasive Species Program and to implement actions to monitor and manage invasive species of aquatic plants and wild animals.

Program Goal Highlights

1. Prevent introductions of new invasive species into Minnesota

Keeping new invasive species out of Minnesota is a high priority for the environment and the state's economy. New introductions are costly to manage and may become perpetual problems.

Regulations

State statutes now allow the designation of infested waters via DNR Commissioner's Order instead of rulemaking. New waters were assigned through three orders. Outdated permanent rules that listed infested waters were repealed through the process for eliminating obsolete rules.

Education

Education efforts explain the risks posed by invasive species and the steps that people and businesses can take to prevent new introductions. New education efforts, including training sessions, presentations, and informational materials, were offered to the public and bait dealers to help raise awareness about aquatic invasive species.

2. Prevent the spread of invasive species within Minnesota

Efforts to prevent the spread of invasive species within Minnesota are focused on people and their habits. After an invasive species becomes established in our lakes and rivers, a primary means for its spread to other waters is the unintentional transport on boats, trailers, and other recreational equipment. Prevention grants were provided to local entities to build partnerships and encourage local projects.

Watercraft inspections

In 2009, 80 watercraft inspectors worked through the summer to check boats and provide information to the public. Inspections began in late April and continued through mid-October in order to reach waterfowl hunters. Within this 25-week period, watercraft inspectors logged 42,000 inspection hours, inspected 66,000 watercraft, and distributed more than 9,300 Invasive Alert Tags. In addition, inspections were conducted at 48 fishing tournaments.

The Watercraft Inspection Program also worked cooperatively with eight lake associations and citizen groups to increase inspection hours in their areas. These citizen groups funded additional hours of inspection at their accesses and often matched them with DNR grants. The Invasive Species Program also provided training, equipment, and supervision. The Lake Minnetonka Conservation District (LMCD) worked with the Invasive Species Program for the eighth year. Inspectors spent an additional 1,563 hours on nine Lake Minnetonka accesses because of the funding provided by the LMCD.

Enforcement

Conservation officers spent 4,843 hours enforcing the invasive species laws and rules. Statewide, there were 57 civil citations, two criminal citations, and 16 written warnings issued to individuals for violation of invasive species laws. Conservation officers assisted with training local authorities in Hubbard County. This training was given to meet the training requirement that peace officers need in order to issue civil citations.

3. Reduce the impacts caused by invasive species

Grant program for control of aquatic invasive plants

The DNR increased funding for its pilot project grant program for lake-wide control of curly-leaf pondweed or Eurasian watermilfoil. Grants totaling \$536,000 were given to

26 lakes under this program for control efforts or for the collection of pre-treatment data. In addition, \$135,000 in grants was given to 22 lakes to control nuisance populations of Eurasian watermilfoil and flowering rush. New in 2009, grants were offered for management of new, small populations of Eurasian watermilfoil and flowering rush. These Early Detection and Rapid Response grants (EDRR) were awarded to three lakes totaling \$4,500.

Regional Updates

Region 1- Northwest

New infestations

- Zebra mussels were discovered near Alexandria in Lake Le Homme Dieu, Carlos and Geneva lakes as well as near Pelican Rapids in Pelican Lake and Lake Lizzie, downstream of Pelican Lake.
- Flowering rush was discovered in Sauk Lake near Sauk Centre.
- Faucet snails were discovered in Lake Winnibigoshish, its connected waters, Upper and Lower Twin lakes, and the Shell River below Lower Twin Lake.
- Eurasian watermilfoil was verified in two additional lakes—Town Line and Washburn—in Cass County.

Prevention activities

- Newly infested lakes were designated as infested waters; signs were posted on public boat access points
- Enforcement was increased around the infested lakes; watercraft inspections increased from 5,146 in 2008 to 7,954 in 2009.
- Contact was made with several private dock removal companies to discuss proper movement of equipment
- Grants totaling more than \$25,000 were provided to area associations for local prevention and awareness activities.
- The Union-Sarah Lake Improvement District was granted a permit to pump water out of the milfoil infested lake for flood control. Screening and pumping upgrades were required.

Management activities

- On Leech Lake, Eurasian watermilfoil was chemically treated in ten harbors and hand pulled in three harbors to reduce the risk of spread to new lakes.
- Technical assistance, surveys, and information were provided to lake groups with curly-leaf pondweed and Eurasian watermilfoil infested lakes including Washburn and Town Line lakes (Cass County). Upper Cormorant (Becker County), Blueberry (Wadena County), and Margaret lakes (Cass County) were included in the pilot program to evaluate lake-wide treatment of curly-leaf pondweed or Eurasian watermilfoil. Washburn Lake was chemically treated for Eurasian watermilfoil in year one of its infestation.
- The DNR continued to work closely with the Pelican River Watershed District, the city of Detroit Lakes, area lake associations, and riparian owners to find ways to

minimize the impacts of flowering rush. Lake-scale efforts to control the plant were implemented again in 2009. Small-scale efforts such as hand removal, harvesting, and chemical applications took place at the city beach.

Region 2 - Northeast

New infestations

- Zebra mussels were discovered in Pike Lake in St. Louis County near Duluth.
- Spiny waterfleas were discovered on Mille Lacs Lake in August. Eurasian watermilfoil was confirmed in Chub Lake (Carlton County) and Louise Mine pit near Crosby.

Prevention activities

- Enforcement efforts were increased on Mille Lacs Lake to educate the public about and to enforce invasive species laws. More than 1,100 hours of watercraft inspection were completed.
- At a sailing regatta near Brainerd, a watercraft inspector stopped a participant with an anchor that had attached zebra mussels from entering a non-infested waterbody.
- The Pelican Lakes Community Aquatic Invasive Species Task Force along with Minnesota Waters and the DNR sponsored four aquatic species seminars to train lake professionals.
- DNR conservation officers and invasive species staff trained bait dealers who applied for licenses to harvest minnows from Mille Lacs Lake. The dealers were taught how to tag nets, clean equipment, and properly dispose of water used to transport bait.

Management activities

- Dixon Lake (Itasca County) and Lower Cullen Lake (Crow Wing County) were added to the pilot program to control curly-leaf pondweed on a lake-wide basis. Both lakes were treated in late spring.
- Blackwater Lake (also known as the Cohasset Hot Pond), a bay on the Mississippi River that has had curly-leaf pondweed growth for many years, was treated with herbicide for the second year.
- Eurasian watermilfoil was confirmed in Sturgeon Lake (Pine County) in 2008. The local lake association applied for a DNR grant to treat the infestation in 2009, and received enough funding to cover the entire 10-acre treatment. The herbicide application took place in early July with good initial results.

Region 3 - Central

New infestations

- Zebra mussels were discovered in Prior Lake in April. Surveys confirmed established populations in several locations. This was the first popular boating lake in the metro area to be confirmed with zebra mussels.
- Flowering rush was discovered in Lake Minnetonka in late June.

Prevention activities

- Invasive species prevention was a primary theme at the Governor's Fishing Opener held at White Bear Lake in May.
- In response to the Prior Lake zebra mussel infestation, watercraft inspectors spent over 280 hours at the two accesses and completed over 1,400 inspections.
- Watercraft inspections increased by 10,000.

Management activities

- Early finds of flowering rush in Lake Minnetonka were treated in an attempt to control and prevent its spread. Subsequently, multiple other locations of flowering rush were found around the lake.
- 60% of the lakes that received DNR grants supporting pilot projects to control curly-leaf pondweed or Eurasian watermilfoil on a lake-wide basis were located in this region.
- 74% of the lakes that received DNR grants supporting control of Eurasian watermilfoil on a partial-lake basis to reduce interference with recreation and risk of spread were located here.
- The U.S. Army Engineer Research and Development Center continued monitoring the efforts of herbicide treatments of Eurasian watermilfoil in Gray's and Phelp's bays on Lake Minnetonka. Results of these efforts are helping the DNR and its partners evaluate the efficacy and also the potential risks of bay-wide treatments.
- Technical assistance, surveys, and information were provided to area lakes with curly-leaf pondweed or Eurasian watermilfoil or both. The lakes included the 31 that received DNR grants supporting management of these invasive aquatic plants, as well as a number of other lakes that did not receive grants in 2009.
- The DNR did not find any Brazilian waterweed in Powderhorn Lake in 2009. The DNR is cautiously optimistic that actions taken when the invasive aquatic plant was discovered in 2007 may have eliminated the plant. The DNR will continue to monitor the lake.

Region 4 - South

New infestations

- Eurasian watermilfoil was discovered on Lake Florida (Kandiyohi County) and in Little Mud Lake (Meeker County).

Prevention activities

- Watercraft inspections continued with a slight increase from 4,131 in 2008 to 4,307 in 2009.
- Several new projects were completed as the result of invasive species prevention grants and partnerships: additional signs were posted at three public accesses, a kiosk at three accesses explains the importance of cleaning boats when entering and exiting the public access area, and invasive species information was included in a newsletter, brochures, and a Web site.

Management activities

- Lake Benton completed its fifth year in the pilot program to control curly-leaf pondweed on a lake-wide basis. Starting in 2005, fluridone herbicide was applied yearly to reduce curly-leaf pondweed. In 2009, the herbicide was changed to endothall, which is more selective in targeting only the invasive species and ultimately promoting native plant growth. The program has been successful in reducing curly-leaf pondweed in biomass and the number of turions, but native plant growth has not yet re-established.
- The DNR worked with the Waterville Lakes Association and the city of Waterville to mechanically remove flowering rush from Sakatah Bay in Lake Sakatah.
- A Lake Vegetation Management Plan for Green Lake was completed in November. Local citizens and the DNR worked on a five-year plan.
- The Lake Florida Improvement Association applied for the Early Detection and Rapid Response Grant to treat Eurasian watermilfoil.

Coordination and Cooperation

State Invasive Species Plan- The “Minnesota State Management Plan for Invasive Species” was completed in late 2009 by the Minnesota Invasive Species Advisory Council, co-chaired by the Minnesota departments of Natural Resources and Agriculture. The plan provides a framework for addressing aquatic and terrestrial invasive species issues in Minnesota and includes strategies and actions to address the main invasive species issues. The plan reflects several years of work by many organizations from the local, state, tribal and federal government levels and nongovernmental organizations. Its completion and federal approval should lead to significant federal funds to implement it.

Revenue and Expenditures

Funding for the Invasive Species Program includes a \$5 surcharge on watercraft registered in Minnesota and a \$2 surcharge on non-resident fishing licenses (which makes up the Invasive Species Account), appropriations from the general fund account, Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources, and local contributions. These funding sources generated \$5,081,000 for all invasive species prevention and management activities for the 2009 fiscal year.

Aquatic invasive species spending (\$3,807,000) for fiscal year 2009 is shown in Figure 2. The Management/Control and Inspections/Enforcement categories account for 76% of aquatic invasive species spending. These two spending categories along with expenditures for Education/Public Awareness activities, reflect the importance the DNR places on efforts to prevent the spread of invasive species and to help manage the problems those species cause once they become established.

In addition, the Invasive Species Program received federal funds from the U.S. Fish and Wildlife Service and the U.S. Forest Service for a variety of research projects.

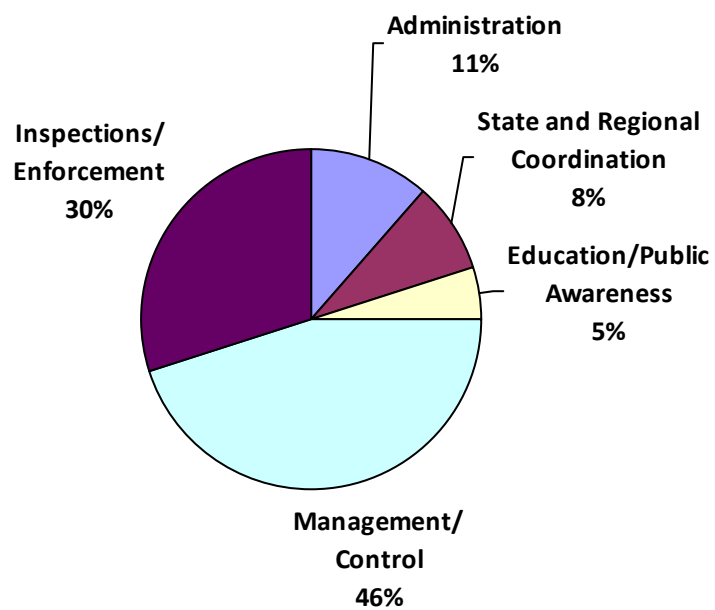


Figure 2. Aquatic Invasive Species Program spending (Invasive Species Account and General Fund only) in FY09 by major categories.

Introduction

Overview of DNR's Invasive Species Program

Invasive species have the potential to cause serious problems in Minnesota. Evidence from numerous locations in North America and from around the world demonstrates that these non-native species are a threat to the state's natural resources and local economies that depend on natural resources.

To address the problems caused by invasive species, the 1991 Minnesota Legislature directed the Minnesota Department of Natural Resources (DNR) to establish the Invasive Species Program and to implement actions to prevent the spread and manage invasive species of aquatic plants and wild animals. Single species programs preceded this comprehensive program. In 1987, the DNR was designated the lead agency for control of purple loosestrife, and in 1989, the DNR was officially assigned a coordinating role for Eurasian watermilfoil control (Minnesota Statutes 84D.02, Subd. 2).

The three primary goals of the DNR Invasive Species Program are to:

1. Prevent introductions of new invasive species into Minnesota;
2. Prevent the spread of invasive species within Minnesota;
3. Reduce the impacts caused by invasive species to Minnesota's ecology, society, and economy.

The DNR Invasive Species Program addresses many invasive species that are present in Minnesota such as Eurasian watermilfoil, purple loosestrife, zebra mussels, and spiny waterfleas (see Appendix A). The program also attempts to prevent the introductions of invasive species that have the potential to move into Minnesota such as hydrilla, water chestnut, and Asian carp. To do so, the Program identifies potentially invasive species in other areas of North America and the world, predicts pathways of spread, and develops and implements solutions that reduce the potential for introduction and spread (see Risk Assessment and Risk Management). Prevention efforts are often undertaken in collaboration with other states, agencies, and partners with similar concerns.

Most of the invasive species prevention and management activities are conducted or directed by staff from DNR's Division of Ecological Resources-Invasive Species Program (See Appendix B). In addition, the Invasive Species Program hires about 75 students during the summer to inspect boats at public water accesses and help implement management activities. Staff from the DNR divisions of Fish and Wildlife and Enforcement, as well as the Bureau of Information and Education, also contribute significantly to the implementation and coordination of invasive species activities. In total, the equivalent of over 20 full-time positions is focused on invasive species work.

The Program has begun to address terrestrial plant species on DNR-managed lands. Within the DNR, our goal is to enhance the ability of field staff to effectively manage terrestrial invasive plants on DNR-managed lands. Key strategies include: 1) coordinate inventories of public lands for invasive species; 2) gather, maintain, and share knowledge of integrated pest management (chemical, mechanical, and biological

control) for invasive terrestrial plants; 3) fund management efforts on state-managed lands; and 4) develop or improve management practices through research (i.e., biological control).

With invasive species issues continuing to grow and a heightened level of concern, the 2007 Minnesota Legislature increased the funding for invasive species from \$2.4 million to \$4.9 million annually. The increase in funding has allowed the Invasive Species Program to restructure to build capacity for the future, react quickly to new threats, and provide more support to those trying to manage invasive species. The DNR is expanding activities focused on both aquatic and terrestrial species. Specific target areas include:

- 1) expand grants to help groups manage invasive aquatic plants;
- 2) expand enforcement efforts by DNR conservation officers;
- 3) expand watercraft inspection program;
- 4) expand efforts to prevent the introduction of invasive aquatic invertebrates;
- 5) expand DNR's ability to monitor and manage invasive terrestrial plants growing on state lands and minimize the movement of invasive species associated with DNR activities;
- 6) expand DNR efforts to identify activities that have a high risk of moving invasive species and work with the groups/businesses involved to reduce risk; and expand public awareness efforts.

Many of these program expansions have been implemented including, 1) hire additional invasive species specialists to work at the local level with lake associations, lake improvement districts, and local units of government on prevention and management efforts; 2) hire nine new conservation officers who will work approximately half time on invasive species issues; 3) increase the number of watercraft inspectors from 50 to 75; and increase funding for prevention and management of aquatic invasive species. You can read about these efforts in detail in the following chapters of this report.

Other DNR Support

Staff from the DNR divisions of Fish and Wildlife and Enforcement, and the Bureau of Information and Education contributes significantly to the implementation and coordination of invasive species activities.

Pesticide enforcement specialists from Ecological Resources and Aquatic Plant Management Specialists in DNR Fisheries assist with the management of various invasive plants including purple loosestrife, Eurasian watermilfoil, curly-leaf pondweed, and flowering rush. In addition to these staff, other individuals from the Division of Fish and Wildlife and the Division of Ecological Resources contribute by providing biological expertise, assisting with control efforts, conducting inventory and public awareness activities, and providing additional avenues for public input.

The Division of Enforcement plays a key role in the prevention and containment of invasive species. Conservation officers are responsible for enforcing the state regulations regarding invasive species of aquatic plants and wild animals. The Water Resource Enforcement Program acts as the lead on invasive species enforcement

within the Division of Enforcement to coordinate enforcement activities, including scheduling, executing, and reporting on enforcement activities related to invasive species. A chapter describing enforcement activities is included in this report (see Enforcement).

Staff from the Bureau of Information and Education provide support for the Invasive Species Program's public awareness activities (see Education and Public Awareness).

Other State Invasive Species Control Programs

The DNR and the Minnesota Department of Agriculture (MDA) administer prevention and control programs for other invasive species in Minnesota. The DNR's Division of Forestry, working in cooperation with the MDA, is charged with surveying and controlling forest pests, including non-native organisms such as bark beetles. Once an invasive forest pest becomes established in the state, DNR Forestry becomes responsible for management of the species. The DNR's Forest Health Protection Team prepares a separate annual report.

The MDA is the lead regulatory agency to address terrestrial invasive species, i.e., noxious weeds, gypsy moth, emerald ash borer, sudden oak death, under authority in Minnesota Statutes, Chapter 18G,H, J and Chapters 18 and 21. Information about control, prevention, and regulatory programs for several terrestrial invasive species, plant pests, and noxious weeds may be obtained from the MDA. University of Minnesota Sea Grant Extension has an Aquatic Invasive Species Information Center in Duluth. The Center promotes education and outreach to prevent the spread of aquatic invasive species in the state.

Participation in Statewide, Regional, and National Groups

The DNR Invasive Species Program and other agencies in the state participate in statewide groups such as the Minnesota Invasive Species Advisory Council, the County Agricultural Inspectors Advisory Committee, and the Noxious Weed Advisory Committee.

The DNR Invasive Species Program and others in the state participate in multiple regional and federal activities regarding invasive species. Participation on panels, such as the Mississippi River Basin and Great Lakes Panels on aquatic nuisance species, helps keep Minnesota informed of regional and federal efforts regarding invasive species and provides a voice for Minnesota interests.

Additional regional groups that the DNR is involved with include, but not limited to:

- St. Croix River Zebra Mussel Task Force (see Appendix B);
- National garlic mustard biocontrol working group; Council of Great Lakes Governors' Aquatic Invasive Species Task Force;
- National Asian carp work group that drafted a national Asian Carp Management and Control Plan.

Development of a Statewide Invasive Species Management Plan

After several years of development, the "Minnesota State Management Plan for Invasive Species" was completed in November 2009. The plan was developed by the

Minnesota Invasive Species Advisory Council (MISAC), co-chaired by the Minnesota Department of Natural Resources and the Minnesota Department of Agriculture, to provide a framework for addressing both aquatic and terrestrial invasive species issues in Minnesota. The plan includes strategies and actions to address the main issues related to invasive species: preventing new introductions into the state; early detection and rapid response to new introductions; containment of populations, and management of established populations to reduce their harm.

The plan reflects several years of work by many organizations from the local, state, and federal government levels and a number of nongovernmental organizations. The plan will also provide opportunities for improved coordination and partnerships between federal, state and local governments, tribes, conservation organizations and others working to minimize the impacts caused by invasive species in the state.

Prior to completion of the plan, an opportunity for public comment on the plan was offered and tribal input was sought through a meeting with several tribes in Minnesota. The public comment and other review opportunities are summarized in the plan.

The plan follows the guidance provided in Public Law 101-646, as amended by the National Invasive Species Act of 1996.

Expenditures

Funding Sources

Funding for activities conducted by the Invasive Species Program comes from a variety of state, federal, and local sources. Those funding sources are described below.

State Funds

The primary funding source is a \$5 surcharge on the registration of watercraft in Minnesota. The surcharge on Minnesota watercraft generates sufficient funds to allow an annual appropriation of approximately \$1,200,000. The 2007 Legislature established a new \$2 fee on non-resident fishing licenses that will generate approximately \$400,000 in FY09 (the first full year of non-resident license fees collection). The program is also supported with funds from general fund appropriations. In addition, the 2007 Legislature created an "Invasive Species Account" in which all watercraft surcharge and non-resident fishing license proceeds are held.

Prior to 2008, the Legislature appropriated additional funds from "regular" watercraft license receipts. The "Surcharge" column in Table 1 includes both surcharge and non-surcharge appropriations from the Water Recreation Account. Funding was expanded by the 2006 Legislature; an additional \$550,000 from the general fund was appropriated.

Table 1. State and local funding (in thousands of dollars) received by the Invasive Species Program, fiscal years 2003-2009.

Fiscal Year	Surcharge ²	Invasive Species Acct	General Fund	Legislative-Citizen Commission on Minnesota Resources ¹	Local Contributions	Total
2003	1,191			45	11	1,247
2004	1,582			55	19	1,656
2005	1,641			54	17	1,712
2006	1,795			100	42	1,937
2007	1,795		550	100	53	2,498
2008	53	1,349	1,520	100	45	3,067
2009	53	2,142	2,740	100	46	5,081

¹ State appropriations, as recommended by the LCCMR, from the Environment and Natural Resources Trust Fund or the Minnesota Resources Fund or both.

² Includes funds appropriated directly to the Division of Enforcement for invasive species work.

Over the last decade, significant support for invasive species research has been appropriated by the Minnesota Legislature from the Environment and Natural Resources Trust Fund and the Minnesota Resources Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR) (Table 1). The LCCMR recommended additional funding for garlic mustard and buckthorn biocontrol research during the FY06/07 and FY08/09 bienniums.

Federal Funds

The DNR seeks funding from federal sources for a variety of program activities. Recent projects that have been funded are shown in Table 2. For example, funds from the U.S. Fish and Wildlife Service (USFWS) support the implementation of the St. Croix Interstate Management Plan for aquatic invasive species. A portion of DNR's public awareness efforts and zebra mussel monitoring dives on the St. Croix River are paid from these funds. Two grants have been approved by the U.S. Environmental Protection Agency (USEPA) to support research on the biological control of European buckthorn. Funding from the U.S. Forest Service (USFS) was also obtained to initiate a garlic mustard biological control project. These federally funded projects often operate on timelines that are different from the state's fiscal year.

Table 2. Recent proposals submitted by the Invasive Species Program that received federal funding.

Category	Federal Fiscal Year ¹ Grant Awarded	Calendar Year(s) Used	Grant Amount (1000s of \$)	Source
Implement St. Croix management plan for aquatic nuisance species				
	2004	2005	71	USFWS
	2005	2006	73	USFWS
	2006	2007	46	USFWS
	2007	2008		USFWS
Research on biological control of European buckthorn				
	2003	2004-05	50	USEPA
Research on biological control of garlic mustard				
	2007-10	2007-10	115	USFS
	2003-06	2004-07	225	USFS
	2006	2006	10	USFWS
	2007-08	2008-09	75	USFS
Terrestrial invasive plant management				
	2005	2005-07	200	USFWS

¹ The federal fiscal year begins on October 1 and ends on September 30.

Local Funds

Local groups work with the DNR to manage invasive aquatic species and, in some cases, provide funds to expand planned efforts (Table 1). During 2009, 13 local groups provided funding so that the number of watercraft inspections on specific lakes could be increased. See Watercraft Inspections and Awareness Events for a more detailed account of these cooperative efforts.

Timeframe

This report covers activities in calendar year 2009, which includes the last half of the Minnesota fiscal year 2009 (FY09), January 1-June 30, 2009, and the first half of fiscal year 2010 (FY10), July 1-December 31, 2009. To provide a comprehensive review of expenditures and to meet the report's January 15, 2010 due date, we report on expenditures that were incurred in FY09 (July 1, 2008-June 30, 2009).

Cost Accounting

The DNR has a detailed cost accounting system that is used to track how funds are spent. All staff time and expenditures are coded. The coding allows us to sort work/expenditures by the type of activity being undertaken (e.g., management activities, public awareness efforts) and/or by what invasive species the work is focused on.

Minnesota Statute (M.S. 84D.02 Subd. 6) identifies five expenditure categories that must be reported. Those categories are Administration, Education/Public Awareness, Management/Control, Inspections/Enforcement, and Research. A sixth category, State and Regional Coordination, has been added to cover a variety of program-wide or "big-picture" activities that do not fit easily into the reporting categories required by statute. Expenditures within each category are subdivided to reflect the program activities described in the following chapters.

Administration

Administration includes *Support Costs* assessed by the Division of Ecological Resources for general office supplies, office rent, telephones, postage, workers' compensation fees, computer support fees, and the state accounting system fees. Administration also includes *Clerical* costs and *Administrative Support* costs that fund administrative staff that work for the divisions of Fish and Wildlife and Ecological Resources. This category also includes charges assessed by the Department to cover operational support costs. Staff leave time (time used for holidays, sick leave, and vacation) has been apportioned across all categories based on the proportion of staff time invested in that category.

State and Regional Coordination

This category includes a variety of activities and expenditures. *State coordination* includes general program planning, preparation of state plans and reports (including this document), and general invasive species coordination with a wide variety of groups. This category includes the work of program staff as well as various managers in the Division of Ecological Resources who periodically work on invasive species issues. For example, program staff and managers meet with groups such as Minnesota Waters and the Lake Minnetonka Conservation District to discuss state activities and to coordinate efforts. Program staff are also members of state-level coordinating groups, such as the

Minnesota Invasive Species Advisory Council, which are included here. Expenditures primarily represent staff time spent on these activities. *Regional and federal coordination* includes staff time and out-of-state travel expenses to work with regional and federal partners on invasive aquatic species issues. Examples from 2009 include: a Mississippi River Basin Panel on Aquatic Nuisance Species (ANS) meeting, participation on conference calls associated with the Council of Great Lakes Governors' ANS Initiative, and a regional workshop focused on Promoting Regional ANS Cooperation and Coordination. "Training, supervising, related work" represents a variety of work activities that staff participate in to improve their skills, direct co-workers, or help on other projects. Finally, *Equipment and Services* includes fleet costs not assigned to a specific activity and the cost to purchase and repair boats, trailers, computers, and similar items.

Education/Public Awareness

Expenditures in this category include staff time, in-state travel expenses, fleet charges, mailings, supplies, printing and advertising costs, and radio and TV time to increase public awareness of invasive aquatic species. The costs of developing and producing pamphlets, public service announcements, videos, and similar material are included, as are the costs of developing and maintaining invasive species information on the DNR's Web site.

Management/Control

Expenditures in this category include staff time, in-state travel expenses, fleet charges, commercial applicator contracts, and supplies to survey the distribution of invasive aquatic species in Minnesota and to prepare for, conduct, supervise, and evaluate control activities. When the management activity is focused on a specific invasive aquatic species, e.g., Eurasian watermilfoil, purple loosestrife, or zebra mussels, detailed expenditure information for that species is shown. Funds provided to local government units and organizations to offset the cost of Eurasian watermilfoil or curly-leaf pondweed management efforts are also included.

Inspections/Enforcement

Expenditures in this category include the costs that conservation officers incur enforcing invasive species rules and laws, the costs of implementing watercraft inspections at public water accesses, and staff time and expenses associated with promulgation of rules, development of legislation, conducting risk assessments, and other efforts to prevent the introduction of additional invasive species into Minnesota.

Research

Expenditures in this category include staff time, travel expenses, fleet charges, supplies, and contracts with the University of Minnesota and other research organizations to conduct research studies. These studies include efforts to develop new or to improve existing control methods, better understanding of the ecology of invasive species, better risk assessment tools, and to evaluate program success. When research is focused on a specific invasive species, such as Eurasian watermilfoil, purple loosestrife, or curly-leaf pondweed, detailed expenditure information for that species is shown.

Fiscal Year 2009 (FY09) Expenditures

Expenditures on aquatic invasive species activities during FY09 (July 1, 2008-June 30, 2009) totaled \$3,807,000. Expenditures from the Invasive Species Account and General Fund account are listed along with spending from other accounts (Table 3). Grants received from various state or federal funding sources, such as LCCMR recommended appropriations and the USFWS, are other examples.

As is shown in Table 3, \$949,000 was spent on terrestrial invasive species management and research activities. That work was funded exclusively from the general fund and by grants from other organizations. Accomplishments for terrestrial invasive species management activities are found in the proceeding chapters.

The \$1,960,000 of “Invasive Species Account” expenditures during FY09 (Table 3) were less than the \$2,142,000 appropriated by the Legislature (Table 1). The unspent FY09 funds remain in the invasive species account for future appropriations. A portion of the appropriated general fund went unspent in FY09. \$171,000 was un-allotted to help balance the state budget deficit. The remaining unspent funds were allocated for grants for management of invasive aquatic plants that went unused by potential grantees and for salary savings for a vacant enforcement position.

Figure 3 provides a broad outline of how the funding was spent from the “Invasive Species Account” and the general fund for aquatic invasive species. Within Figure 3, the Management/Control category (\$1,892,000) and Inspections/ Enforcement category (\$1,264,000) represent the two largest segments of the budget; these two categories accounted for 76% of aquatic invasive species expenditures in FY09. The focus on those two categories, plus Education/Public Awareness which represents an additional 5% of FY09 spending, reflects the priority the Department places on efforts to prevent the spread of invasive species and to help manage the problems those species cause.

Eurasian watermilfoil and curly-leaf pondweed are the two invasive species that received the most focus based on dollars spent. FY09 spending targeted specifically at Eurasian watermilfoil was \$238,000; \$472,000 was spent on curly-leaf pondweed. This is a substantial increase from 2008. Spending also substantially increased for enforcement (\$474,000) and watercraft inspections (\$790,000) related to prevention efforts. Individual chapters of this report provide details on the activities accomplished with those funds.

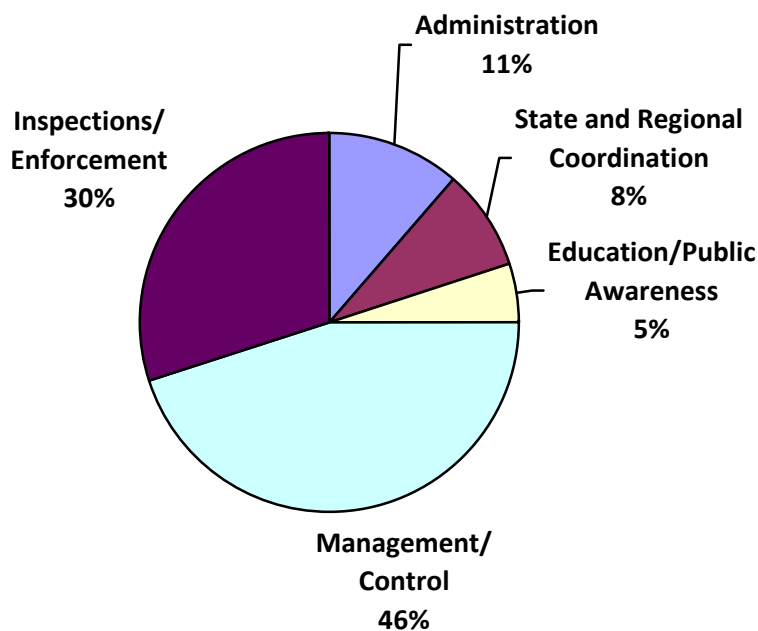


Figure 3. Aquatic Invasive Species Program spending (Invasive Species Account and General Fund only) in FY09 by major categories.

Fiscal Year 2010 (FY10) Future Expenditures

Since this report is due in the middle of FY10, projected expenditures for that fiscal year are not reported. A comprehensive review of FY10 expenditures will be provided in the 2010 Annual Report.

Table 3. Invasive species related expenditures in fiscal year 2009 (FY09) (in thousands of dollars).

Categories of Expenditures	Invasive Species Account	General Fund	Other Funding Sources
	FY09	FY09	FY09
Administration Division Support Costs Regional Representation Clerical Administrative Support Subtotal	 187	 297	 0
State and Regional Coordination State coordination Support regional/federal activities Training, supervising, related work Equipment and services Other Subtotal	 299	 58	 0
Education/Public Awareness Radio spots, TV, Web site development Other Subtotal	 73	 142	 ³ 61
Management/Control General Eurasian watermilfoil Purple loosestrife Zebra mussel Curly-leaf pondweed Flowering rush Other aquatic invasive species Terrestrial invasive species Subtotal	 257 145 44 14 97 17 49 -- 623	 182 93 -- 1 375 -- -- 618 1,269	 ^{1,3} 62 -- -- -- -- -- -- -- 62
Inspections/Enforcement Watercraft inspections Enforcement - access checks Prevention - laws/risk assessments Subtotal	 778 -- -- 778	 12 474 -- 486	 ¹ 37 ¹ 53 -- 90
Research General Eurasian watermilfoil Purple loosestrife Other aquatic species Terrestrial Invasive Plants Subtotal	 -- -- -- -- -- 0	 35 35	 -- -- -- -- ^{1,2, 3} 296 296
Total	1960	2287	509

¹Other DNR funding, ²LCCMR funding, ³federal funding

*Subtotals are rounded to the nearest thousand

Prevention and Containment

Introduction

Issue

Two key elements in addressing invasive species are: preventing introductions of new invasive species; and containing existing invasive species infestations to avoid their spread to other locations. They fit into the overall approach to invasive species in the Minnesota State Management Plan for Invasive Species. The Plan's elements are:

- Prevention
- Early Detection, Rapid Response, and Containment
- Management of Invasive Species, and
- Leadership and Coordination

Goals

The state Invasive Species Plan's desired outcomes related to the prevention and containment elements are below.

"Seek to prevent the introduction of new invasive species in Minnesota"

"Continue to contain infestations where eradication is not possible"

Progress in Prevention and Containment - 2009

Several prevention and containment activities are addressed in other chapters of this report: Regulations, Enforcement, Watercraft Inspections and Awareness Events, and Education and Public Awareness. A few of the prevention highlights in those chapters include:

- DNR Enforcement activities continued to increase and broaden in scope.
- DNR and MPCA provided joint comments to the USCG on its proposed ballast water regulations; and
- DNR Identified and designated additional infested waters.
- Funding for public awareness projects was provided to lake associations and other local groups for a second year through the DNR's Prevention Grant Program. Nearly \$70,000 was awarded to 17 groups to initiate new or continue customized projects and watercraft inspections at the local level.
- Watercraft inspectors logged over 42,000 inspection hours resulting in a total of 66,000 watercraft/trailers being inspected.

Some prevention and containment activities that are not covered in other chapters of this report are discussed below.

Early Detection and Rapid Response

In 2009, there were no discoveries of *new* aquatic invasive species in the state; therefore, there were no rapid response efforts necessary.

Response to New Infestations of Aquatic Invasive Species

There were numerous responses to the discovery of new infestations of species already known to occur in the state. The discovery of zebra mussels in Pike Lake near Duluth, Lake Le Homme Dieu near Alexandria, and Pelican Lake near Detroit Lakes, as well as, findings of Eurasian watermilfoil in several lakes, and flowering rush in Lake Minnetonka triggered responses by the Invasive Species Program. Responses at these waters included:

- 1) assessing of the infestation size and distribution by DNR staff,
- 2) notifying local lake associations,
- 3) issuing a news release about the new infestation,
- 4) posting Invasive Species Alert signs at the water accesses,
- 5) treating a portion of the flowering rush population when it was thought to be limited,
- 6) starting watercraft inspections at public water accesses on the new infested waters,
- 7) designating the waters as infested waters,
- 8) increasing enforcement in the new infestation areas, and
- 9) considering and assessing prevention options to curb the spread to upstream waters.

More information on the responses is provided in the species management chapters.


Priority Containment Lakes

Two lakes in the state were the focus of containment efforts beginning in May 2009: Mille Lacs and Winnibigoshish. Lake Mille Lacs, which contains Eurasian watermilfoil, zebra mussels, and the most recent invader being spiny waterfleas, was the focus of increased signing, public awareness actions, watercraft inspections, and enforcement. Three “Pull the Plug on Invasives” billboards were placed on highways around the lake. Brochures, zebra mussel identification cards, and regulations cards were provided to many resorts through the Mille Lacs Area Tourism Council and by DNR staff. Radio and newspaper ads were placed in the Lake Mille Lacs and Brainerd area. A *Stop Aquatic Hitchhikers!* ad was placed in the *Mille Lacs Area Travel Guide* for 2010-2011. Watercraft inspectors' hours to work at the lake were increased from 685 in 2008 to 1,637 in 2009 (see Watercraft Inspections and Awareness Events) and enforcement of state invasive species laws was increased at the lake by DNR conservation officers (see Enforcement).

At Lake Winnibigoshish, containment was intended to prevent spread of the faucet snail (see Other Invasive Animal Species in Minnesota). The lake was designated as infested waters in May 2009 and both *Invasive*



State laws apply at Faucet Snail infested waters




mini faucet snails
grow up to 1/2"

It's the Law! Before you leave a water access at infested waters with faucet snails you must:

- ✓ **Drain water** from motor, boat bilges, livewells, and other boating equipment holding water (MN Rule 6216.050, Subp. 3 and MN Statutes 84D.13). Drain plugs should be removed from bilges and livewells
- ✓ **Drain water from bait containers.** (MN Rule 6216.0500, Subp. 3) **If you want to keep your live bait – you must replace water in bait containers with tap or spring water. Place unwanted bait in the trash where it is convenient.**
- ✓ **Remove all aquatic plants** from your boat, trailer, anchors, and other boating equipment (MN Statutes 84D.09, & 84D.13).

Before reuses, remove snails and mud from boats, anchors, lines, and gear.

For more information:
Contact the Department of Natural Resources
at 1-888-MINNDNR or www.dnr.state.mn.us



Species Alert and *Stop Aquatic Hitchhikers!* signs were posted at water accesses around the lake. DNR conducted training for non-tribal bait dealers that harvest bait at Lake Winnibigoshish and those dealers that were issued a permit must take precautions while harvesting bait. DNR also worked with the Leech Lake Band of Ojibwe-Division of Resource Management to develop prevention strategies for band members. New informational cards (see example) with regulations related information were produced and distributed at the lake.

Prevention Grants

In 2009, the DNR continued providing grants to local groups and governments to help prevent the spread of aquatic invasive species, especially zebra mussels and spiny waterfleas into Minnesota waters. Grants were provided to help local entities (lake associations, coalitions of lake associations (COLAs), local citizen groups, and local units of government (e.g., conservation districts, lake improvement districts, watershed districts, and counties) implement locally focused prevention efforts and to dovetail those efforts with other ongoing statewide aquatic invasive species prevention efforts. One example of a statewide prevention effort is the "Stop Aquatic Hitchhikers!" campaign, which is being implemented by the DNR, Minnesota Sea Grant, Wildlife Forever, and the U.S. Fish and Wildlife Service. In total, \$68,855 of grants were awarded to 17 grantees during 2009 (Table 4). The grant funded portions of the grant proposals were capped at \$10,000.

The four types of grants or partnership projects eligible in 2009 are described below:

Watercraft Inspections - DNR Watercraft Inspectors

This is a cooperative hiring program where the local organization provides funding for salaries (at \$12/hour) and the DNR hires watercraft inspectors to work at local water accesses. The DNR provides/grants an equal amount of inspection hours (up to the maximum grant amount) to those funded by the local entity. The cooperating organization provides input into scheduling the hours of inspection. For example, if a local group provides \$2,000 for local inspections, which is 166 hours of inspection at \$12/hour, then DNR provides an additional 166 hours at local accesses. DNR will also recruit, hire, and schedule the inspectors, and provide supervision, insurance, and social security costs.

Watercraft Inspections - Non-DNR Watercraft Inspectors

Local government units (LGU) can hire watercraft inspectors for work at local waters. DNR will train the inspectors and provide grant funds for 50% of the inspection costs. The LGU must recruit, hire, and schedule the inspectors, and provide supervision, insurance, social security and potential unemployment costs. There were no participants in this type of grant during 2009.

Public Awareness - Projects with standard designs or audio/video provided

DNR provides newspaper, TV, and radio ads, and billboards and gas pump ad designs that include local grantee names/logos. Grantee provides 50% of ad costs and makes all arrangements. Grantees that used billboards coordinated with DNR and Wildlife Forever on billboard placement.

Public Awareness - Customized Public Awareness Projects

Grants from DNR provide 50% of the cost to develop and implement local prevention projects. Grantees and DNR staff work on local projects with bait dealers, local marinas, or dock haulers, or develop new literature and signage. Grantees can provide their half of project costs through work hours necessary to accomplish the project and/or funds to produce new informational products.

The following criteria were established prior to the grant applications being submitted to evaluate proposals if more applications were received than funds available:

- were focused on zebra mussels and/or spiny waterfleas;
- were located at or near infested waters or high-use waters;
- were located in high-use or popular traveler destination areas;
- was a combined effort of local groups who applied for the grant (e.g., COLA level, multi-lake or multi-organization projects).

In 2009, the total eligible applications did not exceed the available funds; therefore, all eligible applications were funded.

The following are examples of public awareness grant products in 2009.

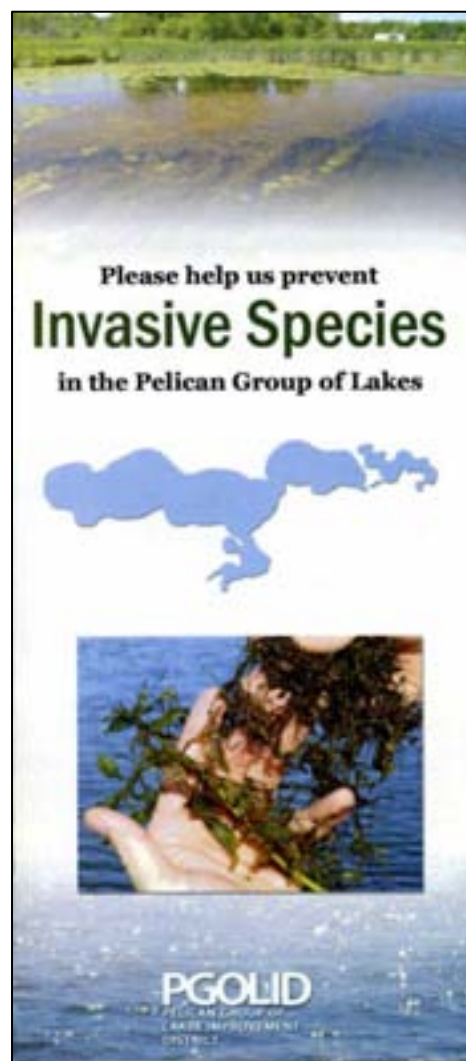
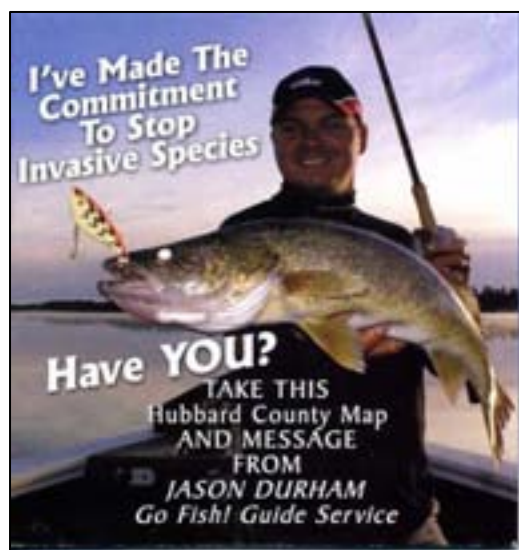


Table 4. Summary of Prevention Grants awarded in 2009.

Local Entity	Grant Awarded	Grant Types	Specific Grant Activities
Bad Medicine Lake Area Foundation	\$480	DNR Watercraft Inspections	
Bay Lake Improvement Association	\$2,000	DNR Watercraft Inspections	
Becker County COLA	\$2,600	Standard Public Awareness	Billboards
Big Watab Lake Association	\$1,440	DNR Watercraft Inspections	
Common and Wells Lake Association	\$500	Standard Public Awareness	Signs
Clear Lake Property Owners Association	\$2,300	Custom Public Awareness	Signs
Friends of Lower Hay Lake Association	\$1,980	DNR Watercraft Inspections	
Gull Chain of Lakes Association	\$5,150	DNR Watercraft Inspections Standard Public Awareness	
Hubbard County COLA	\$7,925	Standard Public Awareness Custom Products	Billboards, signs at resorts. Resort cards and packet, Custom road signs.
Lake Minnetonka Conservation District	\$10,000	DNR Watercraft Inspections	
North Long Lake Association	\$4,914	DNR Watercraft Inspections	
Ottertail Lake POA	\$2,750	DNR Watercraft Inspections Custom Public Awareness	Signs
Pelican Group of Lakes Improvement District (PGOLID)	\$4,720	DNR Watercraft Inspections Custom Products	Brochure
Pelican Lake Property Owner's Association (PLPOA)	\$8,660	DNR Watercraft Inspections Custom Products	
Sportsmen's Club of Lake Vermilion (SCLV)	\$5,151	DNR Watercraft Inspections Standard Public Awareness Custom Public Awareness	Billboard Placement
Waterville Lakes Association	\$2,500	DNR Watercraft Inspections Standard Public Awareness	
Whitefish Area POA	\$5,785	DNR Watercraft Inspections Standard Public Awareness Custom Public Awareness	

In 2010, DNR is proposing to expand the total prevention grant amount available to \$300,000 due to new federal funding that should be available to the DNR. A request for proposals was issued in November 2009 by DNR. Successful grantees for 2010 grants will be notified by February 7, 2010.

Infested Waters Permits

Minnesota Rules, Chapter 6216 prohibit the diversion and transport of water from designated infested waters except by permit. In 2009, there were several requests to transport infested water and to divert infested waters. The following entities obtained infested waters permits in 2009 from the DNR Invasive Species Program:

- Frankie's Marine - for a fishing tournament weigh-in;
- Minnesota Dept. of Transportation - MNDOT District 3 - Bridge Flushing;
- University of Minnesota - Appropriation and transport of infested water for common carp research;
- University of Minnesota-Duluth - Appropriation and transport of infested water from ballast water of ships;
- Minnesota Pollution Control Agency - Appropriation and transport of infested water from ballast water of ships; and
- Minnesota Waters - Water quality sampling at Little Fork River

In addition, two permits were issued where previous pumping had occurred between lakes. At these locations, permits were written to allow pumping with new requirements in the permits for filtering or screening invasive species from the water:

- Snail Lake Improvement District - for pumping water into Snail Lake from a zebra mussel infested lake to raise the water level; and
- Union-Sarah Lake Improvement District - for pumping water out of a Eurasian watermilfoil infested lake to lower the water level.

The Snail Lake Improvement District filter system was installed in November 2009 (see photo at right). The system filters the water through 200- and 25-micron screens to remove all life stages of zebra mussels. The Union Lake intake screen (see photo below) was installed in the first week of December 2009. The screen has 500-micron openings in the stainless steel screen to eliminate



all life stages of Eurasian watermilfoil.



Prohibited Invasive Species Permits

State law prohibits the possession, transport, sale, purchase, and import of prohibited invasive species except by permit. In 2009, several permits were issued to entities that did research, education, or control related to prohibited invasive species in the state. Permits, with conditions to avoid spread, were issued to the following entities for the prohibited species listed:

- U.S. Army Corps of Engineers - Eurasian watermilfoil;
- National Park Service - zebra mussel;
- Concordia College - Eurasian watermilfoil;
- DNR Invasive Species Program staff and interns - Eurasian watermilfoil, curly-leaf pondweed, flowering rush, purple loosestrife, and brittle naiad; and
- Central Lakes College - Eurasian watermilfoil, curly-leaf pondweed, flowering rush, and purple loosestrife.

Permits to Harvest Bait from Infested Waters

Under state statutes and rules, the commercial harvest of bait from infested waters is prohibited, except by permit. DNR Fisheries issued permits to bait dealers who attended training in the past three years and passed a written test in the current year. Permits are issued with several conditions to prevent the transfer of invasive species from infested waters including a requirement that nylon tags must be attached to equipment used in infested waters and that gear may not be used in non-infested waters. Training sessions were held in Brainerd during March and Deer River during August.

Education and Public Awareness

2009 Highlights

- Funding for public awareness projects was provided to lake associations and other local groups for a second year through the DNR's Prevention Grant Program. Nearly \$70,000 was awarded to 17 groups to initiate new or continue customized projects and watercraft inspections at the local level.
- Paid media was used in conjunction with unpaid media (news releases and interviews) to raise awareness about new infestations of invasive species in Minnesota. Billboards as well as print and broadcast media were used to expand the reach of DNR's informational efforts and to target key locations in the state.
- A public awareness partnership with tourism industry representatives, businesses, and law enforcement in the Mille Lacs Lake and Brainerd lakes areas was formed in response to the increase in zebra mussel populations in these areas.

Goals

Public awareness efforts in Minnesota are designed to:

- Make the public and certain businesses aware of the negative environmental and economic impacts caused by some invasives;
- Help these groups identify and report findings of specific invasive species;
- Outline actions that boaters, anglers, seaplane pilots, waterfowl hunters, aquarium owners, water gardeners, riparian landowners, bait dealers, and others must do to reduce the spread of these invasives; and
- Enhance understanding of management options.

Progress in Public Awareness - 2009

Similar to previous years, key components of this year's communication efforts included billboards, radio and television advertising, public service announcements, printed materials, press releases, media contacts, newspaper ads, information on DNR's Web site, staffing at sports shows and other major events, educational displays and exhibits, informational signs at public water accesses, presentations to the public, and training.

Radio

Radio was used to reach boaters and anglers in several ways. Paid advertising was used on major stations in the Twin Cities and Brainerd during the weeks preceding the Fishing Opener, Memorial Day, Fourth of July, and Labor Day. The stations were selected for their listener profiles which correspond with those of boat owners. In addition, paid ads and public service announcements were aired on Minnesota News Network, reaching 80 commercial radio stations throughout greater Minnesota in May, July, and August.

In late summer, ads were placed in the Duluth market, Brainerd Lakes area, Twin Cities, and southeastern Minnesota (Rochester and Winona) where zebra mussel infestations occur. Broadcast ads were also placed on stations in Baudette and International Falls

to raise awareness about spiny waterfleas and other invasive threats along Minnesota's northern border waters.

In addition, public service announcements (PSAs) were made available to Minnesota radio stations along with communication encouraging program managers to play the announcements. The PSAs also are available from the DNR's Web site, making them readily accessible to station managers when needed (www.dnr.state.mn.us/news/psas/index.html). The PSAs were distributed throughout the spring and summer boating season and into fall for the waterfowl hunting season.

Television

Paid television advertising was used again this year in the Duluth market during July and August to remind viewers of the continuing concerns about invasive species in the area. The 30-second ad features a DNR conservation officer alerting boaters and anglers about the threat of zebra mussels, round gobies, and New Zealand mudsnails and the steps they can take to help prevent the spread of these invasives. The ad aired during morning and evening newscasts leading into popular outdoors segments including "Sportsman's Notebook," "Gone Fishin'," "Up North," and "Pro's Pointers."

A second version of the spot was created to air in other markets where zebra mussels and Eurasian watermilfoil are a primary concern. This version was shown throughout the summer and early fall on "Minnesota Bound," a popular half-hour program that appeals to both outdoor enthusiasts and general audiences. The ad also aired in the LaCrosse area to reach viewers in southeastern Minnesota/southwestern Wisconsin.

In addition, spots informing viewers about the threat of zebra mussels and Eurasian watermilfoil were scheduled on metro area cable stations to coincide with a variety of outdoor programs.

Newspapers and informational materials

A newspaper advertising campaign also was completed in 2009. The ad design incorporated the "Stop Aquatic Hitchhikers!" national campaign logo and listed four simple steps that boaters and anglers could take to help stop the spread of aquatic invasive species. The ad ran in the outdoor or recreation sections of daily newspapers in targeted areas of the state including Brainerd, Duluth, Rochester, Twin Cities, and Winona in spring and summer. The ads also ran in several specialty newspapers and magazines reaching boaters, campers, anglers, outdoor enthusiasts, and tourists.

Newspaper coverage continued in the Mille Lacs and Aitkin newspapers to keep attention on the increasing zebra mussels population at Lake Mille Lacs. In addition, ads were placed in newspapers covering northern Minnesota including Baudette, International Falls, and Warroad to help raise awareness about the continuing spread of spiny waterfleas along the U.S.-Canadian border waters.

Watercraft inspectors, DNR creel census clerks, conservation officers, bait dealers, and the National Park Service continued to distribute a 4- x 6-inch card informational card, which was developed to raise awareness about spiny waterflea infested waters in northern Minnesota.

Distribution of the *Help Stop Aquatic Hitchhikers* brochure continued this year. The publication provides information about actions that recreationists can take to help minimize the spread of aquatic hitchhikers. Distribution efforts are ongoing to sport and outdoors shows, special events, and information kiosks. The brochure was also distributed to 10 travel information centers located at Albert Lea, Beaver Creek, Dresbach, Fisher's Landing, Grand Portage, Moorhead, St. Cloud, St. Croix, Thompson Hill (Duluth), and Worthington. The centers are a primary information source for motorists traveling to key recreation destinations in Minnesota.

The 2009 *Minnesota Fishing Regulations* included a section on invasive aquatic species. Descriptions and illustrations of several invasive species were included in the booklet along with a summary of invasive species laws and other pertinent information. More than one million copies of the fishing regulations were printed and distributed.

The *Minnesota Boating Guide* also included a page of information on how to prevent the accidental transport of invasive plants and animals. The guide is updated annually and was distributed this year to more than 300,000 boaters.

Information about invasive species also was included in the 2009-2010 edition of the *Explore Minnesota Fishing Guide*, a publication of Explore Minnesota Tourism. The guide targets anglers traveling to Minnesota and is widely distributed throughout the Midwest at major outdoor sports shows including those held in Chicago, Milwaukee, Kansas City, Omaha, Des Moines, Sioux Falls, and Fargo. It is also distributed at travel information centers across Minnesota and some Minnesota outdoor retailers.

Watercraft inspectors, conservation officers, and other groups helped distribute information cards that provide references to state laws at zebra mussel infested waters.

Outdoor media

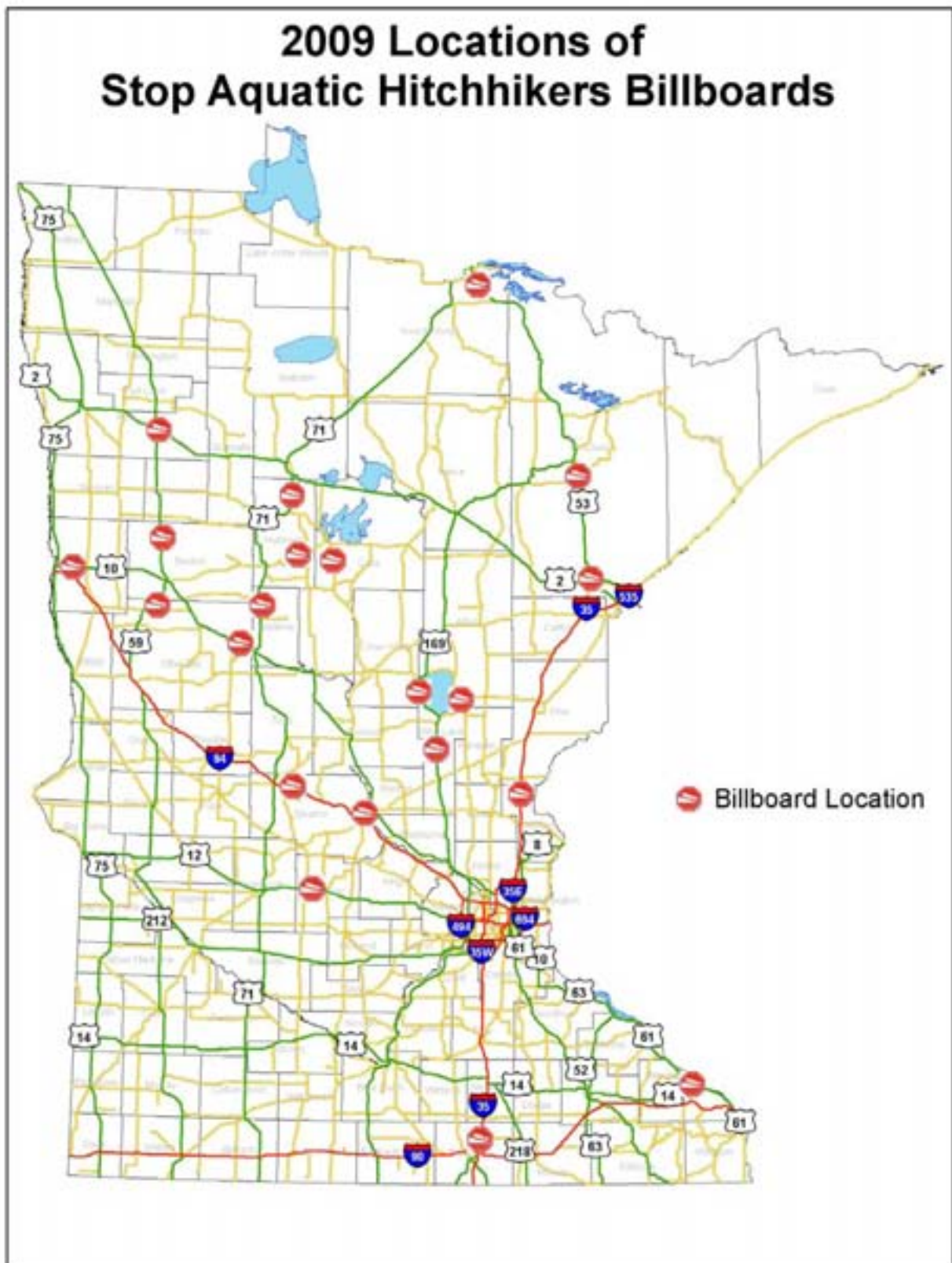
DNR partnered with Wildlife Forever, U.S. Forest Service, USFWS, Coalition of Lake Associations in Hubbard and Becker counties, Sportsmen's Club of Lake Vermilion, and Minnesota Sea Grant to develop and post billboards with the "Stop Aquatic Hitchhikers!" message (right) at

18 locations and three "Pull the Plug on Invasives" messages on key state travel routes to and from lake areas (see map).



News releases

News releases alerting the public about invasive species in the state were distributed throughout the year to all major Minnesota media outlets. In addition, several interviews with Minnesota media resulted in expanded television, radio, and print coverage this year, helping to raise awareness about these issues. Major daily and weekly



newspapers ran articles generated from the news releases and several of these articles were syndicated to other newspapers around the country.

DNR Web site

The DNR's Web site pages covering invasive species and related information are updated regularly (www.dnr.state.mn.us/eco/invasives.html) to provide the most current information available on invasive species issues. In addition to profiles of many invasive species, the site includes an overview of the Invasive Species Program as well as information on individual programs and staff. A summary of Minnesota's invasive species laws, lists of invasive species and infested waters, as well as field guides to aquatic plants and aquatic invasive plants and animals are available online. The site also provides a list of publications and resource materials in addition to links to related Web pages and sites for other partnering agencies.

Shows and fairs

Invasive Species Program staff participated at the Minnesota State Fair and other events to discuss invasive species issues and also distribute literature and information. DNR watercraft inspectors staffed the display throughout the State Fair providing a venue for visitors to ask specific questions about invasive species while visiting the exhibit. The display was updated recently to include a new, three-sided kiosk with information for water gardeners and aquarium owners, tips for preventing the transport of nuisance species, and updates on new areas of concern. An estimated 800,000 people visit the DNR's exhibits at the Minnesota State Fair each year.

DNR staff also participated at various outdoor, boating, and fishing events including the Swift County Soil and Water Conservation District Annual Water Festival, Minnesota Muskie Expo, Minneapolis Boat Show, Northwest Sportshow, and Farm Fest. Staffing events such as these provides an opportunity to educate the public about invasive species issues as well as to provide a variety of informational materials that people can take home with them for reference.

Special Events

The DNR provided staffing at an information booth for the 2009 Minnesota Governor's Fishing Opener held in the Twin Cities metro area at White Bear Lake. Invasive species printed materials and identification cards were included in an information packet for attendees. Watercraft inspectors were stationed at the public landings throughout the event and a demonstration was given to show how to properly wash boats and trailers in order to help prevent the spread of invasive species.

The *Stop Aquatic Hitchhikers* campaign was featured during Mills Fleet Farm's *Kid's Fishing Day* on July 11. This year the event included aquatic invasive species information and displays in addition to other activities. DNR watercraft inspectors participated at all the Minnesota locations of Mills Fleet Farm along with individuals from Minnesota Sea Grant (see Sea Grant below), Wildlife Forever, Pelican Lake Association of St. Anna, Pequot Lakes Property Owners Association, Douglas County Lakes Association, Sauk River Watershed District, and others to answer questions about AIS.

Mille Lacs Lake and Brainerd Lakes Area

Beginning with the Memorial Day weekend and continuing throughout the summer, a special informational campaign was launched in the Mille Lacs Lake and Brainerd lakes areas in an effort to curb the spread of zebra mussels in these major tourism destinations. Through billboards and newspaper ads, boaters were encouraged to “Pull the Plug” on invasive species by inspecting their boats and trailers, removing vegetation, and draining water from their boats before entering or leaving water accesses. The campaign included increased watercraft inspections and enforcement activity at public water accesses in the area. Local tourism organizations, businesses, and law enforcement along with Tribal authorities, and the Great Lakes Indian Fish and Wildlife Commission collaborated with DNR watercraft inspectors, creel census clerks, and conservation officers on this effort.

Grants

A new grant program was established last year to help local entities throughout Minnesota develop programs or products with the goal of raising public awareness about preventing the introduction and spread of invasive species, and, in particular, zebra mussels and spiny waterfleas. Lake associations, local government units, and citizen groups were eligible again in 2009 to apply for the grants, which were awarded on a dollar-for-dollar match basis. The grant funds greatly enhance the ability of local entities to produce customized informational materials and increase watercraft inspection efforts in their respective areas (see Prevention and Containment).

ExhibitsUnderwater Adventures

Visitors to the Underwater Adventures aquarium at the Mall of America in Bloomington can learn about Invasive species. The exhibit includes a large silver carp model, a “Habitattitude” message about not releasing unwanted pets into the wild, and a continuous loop video on Asian carp.

Minnesota Zoo

The Minnesota Trail exhibit at the Minnesota Zoo provides visitors an opportunity to learn about invasive species and see a silver carp model. Education trunks are also available for ongoing educational events at the Zoo.

Cabela’s

An educational exhibit and supporting Traveler Information System (TIS) was established at the Cabela’s store in Owatonna in late 2005. The DNR worked with the USFWS, Pacific States Marine Fisheries Commission, and Minnesota Department of Transportation on this project.

The exhibit features three major components: a habitat diorama of aquatic invasive species, including painted depictions or replicate mounts of zebra mussels, silver and bighead carp, snakehead, goby, ruffe, spiny waterflea, sea lamprey, Eurasian watermilfoil, curly-leaf pondweed, and water chestnut seeds; a large screen TV displaying DVD footage of invasive species information and imagery; and an interactive

computer kiosk with a field guide of aquatic invasive species, what we can do to prevent their spread, and what agencies are doing to address the problems.

Boat washing program

The DNR worked on a collaborative effort with Minnesota Waters, Minnesota Bass Federation, Minnesota Sea Grant, and other local partners in the Brainerd lakes area for the fifth consecutive year. The region is a popular vacation and fishing destination and the risk of spreading aquatic invasive species from one body of water to another is extremely high. Patterned after a similar effort in South Dakota, the project was designed to encourage boaters to wash and dry their boats before entering or upon leaving a body of water.

Area car wash owners were contacted to find out if they would be willing to participate in the program and promote their facilities as boat and trailer wash stations. The facilities first had to meet specific criteria required by the DNR to ensure that they were suitable for washing boats and recreational equipment.

A collateral piece listing the participating car wash facilities along with a location map was produced and distributed to local convenience stores, bait shops, travel information centers, and sporting goods retailers. The publication explains why it is important to wash boats and trailers and provides step-by-step instructions for removing invasive species from recreational equipment.

Public water accesses

DNR watercraft inspectors completed more than 42,000 hours of inspection (see Watercraft Inspections and Awareness Events), providing boaters with information and tips on ways to reduce the spread of invasive species. In addition to the expanded efforts of watercraft inspectors, conservation officers spent more than 4,800 hours educating boaters about public access regulations and invasive species laws (see Enforcement).

Stop Aquatic Hitchhikers signs (see right) are posted at public and private water accesses in the state. Local partner have helped post dozens of the signs at accesses around entire lakes such as Leech and Cass lakes. Signs including new large Stop Aquatic Hitchhikers signs will be part of the 2010 Prevention grants.



Presentations

Presentations were given by DNR Invasive Species Program staff to over 100 audiences including university classes, high schools, conferences, annual meetings, training sessions, service and professional organizations, sportsmen's groups, County Coalitions of Lake Associations, and lake associations.

Effectiveness of Public Awareness Efforts

Background

The DNR and Minnesota Sea Grant have conducted several surveys to help assess the effectiveness of public awareness efforts conducted in Minnesota. In 1994, Minnesota Sea Grant conducted a survey of boaters in Minnesota, Wisconsin, and Ohio to evaluate and compare regional differences in educational and awareness programs (Gunderson 1994a and Gunderson 1994b). In 1996, the DNR funded a follow-up survey of boaters in the Minneapolis/St. Paul metro area (DNR 1996). Also in 1998, a survey of boaters in the Brainerd area was conducted (DNR 1999). Both these surveys indicate that awareness about invasives has continued to increase. Another five state survey was done by Sea Grant in 2000 that showed significant increases from the 1994 survey. Ninety percent of Minnesota boaters responding to one question in the 2000 survey said they took action (Jensen 2010), an increase over a similar Minnesota Sea Grant survey in 1994 when 70% of Minnesota boaters said they took action. Information from past and current surveys is used to guide development of annual public awareness efforts and maximize their effectiveness.

Effectiveness and boater survey results

DNR and Minnesota Sea Grant have conducted surveys of boaters and anglers in the past and the results (see past reports) have indicated that public awareness efforts do work to raise awareness and change behaviors. In 2006, 99% of Minnesota boaters and anglers surveyed at locations where watercraft inspectors work said that they would be influenced by the "Stop Aquatic Hitchhikers!" campaign to take action in the future to prevent the spread of aquatic invasive species (AIS). Of these, 89% said they would be "very likely" and 10% said they would be "somewhat" influenced by the campaign. Similarly in 2007, 99% said they would take action in the future, however, a slightly higher percentage (92%) were "very" influenced to take action. Comparatively, 94% of Iowa and 98% of Wisconsin boaters and anglers surveyed in 2006 said they would be influenced to take action, however, the percentage of boaters and anglers grew by about 15% from "somewhat likely" in 2006 to "very likely" in 2007 (Doug Jensen, personal communication 2008). Together, these results strongly indicate that the "Stop Aquatic Hitchhikers!" campaign not only can raise awareness, it can change behavior, thereby, working to prevent the spread of AIS. In 2009, 97% of boaters contacted responded "yes" when asked if they were aware of the state's invasive species laws, an increase from 91% in 2008 (see Watercraft Inspections and Awareness Events).

Participation of Others in Public Awareness Activities

Other agencies and organizations in Minnesota have been cooperatively involved with public awareness activities in the state for more than a decade and continue to conduct public awareness efforts throughout the state.

Minnesota Invasive Species Advisory Council

The Minnesota Invasive Species Advisory Council (MISAC) produced a 2010 invasive species wall calendar highlighting 12 non-native invasive species that are potential threats in Minnesota. The publication contains information about each of the featured species such as keys to identification, means of spread, and impacts. This is the sixth year MISAC has produced the calendar, which was distributed to natural resource,

agricultural, highway, and other professionals throughout the state. The project was a cooperative effort of MISAC members to raise awareness of all types of invasive species and to direct the recipients to the Council's Web site at www.mda.state.mn.us/misac/ where they can obtain further information. The DNR is a member and co-chair of MISAC.

Wildlife Forever

Wildlife Forever continued to be a key partner to raise awareness in Minnesota and other states in 2009. They lead a cooperative effort to place "Stop Aquatic Hitchhikers!" billboards along key travel corridors in Minnesota and other states. Last year, the organization placed Stop Aquatic Hitchhikers! panels in the Minneapolis-St. Paul airport. Their 2009 Threat Campaign in Minnesota brought a diverse group of invasive species stakeholders. Working with lake associations, tribal organizations, state and federal agencies, sportsmen's clubs, academia, and fishing industry organizations, the collaborative outreach marketing and messaging campaign reached a potential of over 56.8 million impressions in Minnesota.

Traveling Trunks

Teachers throughout Minnesota can reserve educational "traveling trunks" that include hands-on activities for classroom instruction. The trunks contain a wide range of tools designed to teach youth about aquatic invasive species. Educators can obtain the trunks from several organizations including Minnesota Sea Grant, Bell Museum of Natural History, Great Lakes Aquarium, and National Park Service. For a more detailed description of the trunks, visit: www.seagrant.umn.edu/education/ttea.html.

Minnesota Sea Grant

The University of Minnesota Sea Grant Program provides leadership and expertise on aquatic invasive species (AIS). Minnesota Sea Grant is part of a nationwide network of 30 university-based programs administered through the National Oceanic and Atmospheric Administration (NOAA) with a federal legislative mandate to "increase the understanding, assessment, development, utilization, and conservation of the nation's ocean and coastal resources." Minnesota Sea Grant is well known in supporting scientific research, and conducting outreach, education, and communication on AIS. Several highlights of Minnesota Sea Grant's outreach and research activities in 2009 related to aquatic invasive species in Minnesota are listed below:

Leadership and Service

Sea Grant staff serve on state, regional, and national task forces including the Minnesota Invasive Species Advisory Council, the Great Lakes Panel on AIS (at-large member), St. Croix River AIS Task Force, the Lake Superior AIS Prevention Team, and the Binational Program's Lake Superior Lakewide Management Program (LaMP) Work Group.

Outreach

In 2009, Minnesota Sea Grant reached over 17,000 people through direct programming at events, meetings, workshops, and conferences. Over 40 talks were given to groups, communities, businesses, industries, agencies, and task forces across Minnesota and beyond.

Of those people reached, Sea Grant promoted the *Stop Aquatic Hitchhikers!* campaign at 22 events, presentations, and displays directly reaching over 14,000 people. Three highlights are:

1. On July 11, the campaign was featured during Mills Fleet Farm's *Kid's Fishing Day*. For the first time, festivities included AIS in addition to other activities. Representatives from dozens of campaign partners, including Sea Grant and state DNRs, co-hosted booths at stores across Minnesota, Wisconsin, and Iowa (38 of 39 stores). In Minnesota, Wildlife Forever, Pelican Lake Association of St. Anna, Pequot Lakes Property Owners Association, Douglas County Lakes Association, Sauk River Watershed District, and others were on-hand to answer questions about AIS.
2. On July 16-19, a campaign booth was featured at a celebration of *Lake Superior Days* in Duluth, which reached over 1,300 visitors. Representatives from Sea Grant, DNR, Minnesota Waters, Clean Water Action, Minnesota Environmental Partnership, St. Louis River Alliance, and Sugarloaf Association were on-hand to answer questions.
3. On August 1, the U.S. Forest Service hosted a booth at the 11th *Annual State Fish Art Expo* at Mall of America in Bloomington, where thousands of Sea Grant and DNR AIS outreach materials were distributed.

Sea Grant co-leads *Habitattitude*, a national campaign to educate aquarists and water gardeners about the importance of not releasing unwanted aquarium pets and plants into the environment. Staff promoted the campaign at eight events in 2009 reaching over 1,000 people. A guest lecture was given at a volunteer training meeting at the Lake Superior Zoo. At large and small pet stores, *Habitattitude* messages are on bags, new tanks, and in-store displays.

Sea Grant provided leadership and expertise during 18 events related to ballast water and maritime commerce. Last winter, Sea Grant was asked to provide advice on state legislative and rulemaking efforts to address ballast water. Sea Grant staff co-lead production of Lake Superior Ballast Water Research, *Superior Science News* radio show and published an article in *Great Lakes Seaway Review* magazine.

Sea Grant assisted the U.S. Coast Guard Ninth District's Prevention Division to organize and facilitate a workshop to discuss vessel ballast water management plans and best management practices with respect to the intra-lake movement of AIS and disease organisms. Focus was on preventing or slowing the spread of viral hemorrhagic septicemia virus (VHSV). Over 40 participants attended the *Great Lakes Ballast Water Management Workshop* in Cleveland. The meeting resulted in a new collaborative interdisciplinary and interagency response to the detection and notification process for disease or AIS at the state and regional levels, which integrates and expands on existing strategies and protocols. To promote public awareness on VHSV, Sea Grant staff wrote an article on VHSV for *Superior Angler* and *Great Lakes Seaway Review* magazines, *Seiche* newsletter, and produced two *Sea Grant Files* KUMD radio shows, *VHS and Lake Superior* and *Great Lakes Shipping*.

Sea Grant educates youth about AIS by participating in a variety of events, responding to student requests, and helping mentor youth on AIS projects.

Staff worked collaboratively with the University of Minnesota Extension's Shoreland Education Team to sponsor five workshops for lake associations and realtors on shoreland buffers, plantings, and plant identification. Several editions of the *From Shore to Shore* newsletter featured AIS efforts.

Communication

In 2009, Minnesota Sea Grant's association with mass media generated 49 story placements with a potential audience of 2.2 million. Interviews (26) appeared on television including: WDIO-TV (Duluth), KBJR-TV (Duluth), KDLH-TV (Duluth), and broadcast on *Minnesota Public Radio*, *KUMD Radio*, and *KDAL Radio*. Articles appeared in newspapers such as the *Minneapolis Star Tribune*, *St. Paul Pioneer Press*, *Pine County Waters*, and *Milwaukee Journal Sentinel*, as well as magazines such as *Cabin Life*, *Lake Superior*, *North Star Port*, *Superior Outdoors*, *Great Lakes News*, and *Great Lakes Seaway Review*. Stories were posted online on the Sea Grant Web site, and distributed via Twitter and RSS feeds. By keeping AIS in the mass media, we contribute to a more aware and knowledgeable society.

Sea Grant produced two radio shows in collaboration with *KUMD Radio* at UMD called *Sea Grant Files* (2008/2009) and *Catching Up With Aquatic Sciences* (2009/2010). Both were so well received by the public that the radio station has packaged them for partnering stations to air across the Great Lakes region. Four of the programs broadcast were related to AIS. Programs can be downloaded from the Internet, by Podcasts and iTunes subscribers.

Sea Grant staff produced nearly 50 publications and articles on AIS including newsletter and magazine articles, WATCH ID cards, a temporary tattoo, a special event flier, reports, mp3 audio clips, RSS feeds, as well as co-authored a book chapter.

Future needs for public awareness in Minnesota

- Maintain spending on paid public awareness radio/TV spots and newspaper ads to reinforce high awareness of invasive species by watercraft users.
- Continue to make public awareness of zebra mussels in Minnesota near Brainerd, Twin Cities, the northern border waters, Lake Superior, the Mississippi, Zumbro, and St. Croix rivers a priority.
- Work cooperatively with specific industry groups to develop targeted public awareness efforts such as the aquaculture industry, live bait dealers, water garden and horticulture industry, and aquarium trade.
- Use MISAC and other multi-entity groups to enhance interagency communication on the status and progress of invasive species management efforts.
- Expand public awareness activities that are cooperative ventures with lake communities outside the metro area.
- Increase information about invasive species available through various communication channels such as the DNR Web site, publications, and media outlets.
- Continue to work collaboratively with Minnesota Sea Grant staff to pursue research and outreach funding through National Sea Grant and other sources.

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Enforcement

Introduction

Enforcement of Minnesota's invasive species regulations is key to reducing the risk of their spread into and throughout Minnesota. Enforcement activities, whether educational opportunities or issuing citations and warnings, are geared towards changing behavior. Enforcement is a primary motivator to changing the behavior of those who may intentionally or unintentionally move invasive species.

In the last 12 months, officers have worked with internal and external stakeholders to identify the types of activities that are likely to spread invasive species in Minnesota waters. These targeted activities are listed below in the regional highlights.

The primary goals of DNR's Enforcement continue to focus on preventing the spread of invasive species into and within Minnesota. Key activities include:

- Reducing the risk of spread by trailered boats for both recreational and commercial watercraft.
- Quickly responding to reports that invasive non-native wild animals have escaped from captivity.
- Rapidly responding to complaints of water appropriation and movement of equipment involving infested waters or prohibited species without the proper permits.
- Investigating non-traditional structures/watercraft being moved into Minnesota waters from infested waters.
- Investigating other pathways of spread such as food markets, bait dealers, aquatic plant dealers, etc.
- Training local law enforcement to enforce invasive species laws.
- Training local bait dealers and lake service providers to gain compliance of invasive species regulations.

Progress in Enforcement Efforts - 2009

Expanded enforcement

This was the first full year that included nine officers who were dedicating a significant portion of their work efforts towards invasive species enforcement. This change was implemented as part of an increased focus on enforcement of invasive species laws.

The efforts to increase enforcement of invasive species laws for the 2009 open water season began long before the ice went out. Enforcement and Ecological Resources management and field staff met in the fall of 2008 to map out strategies on a statewide as well as regional and district levels. During the meeting, it became clear that although this is a statewide effort, the geographical differences across the state made it virtually impossible to have a "one size fits all" approach. At the joint staff meeting, Water Resource Enforcement Officers (WREOs) were able to sit down with their field staff counterparts from Ecological Resources and discuss the best course of action for their

respective areas. These ideas were brought back to the group as a whole for discussion.

In the time period from November 1, 2008, through the present, Minnesota conservation officers have worked 4,843 hours of invasive species enforcement, as compared to 4,163 hours last year for the same time period

Regional Enforcement Highlights

Region 1

Region 1 WREOs attended community meetings throughout 2009 in regard to flowering rush on Detroit Lakes chain of lakes. The meetings included representatives from the Pelican River Watershed District, DNR officials, Detroit Lakes city council, and lake associations from area lakes. The meetings also drew in legislators to discuss law proposals for 2010.

Upon being advised of the arrival of zebra mussels in the area, conservation officers visited with local enforcement officers to formulate a plan of action. The officers took on the task of notifying lake service companies who were currently doing the removal and storage for the season. Officers facilitated training for one company along with staff from Ecological Resources. Information was well received, with the owner's commitment to slow the spread.

With the discovery of zebra mussels in the Alexandria area, WREOs along with local officers coordinated work crews focusing on enforcement of invasive species transportation laws. One work crew was held over the July 4 weekend in the Alexandria chain of lakes. Several local officers and one WREO worked public accesses on area lakes including Le Homme Dieu, Carlos, Darling, Geneva, and Victoria. Another work detail was held on Battle Lake and Ottertail Lakes in Otter Tail County on the weekend of July 16-18. These are popular fishing lakes and receive high numbers of anglers.

Region 2

Early on in the open water season, officers in Region 2 focused on Lake Mille Lacs. There was much media attention regarding the increase in the zebra mussel population and the threat to area lakes. Prior to the inland fishing opener, the invasive species prevention coordinator and the enforcement program manager met with representatives from the Mille Lacs Area Tourism Council to go over enforcement plans for the season as well as eliciting from the tourism board, what specifically the DNR could do to assist them in getting the word out about preventing the spread of invasive species.

In the weeks leading up to and continuing through the walleye opener, officers focused on the Lake Mille Lacs area, educating boaters and issuing warnings, criminal citations, or civil citations as the officers found appropriate.

Region 2 WREOs also were active in training and educating bait dealers as well as lake service providers. Both of these user groups spend a great deal of time moving between bodies of water, making them a possible vector for the spread of invasive species with their equipment.

Region 2 officers also spent time on Lake Superior educating the public. This included anglers, as well as construction crews that had to be informed of the restriction on taking water from an infested water body for projects. Officers also spent time at the Lake Superior Day event, staffing an information booth with coastal management staff.

Region 3

Region 3 officers worked traditional invasive species enforcement as well as branching out into new areas.

Work crews were held throughout the summer on Prior Lake as well as Lake Minnetonka. These details varied from formal planned events to events that local officers conducted on the spur of the moment. The officers' presence was very well received and numerous contacts were made with the public.

A new effort involved working with the U.S. Fish and Wildlife Service (USFWS). A WREO accompanied a USFWS special agent on visits to ethnic markets throughout the region. Officers were looking for live and dead plant and animal species whose importation is illegal. This project is ongoing.

Region 4

The WREOs in Region 4 spent time working with school children at various venues throughout the year, spreading the message of the importance of cleaning off watercraft. Results from this project are hard to quantify, but anecdotally, officers talked to several parents at public accesses throughout the summer who indicated that their school-age children were educating them on the proper cleaning techniques.

Region 4 WREOs also coordinated enforcement regarding two mute swans in the Worthington area. The swans were released into the wild, and the owner was reluctant to re-capture them. After communicating with the owner, his attorney, and a local legislator's office, compliance was worked out. The WREO then assisted the landowner in obtaining proper permits and licenses.

Goals for 2009

The Division of Enforcement believes that enforcement and education play a critical role in reducing the spread of invasive species. A large part of this effort focuses on educating the public. For 2009, WREOs developed plans for education enforcement of invasive species law that are customized to the geographic areas they patrol. These plans focus on both species and activities that are unique to these areas. The WREOs will then coordinate with the invasive species specialists and the local enforcement officers to accomplish these goals.

Participation of Others

Conservation officers continue to work with lake associations and other user groups to assist in spreading the word about controlling the spread of invasive species. Officers will work closely with watercraft inspectors to determine which accesses will afford the best opportunities for educating the public.

Officers are working with other Department staff to develop a schedule to train local officers. These additional officers in the field to observe violations and take enforcement actions are a force multiplier that greatly enhances the ability to detect violations.

Summary of Enforcement Activities

Comparison Summary FY 2008 vs. FY 2009

Violation Type/Time Period	July 1, 2008- June 30, 2009	July 1, 2009- Nov. 2, 2009
Transportation of Aquatic Macrophytes	36	57
Fail to Drain Water/Pull Plug	31	11
Miscellaneous	6	7

Enforcement Action by Type

July 1, 2008 through June 30, 2009 (FY 2008)

Citation Type/Violation	Transport	Drain	Miscellaneous
Written Warning	13	7	1
Criminal Citation	0	3	4
Civil Citation	23	21	1

July 1, 2009 through November 2, 2009 (FY 2009)

Citation Type/Violation	Transport	Drain	Miscellaneous
Written Warning	12	1	3
Criminal Citation	1	1	0
Civil Citation	44	9	4

Enforcement Action Percentages

July 1, 2008 through June 30, 2009 (FY 2008)

Citation Type/Violation	Transport	Drain	Miscellaneous
Written Warning	36%	23%	17%
Criminal Citation	0%	9%	66%
Civil Citation	64%	68%	17%

July 1, 2009 through November 2, 2009 (FY 2009)

Citation Type/Violation	Transport	Drain	Miscellaneous
Written Warning	21%	1%	43%
Criminal Citation	2%	1%	0%
Civil Citation	77%	98%	57%

The data for this fiscal year, although still preliminary, is only lacking citations that have not been sent in for entry into the Department's records. Major changes to the numbers are not anticipated.

Regulations and Proposed Changes

Introduction

Issue

Minnesota's regulations related to invasive species of aquatic plants and wild animals currently in Minnesota Statutes and Minnesota Rules are generally considered to be comprehensive by entities outside of Minnesota that have reviewed invasive species regulations. The state statutes related to these invasive species are found in Minnesota Statutes, Chapter 84D. The administrative rules related to invasive species are found in Minnesota Rules, Chapter 6216. Current versions of both statutes and rules are available at www.revisor.leg.state.mn.us. Summaries of annual changes in the regulations can be found in past DNR annual reports on invasive (harmful exotic) species.

It is the DNR's responsibility to designate *infested waters* (see M.S. 84D.03). Water bodies are designated infested if they contain specific invasive species such as Eurasian watermilfoil, faucet snail, flowering rush, New Zealand mudsnail, ruffe, round goby, spiny waterfleas, white perch, or zebra mussels. The most current list of infested waters was posted on the DNR Web site in December 2009.

The DNR is also required to adopt rules (per Minnesota Statutes 84D.12) that place non-native aquatic plant and wild animal species into various regulatory classifications and prescribe how invasive species permits will be issued (per Minnesota Rules 6216.0265). The DNR is authorized to adopt other rules regarding infested waters and invasive species of aquatic plants and wild animals.

In 2007, the Minnesota Pollution Control Agency (MPCA) joined with the DNR to address the ballast water issue spurred by a Federal District Court ruling in late 2006 that vacated federal exemptions of vessel discharges from National Pollutant Discharge Elimination System (NPDES) permitting. In 2008, the MPCA became involved in developing and implementing vessel discharge (e.g. ballast water) regulations for the state.

Goals

- Continue to support efforts to integrate and improve the comprehensiveness, enforceability, and responsiveness of federal laws regarding noxious weeds, injurious wildlife, and other designations related to invasive species. Specifically seek reauthorization of the National Invasive Species Act (NISA), more restrictive ballast discharge regulations, and designations of injurious wildlife.
- Continue to adopt rules that designate or redesignate additional prohibited invasive species, regulated invasive species, and unregulated non-native species.
- Continue to designate infested waters using Commissioner's Orders.

Progress in Regulations - 2009

Federal

At the national level, the following are key regulatory areas: 1) reauthorization of the National Invasive Species Act of 1996; 2) national ballast water regulations; and 3) potential designation of additional injurious wildlife. Progress during 2009 on these areas is described below:

- **U.S. Coast Guard** - On August 28, the U.S. Coast Guard issued its "Notice of Proposed Rulemaking for the Standards for Living Organisms in Ships' Ballast Water Discharged in U.S. Waters" in the *Federal Register* detailing proposed national ballast treatment requirements and processes. Comments on the proposed rules were submitted jointly by the MPCA and DNR on December 3- 4, 2009. The comments pointed out that strong federal action that is protective of Minnesota's waters remains an objective of the MPCA and DNR. The comments also encouraged the Coast Guard to impose the most rapid implementation schedule achievable.

State Statute Changes

The Legislature passed legislation in 2009 that was related to non-native and invasive species that allows DNR to respond to non-native or domestic animals that have been released, escaped, or otherwise running at large.

House File 1122 included the following:

Sec. 89. Minnesota Statutes 2008, section 97A.045, subdivision 1, is amended to read: [changes are underlined]

Subdivision 1. Duties; generally. (a) The commissioner shall do all things the commissioner determines are necessary to preserve, protect, and propagate desirable species of wild animals. The commissioner shall make special provisions for the management of fish and wildlife to ensure recreational opportunities for anglers and hunters. The commissioner shall acquire wild animals for breeding or stocking and may dispose of or destroy undesirable or predatory wild animals and their dens, nests, houses, or dams.

(b) Notwithstanding chapters 17 and 35, the commissioner, in consultation with the commissioner of agriculture and the executive director of the Board of Animal Health, may capture or control nonnative or domestic animals that are released, have escaped, or are otherwise running at large and causing damage to natural resources or agricultural lands, or that are posing a threat to wildlife, domestic animals, or human health. The commissioner may work with other agencies to assist in the capture or control and may authorize persons to take such animals.

Sec. 103. FERAL SWINE REPORT.

The commissioner of natural resources, in coordination with the commissioner of agriculture and the executive director of the Board of Animal Health, shall develop a report and recommend any necessary changes to state policies, authorities, and penalties related to feral swine and other nonnative or domestic animals released, that have escaped, or that are otherwise running at large. The agencies shall consult

with interested stakeholders. No later than January 15, 2010, the commissioner of natural resources shall submit the report to the legislative committees with jurisdiction over natural resources or agriculture policy or finance.

DNR Permanent Rules

State statutes now allow the designation of infested waters via DNR Commissioner's Order instead of rulemaking. Therefore, the outdated permanent rule that previously listed infested waters in *Minnesota Rules*, part 6216.0350 was repealed. It was published in the *State Register* on October 12, 2009, and the repeal became effective on October 19, 2009.

MPCA Permits

The MPCA used its existing state authorities to issue a five-year Ballast Water Discharge General Permit (Permit) on September 24, 2008, that helps to mitigate the introduction and spread of invasive species via ballast water. Since the permit became effective, over 250 vessels have applied to MPCA and are now covered by the permit.

DNR Commissioner's Orders

Three Commissioner's Orders were issued in 2009 to designate additional infested waters. The orders were published in the *State Register* on May 18, July 20, and December 28, 2009.

Future needs for Regulations and Proposed Changes

- Support the reauthorization of NISA and designations of injurious wildlife such as the bighead carp.
- Use species evaluations and current literature to propose appropriate regulatory designations that will protect Minnesota's environment from the introduction of invasive species.
- Work with staff members at the MPCA who regulate wastewater to inform licensees about laws regarding transport of water from infested waters and also contact marinas statewide regarding invasive species laws.
- Partner with the MPCA regarding establishment of state and federal ballast water regulations protective of Minnesota and the nation's waters.

Watercraft Inspections and Awareness Events

Introduction

Issue

The potential for boaters to accidentally move aquatic invasive species from one lake to another is a clear threat to Minnesota's aquatic ecosystems. For this reason, the 1991 Minnesota Legislature mandated that DNR conservation officers conduct inspections of trailered boats on Minnesota highways. The purpose of these inspections was to look for Eurasian watermilfoil, issue citations to violators, and inform the public about the potential spread of aquatic invasive species.

In 1992, the DNR, Minnesota Lakes Association, and angling groups proposed and supported legislation (adopted as M.S. 18.317, Subd. 3A, and recodified as 84D.02 subd. 4) requiring 10,000 hours of inspections of watercraft leaving infested water bodies containing aquatic invasive species such as Eurasian watermilfoil, spiny waterflea, and zebra mussels. Subsequently, a Watercraft Inspection Program was established by the DNR in 1992 to accomplish this mandate. In 1993, legislation was passed increasing the number of inspection hours to 20,000 starting with the 1994 boating season. In 1999, this statute was amended to allow inspections on both infested and uninfested water bodies to fulfill the 20,000-hour requirement. Effective June 1, 2004, the 20,000-hour requirement was lowered to 10,000 hours.

Goals

Watercraft inspections help to achieve the second goal of the Invasive Species Program: preventing the spread of invasive species within Minnesota. The inspectors also help to:

- Complete up to 20,000 hours of watercraft inspection at public water accesses across the state;
- Increase public awareness about invasive species and the potential for boaters to transport invasive species between water bodies;
- Reduce the percentage of trailered boats carrying invasive species;
- Increase educational efforts with citizen groups.

Progress in Watercraft Inspections - 2009

Complete required hours of watercraft inspection

In 2009, approximately 80 watercraft inspectors worked through the summer providing information to the public on watercraft inspections and invasive species. Inspections began in late April and continued through mid-October. Within this 25-week period, watercraft inspectors logged over 42,000 inspection hours. A total of 66,000 watercraft/trailers were inspected.

During the inspection season, inspections were conducted at 48 fishing tournaments and continued through October in order to reach waterfowl hunters. Inspectors distributed more than 9,300 Invasive Alert Tags on vehicles with trailers at access

points on infested waters. Inspectors also worked to clear aquatic plant fragments from the public water accesses (PWAs) at which they were stationed.

Inspection efforts were conducted across the state in rough proportion to the number of PWAs on infested water bodies (Table 5 and Figure 4). The actual distribution of time reflects both the number of PWAs and the intensity of public use at those accesses. The percent of time that the program spent in Region 1 had gradually increased from 2001 to 2006 and then jumped significantly in 2007, 2008 and 2009 (Table 5 and Figure 5). This increase is due to the discovery of the spiny waterflea in the northern border waters and the addition of a new crew to the northwest area of the state in 2008. Region 2 had an increase in inspections in 2009 (Table 5). This can be attributed to the spiny waterflea infestation along the northern border waters, the zebra mussel infestation of Lake Mille Lacs, and an increasing number of cooperative hires and prevention grants in the Brainerd area. Region 3 inspections increased dramatically from 2008 to 2009 in part due to a prevention grant and cooperative agreement with the Lake Minnetonka Conservation District that resulted in a crew of 15 inspectors working there for the season. Region 4 inspections remained stable from the previous year (Table 5).

Table 5. Number of watercraft inspections conducted by watercraft inspectors in 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, and 2009. (Totals are rounded values).

Year	DNR Region				Total
	1	2	3	4	
2001	1,700	4,000	27,200	5,800	39,000
2002	660	3,100	32,300	7,700	44,000
2003	760	5,600	29,700	5,500	42,000
2004	1,200	6,800	35,600	6,800	50,000
2005	1,500	8,300	39,500	5,800	55,000
2006	1,900	9,900	25,600	3,200	41,000
2007	3,100	7,900	25,700	4,900	42,000
2008	5,400	10,100	29,400	4,100	49,000
2009	7,900	14,100	39,600	4,300	65,900

The Watercraft Inspection Program has primarily focused on water bodies with infestations of aquatic invasive species. This approach was used because there were relatively few infested water bodies and so it was very efficient. While it is important to contact boaters leaving water bodies infested with aquatic invasive species, we feel it is also important to inform boaters on other popular recreation lakes in Minnesota. To allow more flexibility in the program, state statute was amended to include watercraft inspections on uninfested water bodies in order to meet the Department's 10,000-hour mandate (M.S. 84D.02, Subd. 4). During 2009, inspections on uninfested waters represented about 29% of the total inspections (19,000 inspections) and approximately 29% of the inspection hours (12,500 hours). Due to an increased number of cooperative contracts for additional inspections at several uninfested water bodies and prevention grants that started in 2008, both the number of hours and inspections at uninfested waters has increased since 2006.

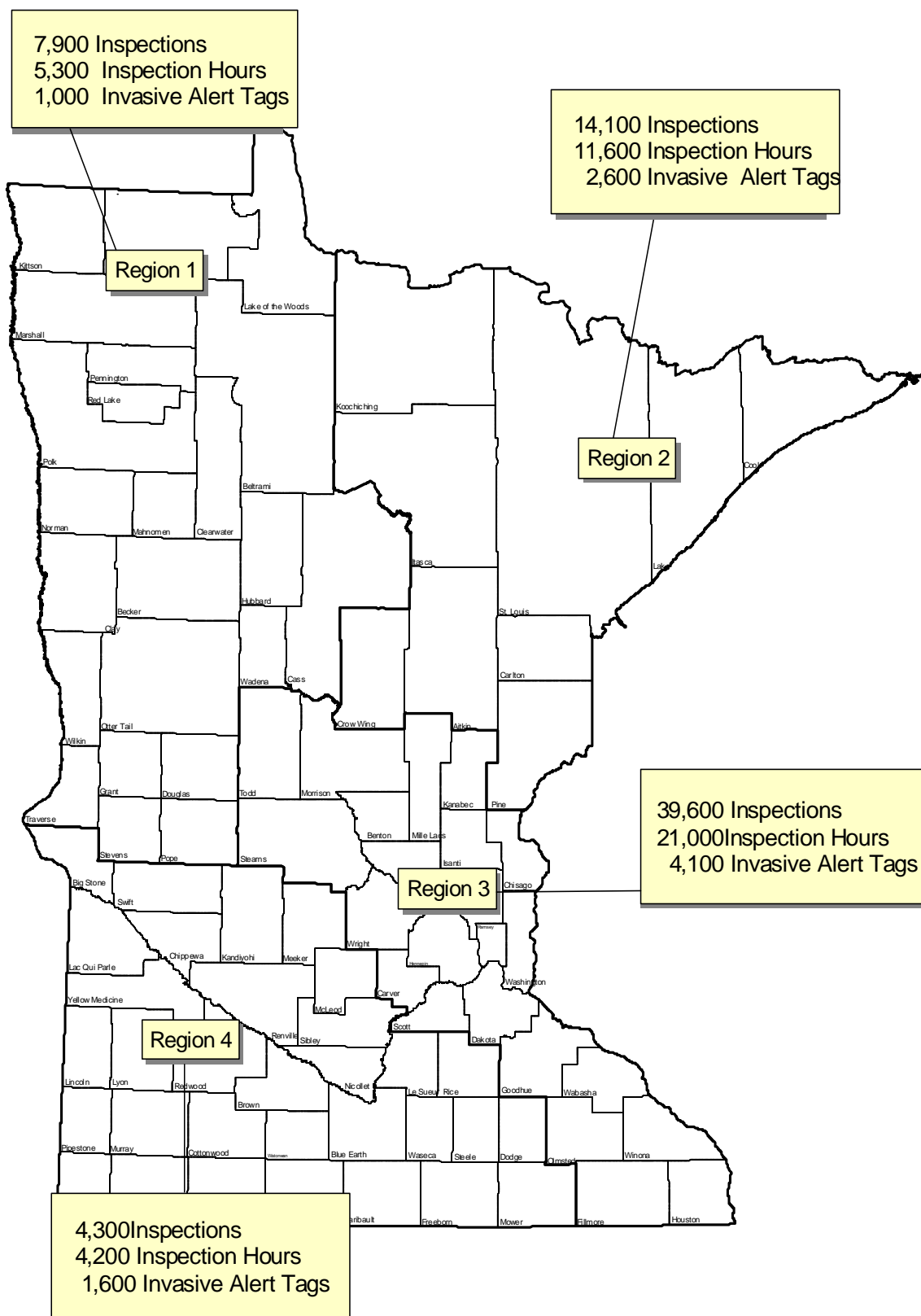


Figure 4. DNR watercraft inspections at public water accesses in 2009.

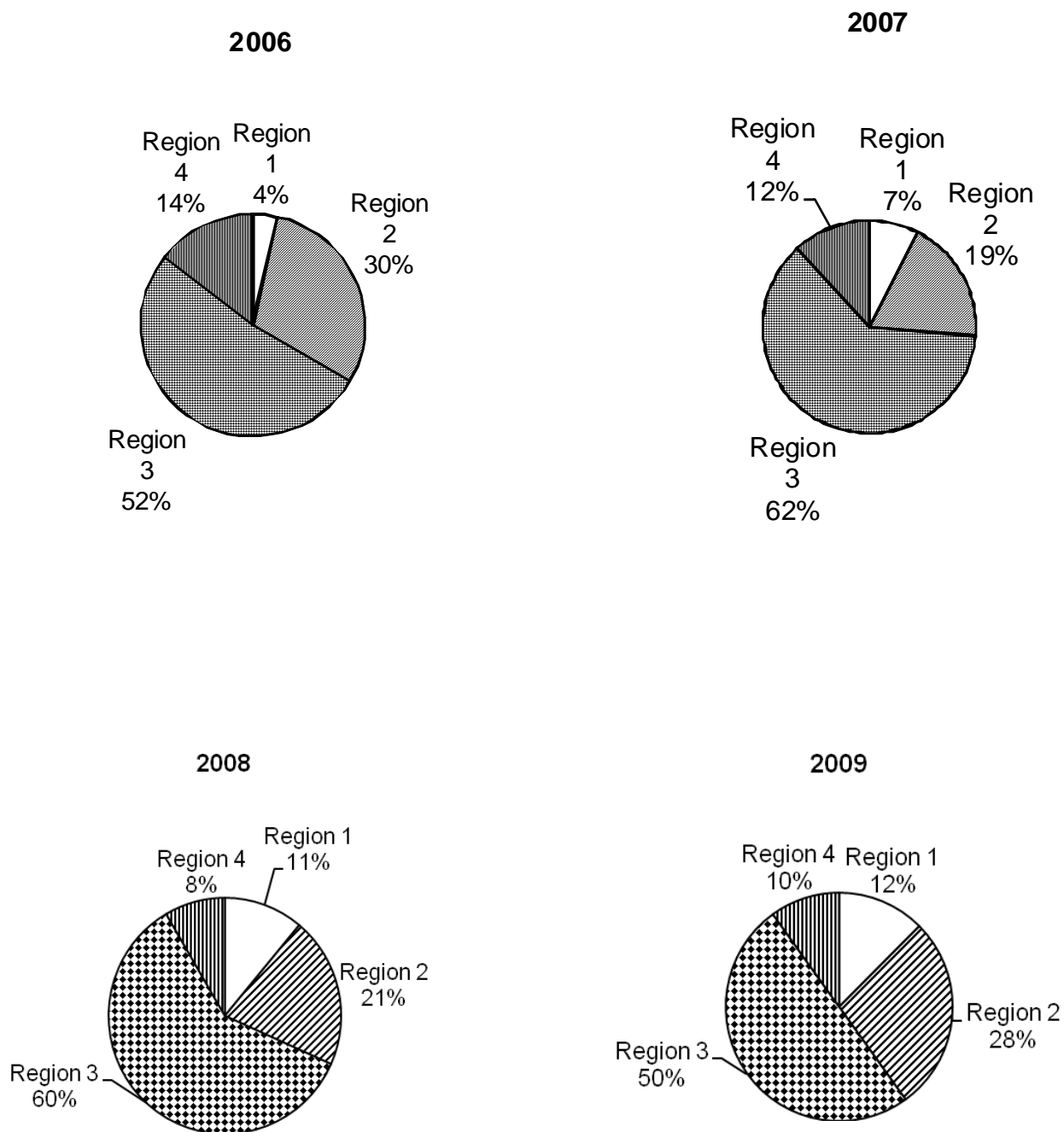


Figure 5. Percent of the state's total watercraft inspection hours spent in each region in 2006, 2007, 2008 and 2009.

To determine which uninfested waters to visit, we used three criteria: 1) lakes or areas with a high level of boater activity; 2) lakes identified on program surveys as frequent destinations for boaters leaving infested water bodies; and 3) lakes with lake associations or groups that desired to hold “Invasive Species Awareness Events”, have cooperatively hired with us, or received a grant for watercraft inspection hours.

Although the program has broadened to include inspections at uninfested waters, the majority of the inspections are still done at infested water bodies. Watercraft inspection hours in Regions 1 and 2 have been increasing since 2007 when spiny waterflea were discovered along the northern border of the state (see Other Invasive Animal Species in Minnesota). The watercraft inspection program also exceeded its goal of 1,000 hours of inspection on Lake Mille Lacs in the Brainerd area. Lake Mille Lacs was found to be infested with zebra mussels in 2005, and in 2009, spiny waterflea were discovered there as well. Also in 2009, zebra mussels were found for the first time in the west central area of the state, and watercraft inspections were increased in response to this infestation (see Management of Zebra Mussels).

Increase public awareness

Each boater contacted by a watercraft inspector is asked a standard series of questions. These surveys provide important information on the public’s awareness of invasive species laws and help identify high-risk areas (i.e., accesses where many watercraft pick up plant fragments). According to survey information collected by watercraft inspectors, awareness of invasive species laws remains very high among Minnesota boaters. The percent of watercraft users who responded “yes” when asked if they were aware of the invasive species laws for the state was 97%, up from 91% in 2008. Boaters from other states using Minnesota water bodies had a slightly lower response at 96%, up from 79% in 2008. These increases in the number of individuals who were already aware of invasive species when they were inspected may be due to program expansions that have been made in the last three years. An increase in inspections in the northern border waters along with the addition of a northwest crew in 2008 meant that we saw a lower number of watercraft users who were aware of the laws in 2008, but when we encountered them for a second time in 2009 they were now aware.

Of those who said they were not familiar with the laws, 1.1% (11 out of 960) had invasive species or vegetation on their watercraft when they entered the access. In contrast, 0.9% (375 out of 41,045) of the people who said that they were familiar with the laws entered the access with vegetation. Overall the number of watercraft that came to the access with attached vegetation or other invasive species decreased by almost half from 1.7% (517 out of 29,984) in 2008 to 0.9% (386 out of 42,005) in 2009.

Decals are given to boaters (see Decal Program for Trailered Watercraft) to signify that they have talked with a watercraft inspector. Of those with no decal, 3.7% (down from 12% in 2008) said they were not familiar with the invasive species laws. In contrast, of those with a year 2009 decal, 306 out of 21,674 boaters or slightly more than 1% said they were not familiar with the laws. Of those with a previous year decal, 1.7% said they were not familiar with invasive species laws. This suggests that the Watercraft

Inspection Program is successful at educating boaters about Minnesota's invasive species laws.

Reduce the percentage of trailered boats carrying invasive species

The Watercraft Inspection Program has been unable to assist with roadchecks due to changes in the law that prevents the Department from conducting them.

Increase educational efforts with citizen groups

In 2009, the Watercraft Inspection Program participated in many public awareness activities and worked with several citizen groups in order to educate the public about aquatic invasive species. Inspectors answered questions at the invasive species display at the Minnesota State Fair, spoke with families at the Mills Fleet Farm Kid's Fishing Day event, and educated visitors at several county fairs. The Watercraft Inspection Program was also able to work with several citizen groups throughout the season both through awareness events and participation in lake association meetings. Twelve volunteer trainings were conducted during the season; trainees included the Sportsmen's Club of Lake Vermilion, Lake Sylvia Association, Big Lake Public Works staff, Bay Lake Association, Big Watab Lake Association, Palmer Lake Association, the Whitefish Area Property Owners Association, the Aitkin County Lakes and Rivers Association, the staff of the Breezy Point Resort boat landing, and Hubbard County Coalition of Lake Associations. The Watercraft Inspection Program also gave 21 talks and presentations to interested groups.

In 2009, the DNR Invasive Species Program offered prevention grants to local entities for the purpose of helping them to implement locally focused prevention efforts. Fourteen local entities received grants for additional hours of watercraft inspection. The grantees are: the Lake Minnetonka Conservation District, Gull Lake Association, Pelican Group of Lakes Improvement District, Friends of Lower Hay Lake Association, Big Watab Lake Association, the Sportsmen's Club of Lake Vermilion, Bad Medicine Lake Area Foundation, Bay Lake Improvement Association, Hubbard County Coalition of Lakes, North Long Lake Association, Otter Tail Lakes Property Owners Association, Waterville Lakes Association, the Whitefish Area Property Owners Association and the Pelican Lake Property Owners Association. Each grantee agreed to pay for a certain number of watercraft inspection hours with a match from the DNR. This cooperative effort helped local entities increase inspection hours in their areas and increase invasive species awareness.

The Watercraft Inspection Program also worked with eight lake associations and citizen groups to increase inspection hours in their areas through cooperative agreements. These citizen groups funded additional hours of inspection at their accesses while the Watercraft Inspection Program provided training, equipment, and supervision. The Lake Minnetonka Conservation District (LMCD) worked with the Watercraft Inspection Program for the eighth year in addition to the grant they received. Inspectors spent an additional 1,563 hours on nine Lake Minnetonka accesses because of the funding provided by the LMCD. This was the second year that the Roosevelt and Lawrence Area Lakes Association (RALALA) completed a cooperative agreement with the DNR, RALALA increased inspection time at their accesses by 62 hours. This was the fourth year that Big Sandy Lake Association and Plantagenet Lake Association

worked with the watercraft inspection program and they increased hours at their accesses by 340 and 84 hours respectively. Pike Lake Association worked with the DNR for the sixth year to increase inspections at their access by 422 hours. This was the first year that the Lake Ossawinamakee Association, Indian Lake Association, and Lobster Lake Association worked with the DNR to increase inspections at their accesses; hours were increased by 60, 75, and 40 respectively.

Estimate of Risk from Trailered Boats

The percentage of boats/trailers carrying vegetation as they were trailered out of a lake or river varied widely by county (Figure 6). These variations may be caused by several variables including the amount and type of vegetation in the water body, its proximity to the public water access, and the amount of recreational boating traffic. An average of 4% of the watercraft checked by watercraft inspectors as they were exiting a water body were found with vegetation, down from 15% in 2008.

Transportation of Other Invasive Species

No watercraft was found to have zebra mussels on them prior to entering a water body. Six watercraft were found to have attached zebra mussels when inspected leaving the Mississippi and St. Louis rivers, Pelican Lake in Otter Tail County, and Lower Prior Lake. All of the water bodies are infested with zebra mussels. This demonstrates a clear risk of zebra mussels being moved on boat hulls or on plants caught on trailers if boats are not properly cleaned. Anglers who “catch” zebra mussels off the bottom and discard them in the bottom of their boats also can move them.

One watercraft was also found to have spiny waterflea attached when exiting Upper Prior Lake. In each of these cases, the watercraft owner would have been asked to dispose of the invasive species before leaving the access.

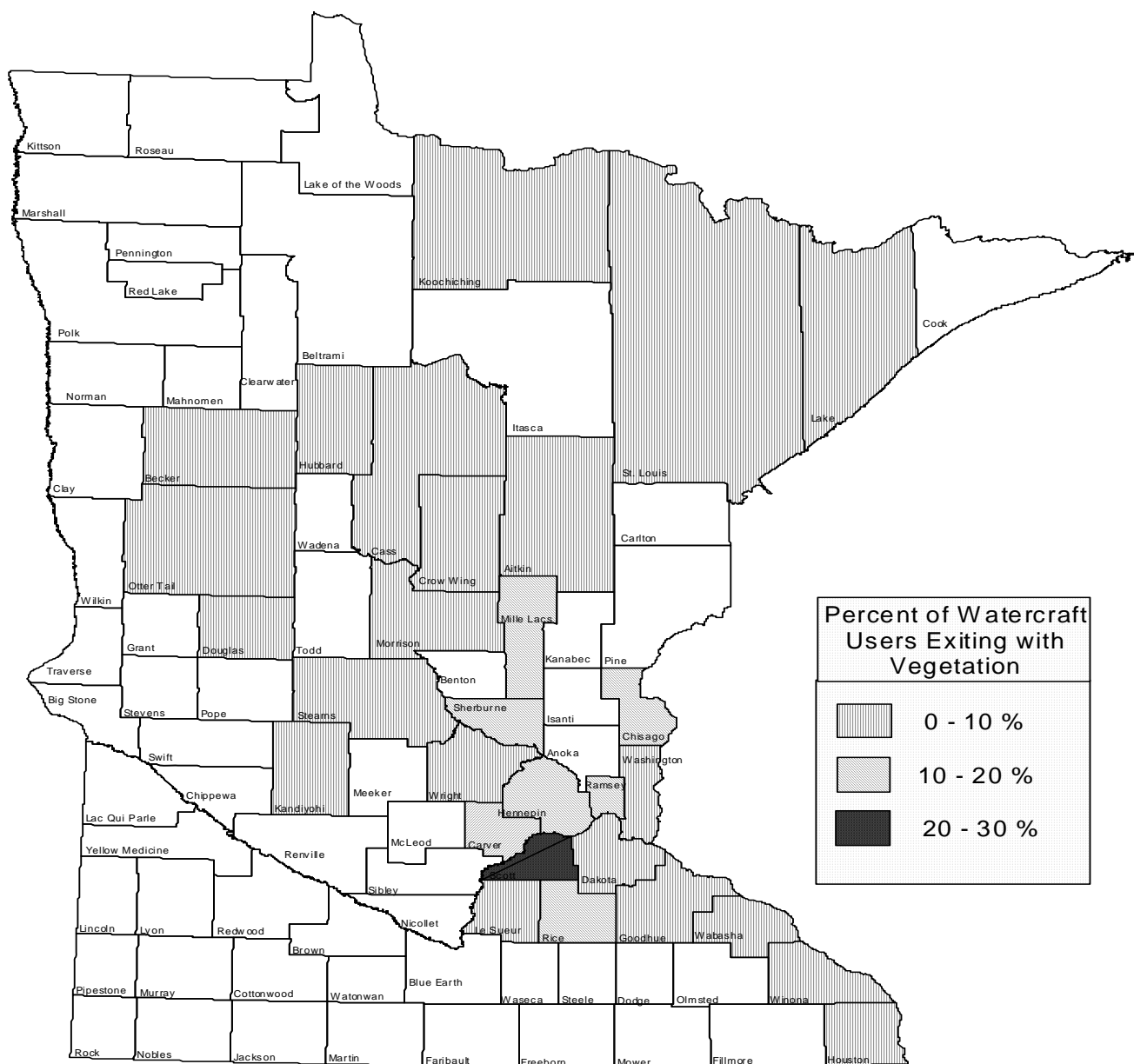


Figure 6. Percentage of exiting watercraft with attached vegetation prior to inspection and cleaning (in counties where more than 100 boats were inspected upon leaving an access).

Decal Program for Trailered Watercraft

During the 1994 boating season, several boaters expressed frustration over being approached by inspectors several times each week throughout the summer. To respond to their concerns and to reduce the duplication of education efforts, a decal was developed and distributed to boaters whose watercraft had been inspected for invasive species (Figure 7). Boaters are instructed to voluntarily affix the decal to the winch post of their trailer. This allows inspectors to identify the boaters who have already spoken with inspectors during the summer. Boaters with a decal are given a brief reminder to drain water and remove vegetation from their boats. The decals have been used for 14 years now and have been well received by the public. The approximately 44,000 decals distributed during the 2009 boating season also remind boaters to inspect their boats when inspectors are not present.

Future needs and recommendations for watercraft inspections

- Increase cooperation and partnerships with citizen groups that would like to help raise awareness in their areas.
- Increase the number of prevention grants awarded for watercraft inspection.
- Expand the number of community events in which we participate in order to educate new audiences about invasive species.



Figure 7. Decal provided to boaters by DNR watercraft inspectors in 2009.

Management of Invasive Plants

Introduction

Invasive species include a number of non-native plants that can naturalize in Minnesota, threatening natural resources and their use. Invasive plant species can displace native plants that provide critical habitat. Reducing such impacts on Minnesota's ecology, society, and economy is the goal of management of invasive plants in the state. For the purposes of management, invasive plants are divided into two groups, aquatic and terrestrial species.

In regards to terrestrial invasive plants, the DNR's Invasive Species Program is primarily concerned with management of these species on lands owned by the state. These include Scientific and Natural Areas, State Forests, Wildlife Management Areas, Aquatic Management Areas, State Parks, and State Trails, all of which are managed by the DNR (see Terrestrial Invasive Plant Management). In the case of private land, owners usually manage invasive terrestrial plants without the involvement of the Invasive Species Program.

By contrast, the waters in which aquatic plants grow are owned by the citizens of Minnesota (Minnesota Statute 84.091). Minnesotans have been managing aquatic plants along our lakeshores for many years, mainly to allow owners of shoreline to gain access to the lake. Management of aquatic plants in lakes is regulated by the State of Minnesota because these plants provide a number of benefits to these bodies of water. These include provision of food and shelter for fish and wildlife, protection and enhancement of water quality, protection of shorelines and lake bottoms from erosion, and so forth.

Management of aquatic plants in wetlands is also an activity undertaken by the DNR. The principal invasive plant in wetlands that concerns the Invasive Species Program is purple loosestrife.

Over the last 20 years, interest in the management of aquatic invasive plant species has increased. Today, there are many projects undertaken in Minnesota to manage aquatic invasive plants. Most of these projects involve both users of the lakes and the DNR.

Management of invasive aquatic plants with support from the DNR

When users of a lake or wetland become aware of an invasive aquatic plant in these habitats, they want to know what the plant is, what problems it might cause, and what can be done. The Invasive Species Program works with citizens to address the issues raised by invasive aquatic plants. These efforts include providing general information and technical assistance, assessment of the distribution and abundance of invasive aquatic plants in lakes, wetlands, and rivers, development of approaches to management, grants to support management, and monitoring outcomes of management.

Following are general observations regarding management of invasive aquatic plants:

1. An invasive aquatic plant cannot be eradicated from a lake or wetland once it is established
2. An invasive aquatic plant cannot be prevented from spreading within a lake or wetland once it is established, and
3. The abundance of an invasive aquatic plant in an area can be reduced, at least temporarily, thereby reducing the nuisances caused by dense or abundant growths. This means that problems for users of lakes and wetlands can be managed, though this usually requires continuing efforts.

In 2009, the capacity of the Invasive Species Program to work with citizens to manage invasive aquatic plants increased with the addition of new invasive species specialists in Park Rapids, Fergus Falls, and New Ulm. Previously existing positions are located in Grand Rapids, Brainerd, and St. Paul. Below is a summary of support for management of invasive aquatic plants provided by the DNR in 2009.

Lake-wide or bay-wide control is done to reduce the effects of invasive aquatic plants on native plants and water quality, as well as provide relief from nuisances. These efforts include pilot projects supported with grants by the DNR's Invasive Species Program (see Management of Curly-leaf Pondweed and Management of Eurasian Watermilfoil). The purpose of offering these funds is to allow a limited number of well-planned and well-monitored projects to go forward in order to determine if ecological benefits could be obtained by lake-wide or bay-wide control. These efforts are called pilot projects because it is not known whether the desired ecological benefits can be reliably achieved.

In 2009, 43 applications were submitted for grants under this program and 26 proposals were approved. This is twice the number of projects that were approved in 2008. During 2009, a total of \$443,000 has been provided as reimbursements to grantees to date. In most cases, grants from the DNR cover a portion of the costs of control and local funds are used to cover the balance. In 2009, grants from the DNR comprised 63% of the total costs of control. In 2009, one project to which a grant was given did not proceed because of inadequate local funds.

Of the 25 projects that proceeded, ten were monitored by the University of Minnesota with \$80,000 in funding from the DNR. Monitoring on the other 15 pilot projects was completed by the DNR and others.

Partial-lake treatments of invasive aquatic plants are focused on reducing interference with use of our lakes. Most of this work is done by owners of shoreline who want to gain access to the lake. Some control of Eurasian watermilfoil and flowering rush where it interferes with use of lakes in off-shore or public-use areas is supported with grants from the DNR's Invasive Species Program (see Management of Eurasian Watermilfoil and Management of Flowering Rush). In 2009, the DNR awarded grants totaling

\$135,000 to 25 lakes for control of nuisances caused by Eurasian watermilfoil or flowering rush.

The Invasive Species Program offered a limited number of grants to support efforts by people on lakes with newly discovered populations of Eurasian watermilfoil or flowering rush to aggressively treat the invasive species in an attempt to prevent spread within the lake. This type of management is called Early Detection and Rapid Response (EDRR). In 2009, applications for grants to support EDRR were received from groups on eight lakes with Eurasian watermilfoil. In five of these cases, inspection of the distribution and abundance of Eurasian watermilfoil by the DNR showed that the invasive plant was too widespread to justify EDRR. In the other three cases, the distribution of milfoil was sufficiently limited to justify a grant for EDRR. Recipients of these grants are expected to receive reimbursements totaling \$4,500. On one lake, the discovery of flowering rush caused the Invasive Species Program to respond rapidly by attempting control of the plant. Unfortunately, subsequent searching of the lake revealed that flowering rush was more widespread than initially thought and not actually a candidate for continued aggressive control.

The Invasive Species Program controls Eurasian watermilfoil at public water accesses to improve access or reduce the risk of spread of Eurasian watermilfoil to uninfested lakes or both. In 2009, the DNR initiated treatment of milfoil on four lakes in the immediate vicinity of public water accesses operated by the DNR and in harbors on Mille Lacs and Leech lakes. The cost of these treatments was \$17,000.

Efforts of the Invasive Species Program to manage purple loosestrife in wetlands during 2009 included treatment of small infestations and release of biological control agents on targeted sites (see Management of Purple Loosestrife).

Management of Curly-leaf Pondweed

2009 Highlights

- The DNR doubled the funding and number of lakes in the grant program for pilot projects for lake-wide control of curly-leaf pondweed or curly-leaf pondweed and Eurasian watermilfoil in 2009 by comparison with 2008. Grants totaling \$472,000 were given to 25 lakes under this program in 2009.
- Continuing evaluations of lake-wide treatments indicate that:
 - Lake-wide treatments of curly-leaf pondweed reduced the invasive plant during the year of treatment.
 - Overall, most native plants were not harmed by these treatments. Nevertheless, there are enough examples of harm to certain native plants to warrant caution in conducting lake-wide treatments.
 - Reductions in curly-leaf alone are not likely to result in major impacts on clarity of lake water.
- More study will be needed to determine the longevity of reductions in curly-leaf once treatments are stopped.



Introduction

Issue

Life history of curly-leaf pondweed

Curly-leaf pondweed (*Potamogeton crispus*) is a perennial, rooted, submersed vascular plant that was first noted in Minnesota about 1910 (Moyle and Hotchkiss 1945). By late spring, curly-leaf pondweed can form dense mats that may interfere with recreation and limit the growth of native aquatic plants (Catling and Dobson 1985). Curly-leaf plants usually die in early summer in response to increasing water temperatures, which can result in rafts of dying plants piling up on shorelines. Before dying, curly-leaf plants form vegetative propagules called turions (hardened stem tips). Turions sprout in fall to produce new plants (Catling and Dobson 1985), which remain alive through the winter slowly growing even under thick ice and snow cover (Wehrmeister and Stuckey 1978). This life history is unlike that of most native plants. Therefore, curly-leaf pondweed plant is often the first plant to appear after ice-out. The death of curly-leaf plants in mid-summer often is followed by an increase in phosphorus (Bolduan et al. 1994, James et al. 2002) and undesirable algal blooms.

Relationships between curly-leaf pondweed and water quality

Before describing the relationship between curly-leaf pondweed and water quality, it would be helpful to review the general relationship between submersed aquatic plants and water quality. It has long been known that aquatic plants are associated with, and may maintain, relatively high water clarity in lakes. Scheffer et al. (1993:275) showed that lakes with abundant submersed plants tend to have higher clarity than lakes with

similar levels of nutrients in which vegetation is sparse or absent. Submersed vegetation helps maintain water clarity by stabilizing bottom sediments and preventing bottom materials from being re-suspended in the water column (James and Barko 1994). The importance of submersed plants in maintaining water clarity is reflected in observations of decreases in water clarity following lake-wide reductions in submersed plants due to treatment with herbicide (O'Dell et al. 1995:314, Welling et al. 1997, Valley et al. 2006, Wagner et al. 2007).

There is much interest in the role of curly-leaf pondweed in phosphorus dynamics in lakes. Among four examples, the proportions of the phosphorus budgets attributed to curly-leaf varied from five to 65% (Table 6). While some or much of the increases in phosphorus observed in lakes following senescence of curly-leaf pondweed may be attributed to the release of the nutrient from the dead plants, other factors may contribute as well. For example, it has been hypothesized that senescence results in the accumulation of dead plant material on the surface of the sediment, which in turn leads to development of anoxic conditions, which then accelerate release of phosphorus from the sediments. The lack of plants in the water column also may allow an increase in mixing of water due to winds, which may increase the availability of phosphorus to phytoplankton and so promote algal blooms.

In addition, phosphorus concentrations in lake water may be affected by other in-lake factors such as activity of benthivorous fish and boat activity, which may increase release of phosphorus from sediment in the bottom of the lake. External loading of phosphorus from the watershed may be significant as well. Among the examples presented here, the proportions of the phosphorus budgets attributed to external loading varied from 21 to 77% (Table 6).

Table 6. Lakes with curly-leaf pondweed, *Potamogeton crispus*, with sizes and percentages of phosphorus budgets accounted for by curly-leaf and external loading.

Number	Lake	Total acres	Littoral acres	Percent littoral	% total load of phosphorus attributed to curly-leaf pondweed	% total load of phosphorus attributed to external loading	Source
1	Medicine	886	399	45	5	52	Vlach et al. (No Date)
2	Half Moon	250	250	100	20	21	James et al. (2002)
3	McGinnis, N lobe	11	<< 11	<< 100	5	77	James et al. (2003)
	McGinnis, S lobe	21	21	100	65	25	James et al. (2003)
4	SE Anderson	81	81	100	29	58	Anonymous (2009a)

Potential to improve water quality by control of curly-leaf pondweed

There is much interest in the potential to improve water quality by control of curly-leaf pondweed. The U.S. Army Engineer Research and Development Center (ERDC) used a model to predict water quality based on specified reductions in sources of phosphorus in a shallow oxbow lake in Wisconsin (James et al. 2002). They estimated that a 90% reduction in phosphorus coming from *P. crispus* due to mechanical control would not appreciably reduce the summer concentration of chlorophyll a or Secchi transparency. The addition of other measures to reduce both internal and external contributions of phosphorus was estimated to have significant potential to reduce concentrations of phosphorus and chlorophyll a, and increase Secchi transparency.

Two lakes in Dakota County, Minnesota, were treated with endothall herbicide on a lake-wide basis to control curly-leaf pondweed annually during a four-year period from 2000 through 2003 by the ERDC in cooperation with the DNR and others (Skogerboe et al. 2008). The treatments reduced curly-leaf and were followed by some increases in native submersed plants. Following treatments, water quality did not significantly improve (Eric MacBeth, pers. comm.).

Medicine Lake was subjected to lake-wide treatment to control curly-leaf pondweed in a long-term effort to improve water quality during 2004, 2005, 2006, 2008 and 2009. Monitoring by Three Rivers Park District through 2007 showed that, even though concentrations of phosphorus in 2005 and 2006 decreased by comparison with previous years, this did not result in a decrease in either chlorophyll a or Secchi disk depth (Vlach and Barten 2008:20). Results such as these suggest that control of curly-leaf alone may not be sufficient to improve water clarity.

Methods for control of curly-leaf pondweed

The DNR recommends that control of curly-leaf pondweed be done by treatments with an endothall-based herbicide such as Aquathol K. Treatment of areas more than one acre in size should be done at a low rate, 0.75 to 1.0 ppm endothall. Treatment of areas less than one acre in size should be done with a rate of 1.5 ppm endothall. Treatments should be done when water temperatures are between 50 and 60 degrees F, and are increasing. While treatment areas can be estimated from surveys in the year before treatment for the purpose of obtaining a permit, actual areas to be treated should be based on pre-treatment plant surveys conducted in April during the year of treatment.

These guidelines are based on research that has been done in Minnesota on early-season treatments with endothall (Netherland et al. 2000, Poovey et al. 2002, Invasive Species Program 2006, Skogerboe et al. 2008) and guidance from United Phosphorous Inc. (formerly CerexAgri), the manufacturer of endothall-based herbicides such as Aquathol K.

Another approach to control of curly-leaf pondweed is whole-lake treatment with fluridone herbicide. Exposure of plants to 4 ppb fluridone for at least 56 days can provide high levels of control of curly-leaf pondweed (Poovey et al. 2009).

Goals

The DNR has two goals for curly-leaf pondweed management:

- To prevent the spread of curly-leaf pondweed within Minnesota.
- To reduce the impacts caused by curly-leaf pondweed to Minnesota's ecology, society, and economy.

Distribution of curly-leaf pondweed locations in Minnesota

Curly-leaf pondweed is known to occur in 759 Minnesota lakes in 70 of the 87 counties (Figure 8).

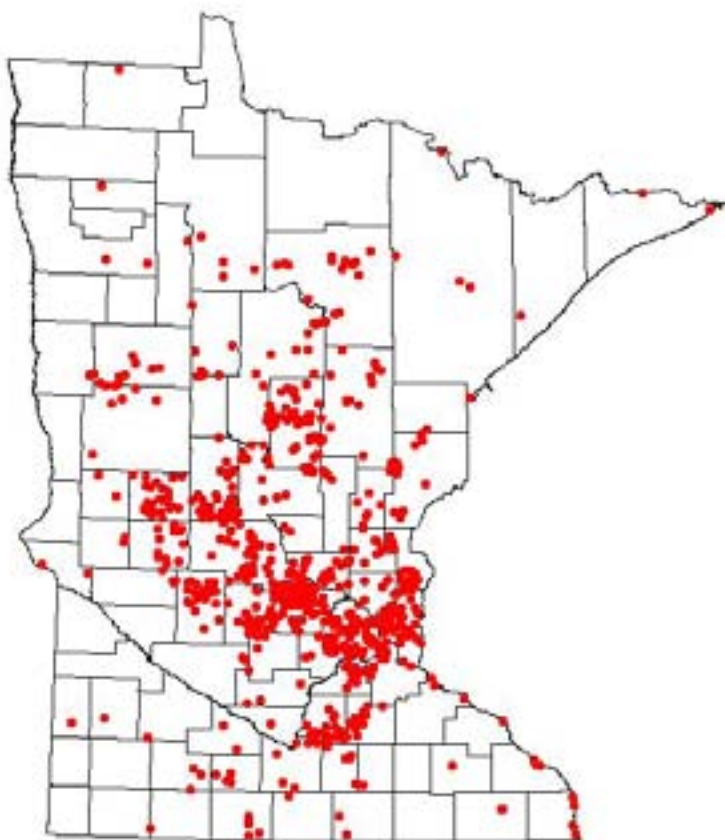


Figure 8. Curly-leaf pondweed locations in Minnesota as of November 2009 (compiled from reports from DNR Fisheries, Wildlife, and Ecological Resources staff).

Prevention of spread

The Invasive Species Program continued to use watercraft inspections, informational materials, and public speaking engagements to further our efforts to prevent the accidental spread of curly-leaf pondweed. In particular, access inspectors spent time at several lakes, which are heavily infested with curly-leaf pondweed (see Watercraft Inspections and Awareness Events). DNR conservation officers also helped prevent the spread of curly-leaf pondweed through enforcement of state laws that make it illegal to transfer aquatic plants on public roads (see Enforcement).

Progress in Management of Curly-leaf Pondweed - 2009

Lake-wide treatments of curly-leaf pondweed for ecological benefits: Pilot projects

Lake-wide treatments are those that attempt to treat all, or almost all, of the curly-leaf pondweed in a lake. These treatments usually involve the use of endothall herbicide. Lake-wide control also may be obtained through whole-lake treatments with fluridone herbicide.

In order to provide long-term reduction of curly-leaf pondweed, an infested lake must be treated for several years in a row. This is so that the bank of turions will be depleted. Even with repeated treatments, it does not appear to be feasible to completely eradicate curly-leaf pondweed from a water body (Invasive Species Program 2006). This may be due to survival of some plants or turions, or germination of seeds (Newman et al. 2006). Research done by the ERDC indicates that at least three years of repeated treatments, and possibly four, are needed to significantly reduce the frequency of curly-leaf pondweed in a lake (Skogerboe et al. 2008).

The four main goals of repeated lake-wide or whole-lake treatments are:

1. Reduce the interference with lake use caused by curly-leaf pondweed.
2. Reduce the frequency and abundance of curly-leaf pondweed for long periods of time.
3. Increase the frequency and abundance of native, submersed aquatic plants.
4. Reduce peaks in concentrations of phosphorous and associated algal blooms.

Increases in the frequency or abundance of native submersed plants and reductions in levels of phosphorus and algae, which should increase water clarity, are considered ecological benefits.

In 2009, 43 applications were submitted to the DNR for grants to support pilot projects involving lake-wide or bay-wide control of curly-leaf pondweed or both curly-leaf pondweed and Eurasian watermilfoil under this program and 26 proposals were approved. Of these, 21 had curly-leaf as the primary object of control (Table 7).

To date, 11 pilot projects that have continued long enough to expect long-term control of curly-leaf, i.e., for three to five years (Table 8). Most pilot projects have not completed enough years of treatment to begin to expect to see long-term control.

Most lakes with pilot projects are located in the central region, which includes the Twin Cities (Table 9).

Table 7. Pilot program - projects granted funding for lake-wide or bay-wide control of curly-leaf pondweed (CLP) or both CLP and Eurasian watermilfoil (EWM) in 2009.

	Region	County	Lake or Bay Name	DOW	Grant (\$\$\$)	Cost (\$\$\$)	Grant as % of cost	Herbicide	Year of Treatment	Target plant(s)
1	NW	Becker	Cormorant, Upper		30,700	67,600		Endothall	1	CLP
2	NW	Cass	Margaret		12,200	5,500	100	Endothall	1	CLP
3	NW	Douglas	Smith	21.0016	0	0	0			
4	NW	Todd	Osakis (three)		15,000	39,750	38	Endothall	2	CLP
5	NW	Wadena	Blueberry		31,000	34,000	78	Endothall	2	CLP
6	NE	Crow Wing	Cullen, Lower		17,200	12,500	100	Endothall		
7	NE	Crow Wing	Lower Mission		30,400	40,600		Endothall	3	CLP
8	NE	Itasca	Dixon		25,000	22,200		Endothall		
9	Central	Carver	Zumbra	10.0041	11,100	33,600				
10	Central	Isanti	Lono	30.0072	24,700	37,000	30	Endothall	2	CLP
11	Central	Isanti	Paul & Elins	30.0035	17,000	16,000	100	Endothall	1	CLP
12	Central	Hennepin	Medicine****		20,000	39,715	50	Endothall	3	CLP
13	Central	Hennepin	Schmidt	27.1020	10,400	8,200		Endo / tric		CLP / EWM
14	Central	Hennepin	Weaver***		10,900	15,900	61	Endothall	4	CLP
15	Central	Morrison	Lona	49.0015	10,800	2,900	100			
16	Central	Sherburne	Big & Mitchell	71.0081	22,600	21,800		Endo / tric		
17	Central	Sherburne	Rush and Julia*		18,300	0		Endothall	3	CLP
18	Central	Ramsey	Kohlmans		10,900	37,554	27	Endo / tric	1	CLP
19	Central	Ramsey	Silver		10,900	29,900		Endothall	2	CLP
20	Central	Stearns	Schneider	73.0082	10,300	7,000		Endothall		
21	Central	Scott	O'Dowd	70.0095	10,600	16,600		Endo / tric		CLP / EWM
22	Central	Wright	Sugar	86.0233	24,300	55,400		Endothall		CLP / EWM
23	S	LeSueur	Sakatah	40.0002	10,400	8,000		Endothall		CLP
24	S	Lincoln	Benton	40.002	61,800	67,300	100	Endothall	4	CLP
25	S	Meeker	Clear		25,300	25,800	88	Endothall	2	CLP
					\$471,800	\$644,819				

* Julia and Rush are part of the Briggs-Rush-Julia chain of lakes. Both lakes had lake-wide treatments for curly-leaf pondweed as part of one treatment plan. They were granted \$10,000 towards those treatments.

** *** Weaver was treated in 2005, 2006, and 2007 with fluridone herbicide

**** Medicine was treated in 2005, 2006, and 2009. It was not treated in 2007, even though they were offered a grant, because the cooperator did not want to pursue treatment due to low levels of curly-leaf pondweed in April 2007.

Table 8. Number of pilot projects to control Eurasian watermilfoil or curly-leaf pondweed on a lake-wide (or bay-wide) basis classified by duration.

Duration of Project (years)	Number of Projects
5	3
4	2
3	6
2	2
1	13
(Total)	26

Table 9. Number of pilot projects to control Eurasian watermilfoil or curly-leaf pondweed on a lake-wide (or bay-wide) basis classified by DNR region.

DNR Region	Number of Projects
NW	5
NE	3
Central	15
S	3
(Total)	26

Partial-lake treatments of curly-leaf pondweed to manage nuisances

Lake residents and associations who manage curly-leaf pondweed to reduce nuisances undertake the majority of curly-leaf pondweed management done in Minnesota. This management uses both herbicides and mechanical harvesting. During 2009, DNR staff actively supported efforts to manage nuisance levels of curly-leaf pondweed by providing technical assistance to lake groups working to manage the plant. Technical assistance included conducting lake vegetation surveys, guidance on the best management practices for controlling curly-leaf pondweed, and assistance in writing Lake Vegetation Management Plans (LVMPs).

Effectiveness in Management of Curly-leaf Pondweed - 2009

Efforts by the DNR Invasive Species Program and our partners in lake associations, the University of Minnesota, local units of government, other state agencies, and the U.S. Army Corps of Engineers are producing information upon which to base realistic expectations for management of curly-leaf pondweed. Researchers at the University of Minnesota include Newman et al. (2009), who described preliminary results from lake-wide or whole-lake treatments of eight Minnesota lakes to control curly-leaf pondweed and provide ecological benefits. All treatments reduced curly-leaf pondweed during the year of treatment. These researchers noted that more study will be needed to determine the longevity of such reductions in curly-leaf once treatments are stopped. Newman et al. (2009) reported that, overall, most native plants are not harmed by these treatments. Nevertheless, there are enough examples of harm to certain native plants to warrant caution in conducting lake-wide treatments. This applies especially in eutrophic lakes with few species of plants or in lakes where multiple herbicides are used

to target both curly-leaf pondweed and Eurasian watermilfoil. Lastly, they observed that reductions in curly-leaf alone are not likely to result in major impacts on clarity of lake water.

Participation by Others in Management of Curly-leaf Pondweed - 2009

Cooperation between the Invasive Species Program and organizations outside the DNR such as lake associations, watershed districts, and local units of government, other state agencies, and the ERDC was critical to the success achieved in management of milfoil in Minnesota. The Invasive Species Program has also received valuable assistance from staff in DNR Fisheries and the Aquatic Plant Management Program in Fisheries and the Division of Ecological Resources.

Evaluation of low rates of fluridone to control the growth and reproduction of curly-leaf pondweed

In 2006, the DNR provided \$50,000 to the USAERDC to study the effects of fluridone herbicide on curly-leaf pondweed growth and turion production (Invasive Species Program 2006). The results of the first study indicated that 4 ppb fluridone is the lowest rate that will suppress plant growth and prevent turion formation (Poovey et al. 2009).

Future needs for management of curly-leaf pondweed

- Fully analyze available data from pilot project lakes.
- Review available information on the ecology and management of curly-leaf pondweed to identify possible research projects that might be carried out to improve management of this invasive species in Minnesota.
- Continue to provide funding for identified research needs, such as research to determine the distribution, viability, and longevity of curly-leaf turions.
- Continue public awareness efforts focused on containing curly-leaf pondweed. Opportunities include our TV and radio advertising, Watercraft Inspection Program, literature, and public speaking engagements.
- Continue to support the management of curly-leaf pondweed in the state through technical assistance and grants for pilot projects.

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Management of Eurasian Watermilfoil

2009 Highlights

- Eurasian watermilfoil was discovered in 12 additional Minnesota water bodies during 2009. There are now 232 Minnesota lakes, ponds, rivers, and streams where the submersed aquatic invasive plant is known to be present.
- Cooperators on six lakes were reimbursed by the DNR for lake-wide or bay-wide control of Eurasian watermilfoil and curly-leaf pondweed.
- Cooperators on 23 lakes were reimbursed by the DNR for control of unavoidable nuisances caused by dense and matted Eurasian watermilfoil in public use areas of the lakes.
- Cooperators on three lakes were reimbursed by the DNR for early detection and rapid response for Eurasian watermilfoil.



Issue

Eurasian watermilfoil (*Myriophyllum spicatum*) is an invasive submerged aquatic plant that was inadvertently introduced to Minnesota. Eurasian watermilfoil, hereinafter called milfoil, was first discovered in Lake Minnetonka during the fall of 1987. Milfoil can limit recreational activities on water bodies and alter aquatic ecosystems by displacing native plants. As a result, Minnesota established the DNR Invasive Species Program to manage milfoil and other invasive species. Milfoil is classified as a *prohibited invasive species*, which means that it may not be bought, sold, or possessed in Minnesota. In this report, we describe the efforts of the Invasive Species Program to manage milfoil and limit its spread in Minnesota during 2009.

Goals

The DNR has two goals for management of Eurasian watermilfoil:

- To prevent the spread of Eurasian watermilfoil within Minnesota.
- To reduce the impacts caused by Eurasian watermilfoil to Minnesota's ecology, society, and economy.

Distribution of Eurasian Watermilfoil in Minnesota during 2009

Milfoil was newly discovered in 12 lakes during 2009 (Figure 9). Nine of these lakes are located outside the seven-county metropolitan area (Figure 10). Milfoil is now known to occur in 232 water bodies in Minnesota. The rate of spread of milfoil in Minnesota, as reflected in the annual discovery of new occurrences of the invasive, has changed little over the last three to four years.

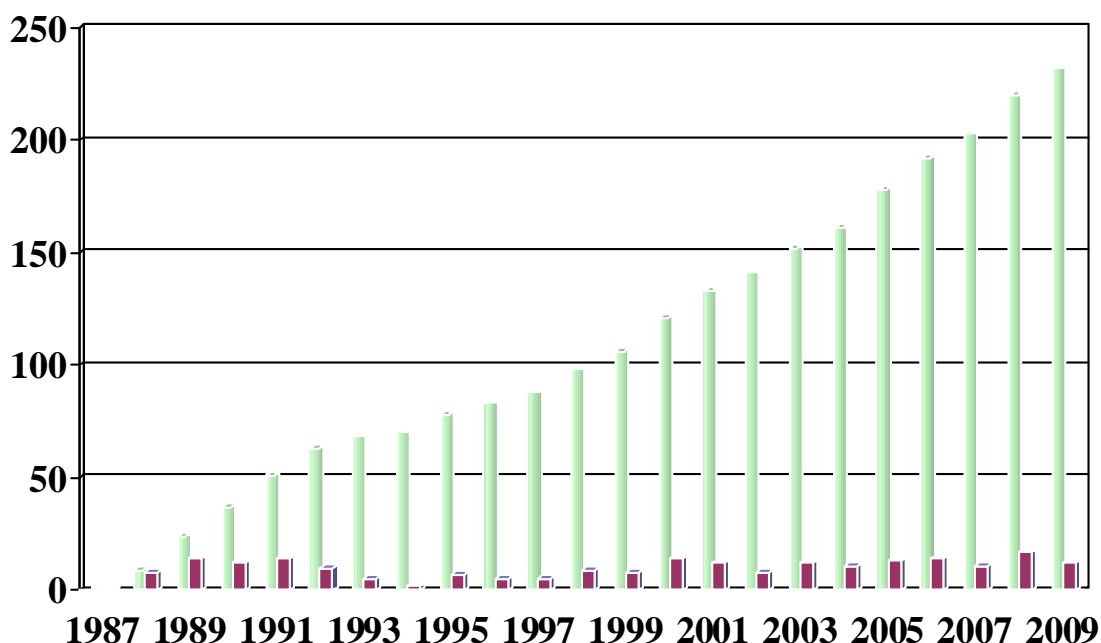


Figure 9. Discovery of water bodies in Minnesota with Eurasian watermilfoil; annual and cumulative numbers.

Discovery of new occurrences of Eurasian watermilfoil in Minnesota

Characteristics of some newly discovered occurrences of milfoil suggest that there likely are other water bodies in Minnesota with the invasive plant that have not yet been discovered. In some cases, milfoil is discovered years after the time when it became established in a lake. In other lakes, milfoil appears to have been discovered before the invasive became abundant or widespread when it was noticed by a person with knowledge regarding identification of aquatic plants.

Many false reports of milfoil result when other species of submersed vegetation, often forming mats, attract the attention of lake users. These individuals suspect that the abundant vegetation is milfoil and report the occurrence to the Invasive Species Program. During 2009, as in previous years, most of these reports were found to be occurrences of various native aquatic plants. It has been very useful for citizens to send the DNR samples of suspected Eurasian watermilfoil so the plants can be quickly identified. The DNR encourages the public to report suspected new occurrences of milfoil.

Monitoring the distribution of Eurasian watermilfoil by other state agencies, local units of government, and interested groups

The participation of DNR Fisheries, other divisions of the DNR, outside agencies, commercial herbicide applicators, citizens, and others in reporting new occurrences of milfoil remains critical. This assistance is very important because staff in the Invasive Species Program are only able to visit a limited number of lakes each year. Efforts by others to search for milfoil and report suspected occurrences of the invasive greatly

increase the likelihood that new occurrences are discovered. The Program investigates likely reports of new infestations as soon as possible for two reasons. First, it is important to determine whether milfoil actually is present in the lake. Second, if the invasive is present, then it is important to minimize the risk of spread to uninfested

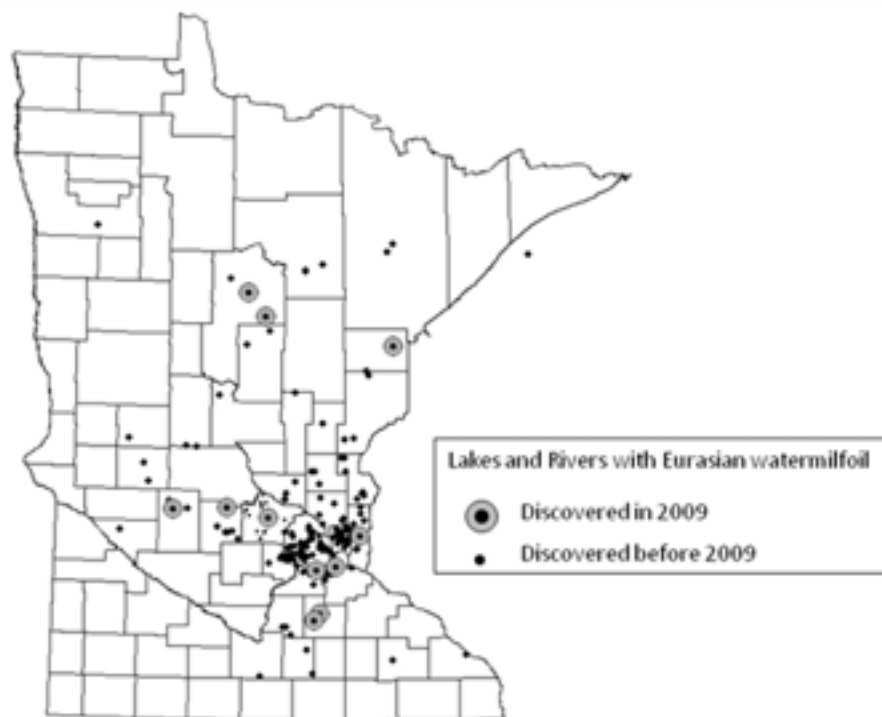


Figure 10. Distribution of water bodies with Eurasian watermilfoil in Minnesota as of November 2009.

waters by notifying the users of the lake. It is hoped that once people who use a lake are aware of the presence of milfoil, they will be especially careful to not transport vegetation from the lake on their boats, trailers, or other equipment.

Reports of suspected occurrences of milfoil that turn out to be mistaken also have value. In the course of responding to such reports, staff in the Invasive Species Program discuss identification of the non-native Eurasian watermilfoil with the observer and so increase the number of people who in the future are likely to be able to distinguish the invasive from native plant species that are similar in appearance.

Progress in management of Eurasian watermilfoil - 2009

Classification of water bodies for management of Eurasian watermilfoil

In the spring of 2009, the Invasive Species Program classified the 220 bodies of water known to have milfoil. One hundred fifty-two lakes were eligible for management with state funds because they have public water accesses and are protected waters that are regulated by the state (Minnesota Statute 103G.005, Subd. 15).

Some lakes were ineligible for management with state funds because they either do not have public water accesses or are not protected waters. Lastly, flowing waters such as rivers and streams are not usually considered for management of milfoil with state funds because 1) users of these waters in Minnesota rarely encounter problems caused by milfoil like those found in lakes; and 2) use of herbicides is less reliable and effective in rivers and streams than in lakes.

Seven of the 12 water bodies that were discovered to have milfoil during 2009 were eligible for management with state funds because they have public water accesses. Five lakes found to have milfoil in 2009 have no public water access and, consequently, are ineligible for management with state funds.

Lake-wide or bay-wide control of Eurasian watermilfoil

In 2009, the DNR provided grants to support lake-wide or bay-wide control of Eurasian watermilfoil and curly-leaf pondweed on four lakes (Table 10). Control involved the application of two herbicides, endothall and triclopyr. In 2009, the DNR also provided a grant to support bay-wide control of Eurasian watermilfoil on two bays in Lake Minnetonka in Hennepin County by application of triclopyr.

The project on Lake Minnetonka is a partnership among the Lake Minnetonka Conservation District (LMCD), the Lake Minnetonka Association (LMA), the U.S. Army Engineer Research and Development Center (ERDC), and the DNR.

Kohlmans Lake was treated in 2008 with endothall and triclopyr to control both milfoil and curly-leaf pondweed. Since little or no milfoil was observed in the lake during spring 2009, the treatment in this year did not include triclopyr.

Silver Lake was treated in 2008 with endothall and triclopyr to control both milfoil and curly-leaf pondweed. Review of observations from 2008 showed that the condition of the vegetation and water quality of Silver Lake was poor following the treatment of invasive species in early 2008. Specifically, the frequencies of native plants and water clarity were low by comparison with pre-treatment conditions. In addition, the frequencies of Eurasian watermilfoil were lower than that of curly-leaf pondweed. As a result, it was decided that treatment in 2009 would be done to control curly-leaf, but not milfoil.

Table 10. Pilot program - projects granted funding for lake-wide or bay-wide control of curly-leaf pondweed (CLP) or both CLP and Eurasian watermilfoil (EWM) in 2009. (Endo is endothall and tric is triclopyr)

	Region	County	Lake or Bay Name	DOW	Grant (\$\$\$)	Cost (\$\$\$)	Grant as % of cost	Herbicide	Year of treatment	Target plant(s)
1	Central	Carver	Zumbra	10.0041	11,100	33,600		endo/ tric	1	CLP/ EWM
2	Central	Hennepin	Minnetonka - Grays Bay	27.013301	12,400	58,500		triclopyr	2	EWM
3	Central	Hennepin	Minnetonka - Phelps Bay	27.013305	12,400	58,500		triclopyr	2	EWM
4	Central	Hennepin	Schmidt	27.1020	10,400	8,200		endo/tric	1	CLP/ EWM
5	Central	Sherburne	Big & Mitchell	71.0081	22,600	21,800		endo/tric	1	CLP/ EWM
6	Central	Scott	O'Dowd	70.0095	10,600	16,600		endo/tric	1	CLP/ EWM
7	Central	Wright	Sugar	86.0233	24,300	55,400		endo*	1	CLP/ EWM
					103,800	252,600				

* Insufficient Eurasian watermilfoil found to treat in spring.

Partial-lake treatments of Eurasian watermilfoil to manage nuisances

During 2009, state funding and technical assistance were available from the Invasive Species Program to potential cooperators for partial-lake treatments of milfoil. The offer of state funding is described in an announcement that is available to potential local cooperators (DNR 2009) who are expected to take the lead in control of the milfoil. The offer is briefly summarized here. The most common activity on lakes that receive funds from the DNR was application of herbicide, followed by mechanical harvesting. These funds are intended to pay for control during spring or early summer of unavoidable nuisances caused by dense and matted milfoil that will benefit a number of homeowners and the general public who use a lake.

The DNR received applications for state funding to control milfoil from potential cooperators on 26 lakes (Table 11). Applications were reviewed by the Invasive Species Program in relation to the standards described in the announcement that is available to potential cooperators (DNR 2009). In most cases, the areas with milfoil where control was proposed in these lakes were inspected by staff of the Invasive Species Program. The results of these inspections and recommended modifications of proposed control projects were reported to the potential cooperators and staff in the Aquatic Plant Management Program who issue permits for control. On some lakes, proposals were modified by reducing the size of the area to be treated, and

subsequently approved. Twenty-three of the applications were approved for funding. To date, most applicants have been reimbursed for control done in 2009. These reimbursements are expected to comprise a total of \$118,000 once reimbursements are completed. On the lakes where applications for grants were not approved, inspections revealed that sites proposed for treatment with herbicide either did not have dense and matted milfoil or did not constitute an unavoidable nuisance for users of the lake.

Table 11. Number of Minnesota lakes where management of nuisances caused by Eurasian watermilfoil was supported with state funds in 2006-2009.

	Applications received	Applications approved and reimbursed	Applications denied or not pursued
2006	27	23	4
2007	30	28	2
2008	29	22	7
2009	26	23	3

Early detection and rapid response for Eurasian watermilfoil

In 2009, the DNR offered grants to support early detection and rapid response (EDRR) for Eurasian watermilfoil to be initiated by organizations such as lake associations, conservation districts, watershed districts, and municipalities. The purpose of these grants was to allow people on lakes with newly discovered populations of milfoil to aggressively treat the invasive species in an attempt to prevent spread within the lake. Though the DNR undertook EDRR on milfoil in the past, the experience of the DNR and cooperators was that these efforts did not prevent the spread of milfoil within a lake. While the DNR may initiate EDRR in some cases, e.g., Brazilian waterweed, *Egeria densa*, in Powderhorn Lake, Minneapolis, in 2007, the DNR would be unlikely to do so for milfoil in most cases.

Nevertheless, there is interest among lake associations and other groups in attempts to prevent the spread of new populations of milfoil or flowering rush within lakes, so the DNR is offering limited support for such attempts where specific requirements are met. The principle requirements to be met are that the distribution and abundance of milfoil must be very limited.

In 2009, applications for grants to support EDRR were received from groups on eight lakes. In five of these cases, inspection of the distribution and abundance of milfoil showed that the invasive plant was too widespread to justify EDRR. In the other three cases, the distribution of milfoil was sufficiently limited to justify a grant for EDRR. The total value of reimbursements to be paid to recipients of these grants is \$4,500.

Effectiveness of management of Eurasian watermilfoil in Minnesota lakes

Though the number of Minnesota lakes known to have milfoil increased in 2009, the number of lakes from which applications for DNR funding for control were received remained much lower than the number of lakes eligible to apply (Tables 9 and 10). The number of lakes where cooperators received funding from the DNR for control of milfoil during 2009 was essentially un-changed by comparison with the previous year (Table 11).

Control of Eurasian watermilfoil by the DNR at public water accesses and in harbors

The Invasive Species Program initiated treatment of milfoil on four lakes in the immediate vicinity of public water accesses operated by the DNR. In addition, the Invasive Species Program initiated treatment of milfoil in 13 harbors on Mille Lacs and ten harbors on Leech Lake. The purposes of this type of control are to: 1) reduce the risk that users of the lake inadvertently transport milfoil from the lake to other bodies of water; and 2) improve access to the lake. The cost of these treatments was \$13,000.

Technical assistance to cooperators and other citizens

Technical assistance was provided by the Invasive Species Program to cooperators and other citizens and managers. Staff of the Invasive Species Program attended numerous meetings of lake associations and local units of government to make presentations and participate in discussions of approaches to management of milfoil. During the course of a season, staff of the Invasive Species Program have many conversations with people over the telephone. In addition, staff of the Invasive Species Program exchange correspondence by regular mail and e-mail with people who need assistance in dealing with milfoil.

Participation in control efforts by other state agencies, local units of government, and interested groups

Cooperation between the Invasive Species Program and organizations outside the DNR such as lake associations and various local units of government was critical to the success achieved in management of milfoil in Minnesota. The Invasive Species Program has also received valuable assistance from staff in DNR Fisheries and the Aquatic Plant Management Program in Fisheries and the Division of Ecological Resources.

Research on Eurasian Watermilfoil and Potential Approaches to Management in Minnesota

The Invasive Species Program has supported or conducted a number of research projects to improve management of milfoil. In this section, we briefly summarize activities or results of recent efforts by researchers working primarily in Minnesota.

Distribution and abundance of the milfoil weevil in relation to harvesting of Eurasian watermilfoil

In 2009, Dr. Ray Newman and a student, Mr. W. Inglis, published a paper entitled "Distribution and abundance of the milfoil weevil, *Euhrychiopsis lecontei*, in Lake Minnetonka and relation to milfoil harvesting." Dr. Newman and a student, Mr. D.L. Blumer (2009), published a second paper in the same journal. In this paper, they report on studies of the use of hot water to prevent the spread of milfoil on trailered watercraft.

Future plans and needs for management of Eurasian watermilfoil

- Keep the public informed about milfoil and the problems it can cause.
- Reduce the plant's spread by targeting watercraft inspection and enforcement efforts in areas of the state where milfoil is present.
- Monitor the distribution of milfoil in the state with emphasis on verification of reports of new occurrences.
- Continue to improve our understanding of the ecology and management of milfoil.

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Management of Flowering Rush

2009 Highlights

- Flowering rush was discovered in Lake Minnetonka in the Twin Cities. Unfortunately, the plant was found to be widespread in the lake.
- The Invasive Species Program continued to provide technical assistance and field support to partners who managed flowering rush. On Detroit Lakes and connected waters, the DNR delineated 286 acres with flowering rush.

Introduction

Issue

Flowering rush (*Butomus umbellatus* L.) is a perennial aquatic plant, native to Europe and Asia. It grows along lake and river shores as an emergent plant with three-angled fleshy leaves and may produce an umbel-shaped cluster of pink flowers (Figure 11). Flowering rush may also grow as a non-flowering submersed plant with limp, ribbon-like leaves.

The plant spreads primarily vegetatively from thick rhizomes (Figure 11), from pea-sized bulbils that detach from the rhizome, and from bulbils that form in the inflorescence (Lui et al. 2005). Flowering rush also may produce seeds. Krahulcova and Jarolimova (1993) determined that there are both diploid and triploid populations of flowering rush in eastern Europe. They reported the diploid to be sexually fertile and self-compatible, while the triploid was predominately sterile and self-incompatible. In the native range of *Butomus*, 82 of 99 localities sampled had triploid plants (Hroudova and Zakravsky 1993).

In North America, Eckert and colleagues have documented the occurrence of both diploid and triploid flowering rush. In Minnesota, one of seven populations sampled was fertile, i.e., diploid, and the rest were infertile, i.e., triploid (Lui et al. 2005). Eckert and colleagues found that the plants in the Detroit Lake area were triploid (Lui et al. 2005:430, Fig. 1; Kliber and Eckert 2005:1903, Fig. 2). Regarding triploid plants, which are sterile, Lui et al. (2005:436) wrote that although they produce rhizomes that are more highly branched than those produced by fertile or diploid plants, they believed that "... this provides little scope for clonal propagation" and so concluded that sterile plants have extremely limited capacity for dispersal.

In the Detroit Lakes area, there are large areas occupied by flowering rush, which has generated a high level of concern among residents. In Minnesota, Lui et al. (2005) found a population of diploid flowering rush in Forest Lake (Washington County). In this lake, the distribution of flowering rush is limited and, to date, the plant has not generated a high level of concern among residents.

The activity of muskrats (Gaiser 1949), water currents, and ice movement can move these reproductive structures to new locations within a water body.

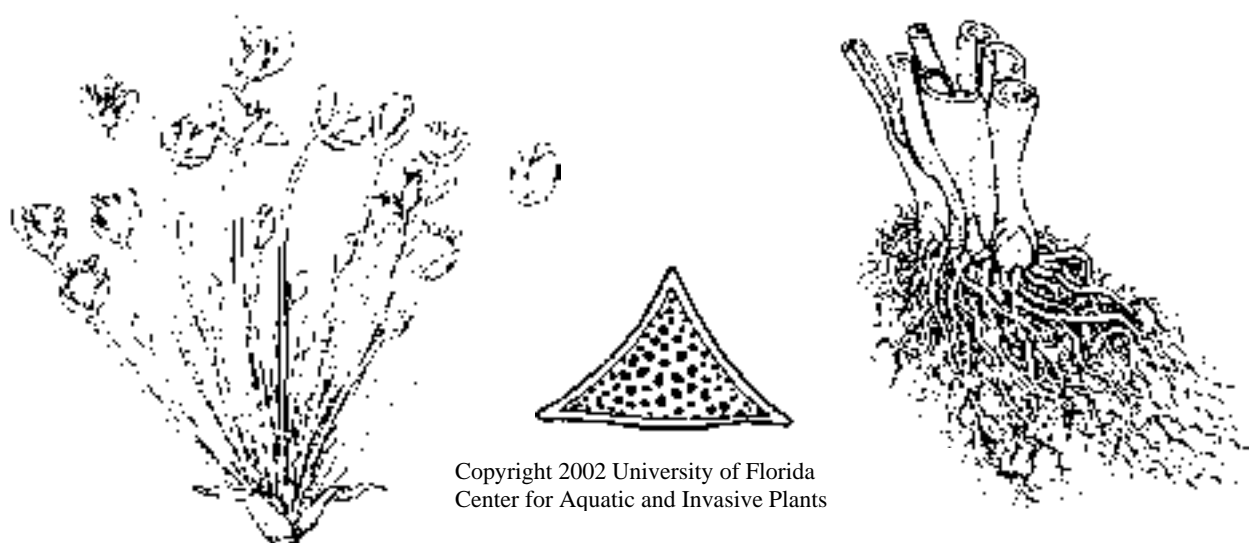


Figure 11. Flowering rush umbel, cross-section of a leaf, and rhizomes.

Flowering rush was likely brought to North America in the late 1800s in ship ballast and has also been repeatedly introduced as an ornamental plant. As early as 1973, resource managers and researchers have expressed concern that flowering rush may grow aggressively in North America and displace native wetland vegetation (Anderson et al. 1974; Staniforth and Frego 1980).

Given the invasive characteristics of flowering rush, it is classified as a *prohibited invasive species* in Minnesota.

Management of flowering rush

Mechanical control

Cutting can reduce dense stands of flowering rush. It is most effective if done early and repeated several times during the growing season (Hroudova 1989). The disadvantages of cutting are that it lacks selectivity, it is labor intensive, and it does not eliminate the invasive plant. Digging also may be an effective method of removing small infestations or reducing dense stands of flowering rush. There is concern that digging may increase the spread of flowering rush within a lake if the entire rhizome is not removed. In lakes where the invasive plant is widespread and well established, it is unclear whether digging may increase the abundance of flowering rush.

Treatment with herbicides

Boutwell (1990) described results of trials with various herbicides and flowering rush. "Good control" of the submersed form of the plant resulted from treatment with diquat and fluridone. Temporary control of the plant in flowing water was achieved with acrolein. Treatment with glyphosate and, to a lesser degree, 2,4-D and imazapyr, of emergent plants controlled flowering rush.

Since the early 1990s, the Pelican River Watershed District (PRWD) has evaluated a number of approaches to control of flowering rush (for example, see Olson (2004)). In recent years, the PRWD has applied imazapyr to flowering rush on a lake-wide basis. In addition, the PRWD also applied imazamox to flowering rush.

In 2008, a trial was initiated in Montana to evaluate the efficacy of foliar applications of imazapyr, imazamox, and triclopyr (P. Rice, University of Montana, personal communication). These trials included applications of herbicide to plants both when the level of the water was below that of the plants and when six to 18 inches of leaves were above the surface of the water, which was 4.5 to 5.5 feet deep. Investigations in Montana also include trials conducted with flowering rush grown in a greenhouse in containers presumably 30 to 45 cm deep. In addition to the herbicides used above, the greenhouse trials also included treatments with endothall, copper, diquat, and fluridone.

In 2008, a trial also was initiated in Washington to evaluate the efficacy of foliar applications of glyphosate, imazapyr, and triclopyr on flowering rush (T. Miller, Washington State University, Mount Vernon, personal communication).

Preliminary results of the recent trials in Montana and Washington seem to be generally consistent with results of previous investigations. Overall, these studies show that flowering rush can be reduced by treatment with herbicide. Nevertheless, obtaining long-lasting reductions in the plant, especially when growing in water, seems to be difficult to achieve.

Distribution

Flowering rush was first recorded in Anoka County in 1968 (Moyle 1968) and has since been located in 27 bodies of water in nine other counties. Despite its 30-plus year presence in the state, the distribution of flowering rush is widely scattered and uncommon (Figure 12).

New introductions are likely the result of intentional planting from horticultural sales. More information about the distribution of flowering rush in the state can be found in the 2000 Exotic Species Annual Report (Exotic Species Program 2001) and the 2008 Invasive Species Annual Report (Invasive Species Program 2008).

Goals

The DNR has two goals that apply to flowering rush management:

- to prevent the spread of flowering rush within Minnesota; and
- to reduce the impacts caused by invasive species to Minnesota's ecology, society, and economy.

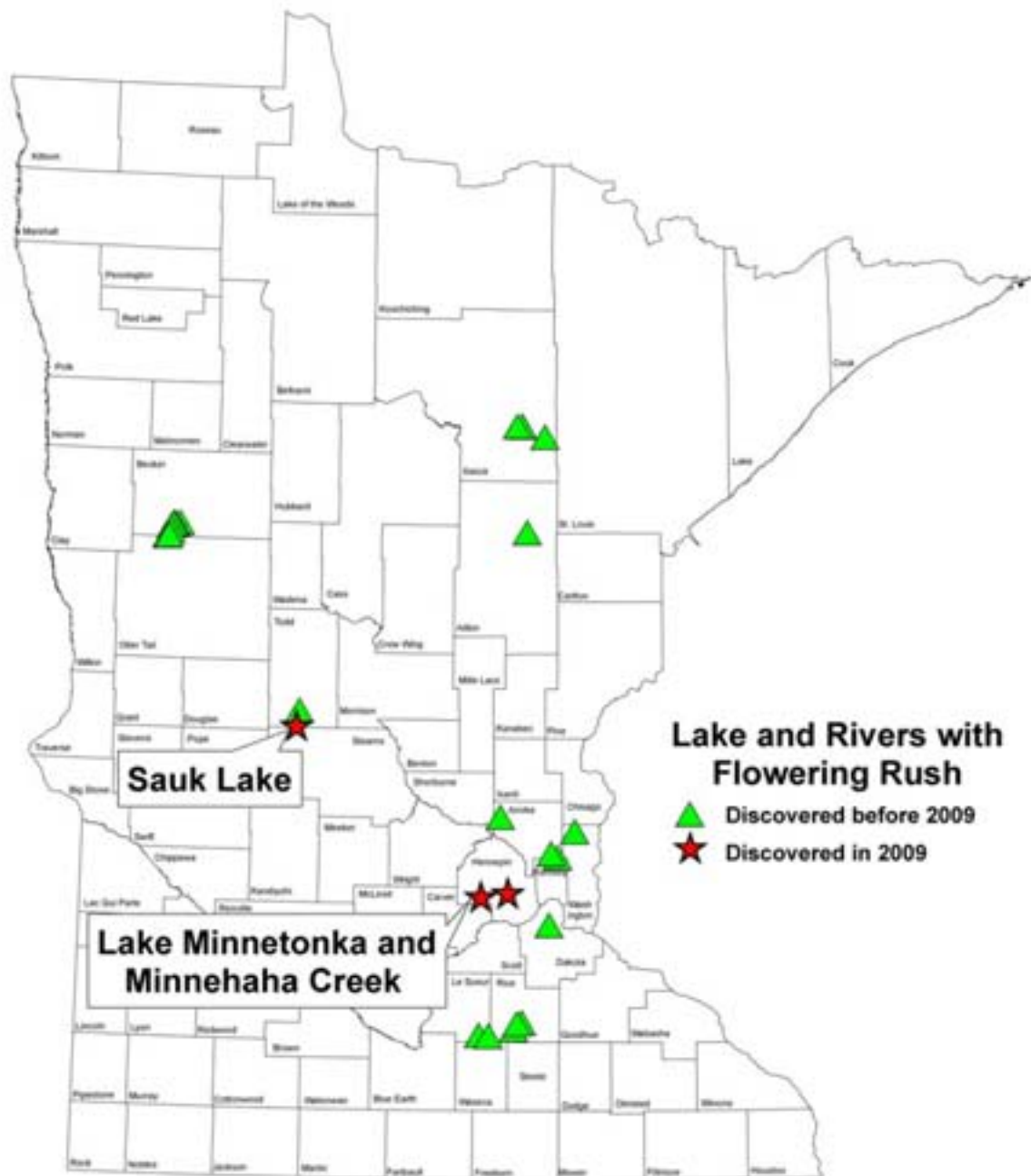


Figure 12. Flowering rush locations as of November 2009.

To attain these goals, the following strategies are used:

- Prohibit the sale of flowering rush in Minnesota.
- Monitor current distribution and assess changes.
- Support research to develop and implement better management methods.
- Provide information to those interested in how to best manage flowering rush.

Discovery of new occurrences of flowering rush in Minnesota - 2009

In late June, the DNR received a report from a commercial herbicide applicator of suspected flowering rush in Lake Minnetonka in the Twin Cities area. Invasive Species Program staff visited the site the next day and confirmed the presence of the invasive aquatic plant in the lake.

Once a new occurrence of an invasive aquatic plant is confirmed in a body of water, the next step is to assess the distribution and abundance of the plant. If the distribution is limited, it may be worthwhile to initiate control in an attempt to eliminate the invasive or limit its spread within the lake. Evaluation of the distribution of flowering rush in Lake Minnetonka required a significant effort because of its large area, 14,000 acres, and its extensive shoreline, estimated to be 132 miles in length. Lake Minnetonka consists of 15 morphologically distinct basins and has more than 25 named arms and bays.

Following the confirmation of the occurrence of flowering rush in Lake Minnetonka, DNR staff spent ten days from July through early September inspecting virtually all of the shoreline of the lake to determine where the plant was established. Unfortunately, flowering rush was found to be widespread in Lake Minnetonka. The plant was observed at 57 sites in more than seven bays or arms of the lake. Cumulatively, flowering rush occupied roughly ten acres in Lake Minnetonka.

During 2009, flowering rush also was found in Minnehaha Creek (Hennepin County and Sauk Lake (Todd County).

Progress in Management of Flowering Rush - 2009

During 2009, the Invasive Species Program continued to offer technical assistance and field support to partners who managed flowering rush. For the first time, the Invasive Species Program offered grants to support control of flowering rush. The first of two partners to receive a grant for this purpose was the PRWD)

The PRWD and DNR have been managing flowering rush since the late 1980s in northwestern Minnesota in the Pelican River chain. The chain includes Detroit Lake, from which water flows into Muskrat Lake, then into Lake Sallie, then Lake Melissa, then Mill Pond.

During July, the Invasive Species Program delineated areas with flowering rush in preparation for application of herbicide by a contractor. In Detroit Lake and the first four bodies of water downstream, the DNR delineated 286 acres with flowering rush in 2009 (Table 12). Though this total is less than that reported for 2008, it is important to note that delineation of areas in a lake with flowering rush is not a precise and reliably

repeatable activity. Following the delineation of flowering rush in these lakes during 2009, these areas were treated with herbicide by a contractor working for the PRWD. This treatment was supported with a grant for \$16,600 from the DNR.

Table 12. Areas within the Pelican River chain of lakes with flowering rush as delineated by the DNR during July 2009.

	Detroit & Curfman	Muskrat	Sallie	Melissa	Mill	Total
Lake Acres	2,187	62	1,256	1,820	171	5,496
2008	272	>1	43	12	>1	329
2009	231	4	35	10	6	286

Downstream of Mill Pond is Buck Lake, which is in the Pelican Group of Lakes Improvement District (PGOLID). In Buck Lake, two small clusters of flowering rush were found and removed during 2009, as was done in 2008. Searches have not discovered flowering rush farther downstream. The PGOLID continues to monitor for new infestations of flowering rush.

The second of two lakes to receive a grant for control of flowering rush was North Twin Lake in Itasca County. The DNR delineated three areas comprising 1.3 acres with the invasive plant near the public access and swimming beach. The Greenway Township then used herbicides to control flowering rush in these areas. This treatment was supported with a grant for \$500 from the DNR.

Soon after the initial discovery of flowering rush in Lake Minnetonka when its known distribution was quite limited, the DNR arranged to have the plant treated with herbicide. The treatment was done in mid-August and cost \$650.

In southern Minnesota, the Invasive Species Program staff worked with staff and citizens from the city of Waterville and the Waterville Lakes Association to mechanically remove flowering rush from Sakatah Bay on Lake Sakatah (Le Sueur County). There is interest in expansion of mechanical harvesting of flowering rush to neighboring Lake Tetonka.

Provide information to those interested in how to best manage flowering rush

DNR staff including representatives from the Invasive Species Program meet regularly with the PRWD, PGOLID, the city of Detroit Lakes, and others to discuss concerns regarding the expansion of flowering rush in the Detroit Lakes area. Currently, the PRWD is spot-treating flowering rush stands with imazapyr and imazamox to reduce the nuisances for lake residents and users, and the city of Detroit Lakes is manually, mechanically, and chemically treating the mile-long stretch of city beach. Support of this project, including technical assistance, will continue.

Effectiveness of management of flowering rush - 2009

In situations where flowering rush is abundant and interferes with use of a lake, the invasive aquatic plant can be reduced, at least temporarily, thereby reducing nuisances. This means that problems for users of lakes and wetlands can be managed, though this usually requires continuing efforts. Long-term suppression of flowering rush on a lake-wide basis is a much more challenging goal. The Invasive Species Program continues to evaluate the potential to improve management of flowering rush.

Participation of other groups**Participation by local units of government and interested groups in management of flowering rush - 2009**

Cooperation between the Invasive Species Program and organizations outside the DNR such as lake associations and various local units of government was critical to the success achieved in management of flowering rush in Minnesota during 2009. A major effort to manage this plant in Detroit Lake and connected water bodies was initiated by the PRWD and the city of Detroit Lakes. Additional efforts were initiated by PGOLID. Others involved in flowering rush management include: Lake Minnetonka Conservation District, Lake Minnetonka Property Owners Association, the city of Waterville, and the Waterville Lakes Association. The Invasive Species Program has also received valuable assistance from staff in DNR Fisheries and the Aquatic Plant Management Program in Fisheries and the Division of Ecological Resources.

Research on flowering rush and potential approaches to management in Minnesota

The DNR continues to work with the U.S. Army Engineer Research and Development Center (ERDC) and other researchers to determine the efficacy of herbicides on flowering rush growing under controlled conditions. The DNR is working with the PRWD and other interested parties to organize a meeting to be held early in 2010 to identify the key questions regarding the potential to improve management of flowering rush by the use of herbicides and approaches to addressing these questions.

Future needs for management of flowering rush

- Organize a meeting to be held during the winter of 2009-2010 to review our current understanding of the use of herbicides to manage flowering rush and identify directions for research to improve the effectiveness of this approach.
- Continue efforts to prevent introductions of flowering rush in Minnesota. Inform the public, nursery industry, and other businesses selling flowering rush of the problems associated with this plant and the existing laws against its possession and sale in Minnesota.
- Encourage research on the distribution, reproductive biology, and potential impacts of flowering rush in Minnesota.
- Continue to investigate new methods of controlling flowering rush and to evaluate the results of continuing flowering rush management within the state.

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Management of Purple Loosestrife

Background

Purple loosestrife (*Lythrum salicaria*, *L. virgatum* and their hybrids) is a wetland plant from Europe and Asia that invades marshes and lakeshores, replacing cattails and other wetland plants. The DNR and other agencies manage purple loosestrife because it harms ecosystems and reduces biodiversity by displacing native plants and habitat for wildlife (Blossey et al. 2001). The Purple Loosestrife Program was established in the DNR in 1987. State statutes direct the DNR to coordinate a control program to curb the growth of purple loosestrife (M.S. 84D.02, Subd. 2) and a significant amount of progress has been made toward the development of a sound approach to manage this invasive.

This management program integrates chemical and biological control approaches and cooperates closely with federal and state agencies, local units of government, and other stakeholder groups involved in purple loosestrife management. The goal of the program is to reduce the impact purple loosestrife is having on our environment. Management efforts include both biological and chemical control methods, monitoring management efforts, and supporting further research.

Statewide Inventory of Purple Loosestrife

In 1987, the DNR began to inventory sites in Minnesota where purple loosestrife was established. DNR area wildlife managers, county agricultural inspectors, local weed inspectors, personnel of the Minnesota Department of Transportation, and the general public report purple loosestrife sites to the DNR. The DNR maintains a computerized list or database of sites that includes the location, type of site, and number of loosestrife plants present (see Figure 13). In 2009, 15 new purple loosestrife infestations were identified in Minnesota. There are now 2,394 purple loosestrife infestations recorded statewide (Table 13). Of those sites, the majority (70%) are lakes, rivers, or wetlands. Inventory totals indicate that Minnesota presently has over 63,000 acres infested with purple loosestrife.

Progress in Management of Purple Loosestrife - 2009

Chemical control of purple loosestrife

Initial attempts by the DNR to control purple loosestrife relied mainly on the use of herbicides. The most effective herbicide is Rodeo, a formulation of glyphosate, which is a broad-spectrum herbicide that can kill desirable native plants. To allow maximum survival of native plants, Rodeo is applied by backpack sprayer as a "spot-treatment" to individual loosestrife plants.

Beginning in 1991, a prioritization plan was developed for selecting control sites in public waters and wetlands where herbicide would be used for purple loosestrife control. This was done because there are insufficient resources to apply herbicides to all known purple loosestrife sites in Minnesota. In addition, DNR personnel observed that herbicide treatments do not result in long lasting reductions of loosestrife when applied

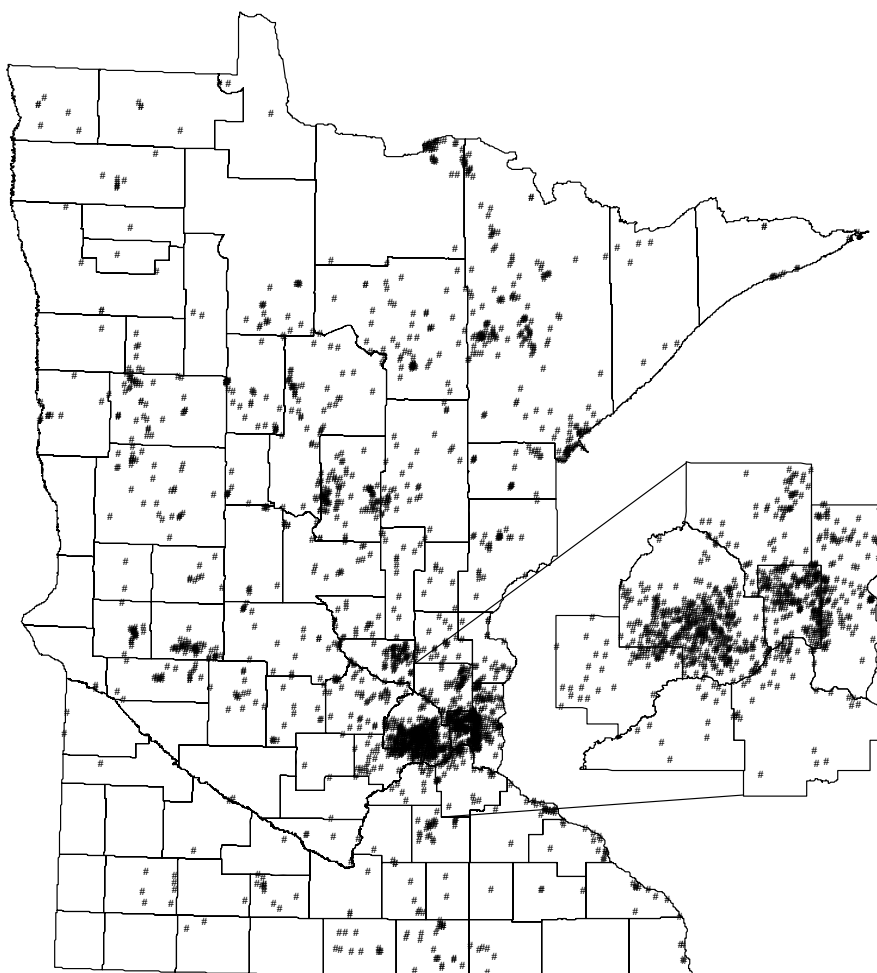


Figure 13. Purple loosestrife infestations in Minnesota as of December 2009.

Table 13. Purple loosestrife infestations in Minnesota recorded by the DNR in 2008 and 2009.

Site Type	Total sites 2008	New sites 2009	Total sites 2009
Lake	723	8	731
River	223	2	225
Wetland	761	2	763
Roadsides and ditches	507	3	510
Other ¹	165	0	165
Total	2,379	15	2,394

¹Includes gardens and other miscellaneous sites.

to large populations that have been established for a number of years. This is due in part to the plant's ability to re-establish from an extensive purple loosestrife seed bank.

Research by the University of Minnesota, under contract to the DNR, demonstrated that long-established stands of loosestrife develop very large and persistent seed banks (Welling and Becker 1990). Herbicide treatments kill the existing loosestrife population only, creating space for additional seeds to sprout. Consequently, small and recently established populations of loosestrife, which are likely to have small seed banks, are given the highest priority for treatment. Because purple loosestrife seeds are dispersed by water movement, the DNR tries to keep loosestrife from infesting downstream lakes. Sites located in the upper reaches of watersheds with small loosestrife infestations are treated before those located in watersheds with large amounts of loosestrife. Implementation of the prioritization scheme in 1991 resulted in fewer large sites (> 1,000 plants) being treated.

Between 1989 and 2009, the number of sites, number of plants, and total cost of treating purple loosestrife with herbicide, have generally decreased (Table 14). This summary includes applications made by DNR personnel, commercial applicators working under contract to DNR, and various cooperators; it is not a complete listing of all herbicide applications made in Minnesota. In 2009, only DNR staff was used to treat purple loosestrife stands statewide. DNR staff visited 57 purple loosestrife stands for herbicide control work (Figure 14, Table 14). At one site, workers found no loosestrife plants to treat. A total of 57 sites were treated with herbicides. Most of the sites were very small: 84% (48 sites) had fewer than 100 plants. Ten purple loosestrife plants were hand-pulled from three locations. This work took a total of 297 worker hours, and only 0.35 gallons of Rodeo. The total cost for this effort was \$8,400.

Effectiveness of chemical control

Effectiveness of control efforts will be based on short-term and long-term objectives. Control or eradication of small infestations statewide with herbicides is the primary short-term objective. Each year, a small number of purple loosestrife infestations (two in 2009) are controlled for at least one year beyond the year of treatment with herbicides. This is critical because these infestations are in watersheds that have very few infestations of loosestrife. This effort helps prevent the spread of purple loosestrife into uninfested wetlands and lakeshores.

Table 14. Historical herbicide applications performed by DNR and applicators contracted by DNR in Minnesota (1989-2009).

Year	Sites visited	Sites with <100 plants treated	Sites with >100 plants treated	No plants located	Total worker hours	Herbicide quantity used/gal	Total treatment costs
1989	166				3,045	471	\$102,000
1990	194	74	120	0	3,290	-	\$74,900
1991	200	109	58	33	3,420	-	\$77,900
1992	227	110	77	40	-	-	-
1993	194	96	79	19	2,300	48	\$65,000
1994	188	81	81	26	1,850	30	\$52,000
1995	203	102	63	38	2,261	35	\$63,000
1996	153	74	56	23	1,396	14	\$45,000
1997	132	55	55	22	965	7	\$36,000
1998	144	66	51	27	1,193	11	\$40,000
1999	131	65	38	28	791	9.5	\$26,000
2000	111	38	28	45	518	2.4	\$22,800
2001	87	55	17	15	359	1	\$19,700
2002	55	32	7	16	305	2.3	\$18,800
2003	54	30	7	17	243	0.9	\$8,180
2004	59	30	9	20	370	0.6	\$9,400
2005	62	48	9	5	296	0.4	\$9,000
2006	95	84	10	1	674	0.4	\$12,400
2007	59	53	4	2	510	1.1	\$12,400
2008	48	41	6	1	330	0.2	\$7,600
2009	57	48	9	0	297	.35	\$8,400

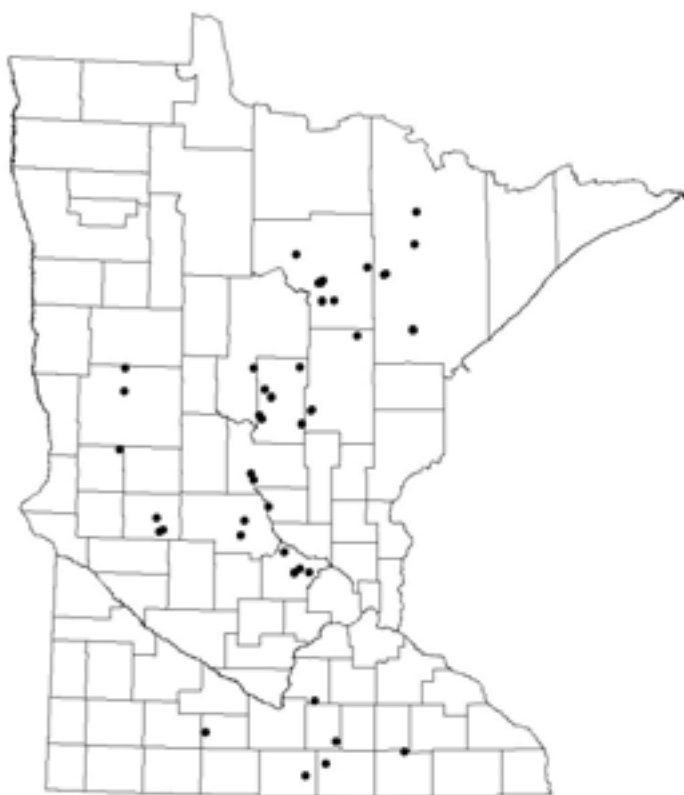


Figure 14. Locations where DNR staff used herbicides to control purple loosestrife in 2009.

Biological control of purple loosestrife

Insects for biological control of purple loosestrife were first released at one site by DNR staff in 1992. This initial release occurred after years of testing to make sure the insects were specific to purple loosestrife and would not damage native plants or agricultural crops and after the insects were approved for release by the United States Department of Agriculture (USDA). To date, four species of insects, two leaf-eating beetles, *Galerucella californiensis* and *G. pusilla*; a root-boring weevil, *Hylobius transversovittatus*; and a flower-feeding weevil, *Nanophyes marmoratus*, have been released as potential biological controls for loosestrife in Minnesota.

Leaf-Eating Beetles: In 1997, the DNR initiated an insect rearing program by providing county agricultural inspectors, MDA field staff, DNR area wildlife managers, Minnesota Sea Grant, nature centers, lake associations, schools, 4-H and garden clubs with a “starter kit” for rearing their own leaf-eating beetles. A starter kit is composed of pots, potting soil, insect cages, leaf-eating beetles, and other materials necessary to rear 20,000 leaf-eating beetles (*Galerucella* spp.). The insects were then released on high-priority areas. All insect rearing was completed outdoors for ease of production and to produce hardier insects. From 1997 to 2009, this cooperative effort has had a significant effect on total number of insects released (Figure 15).

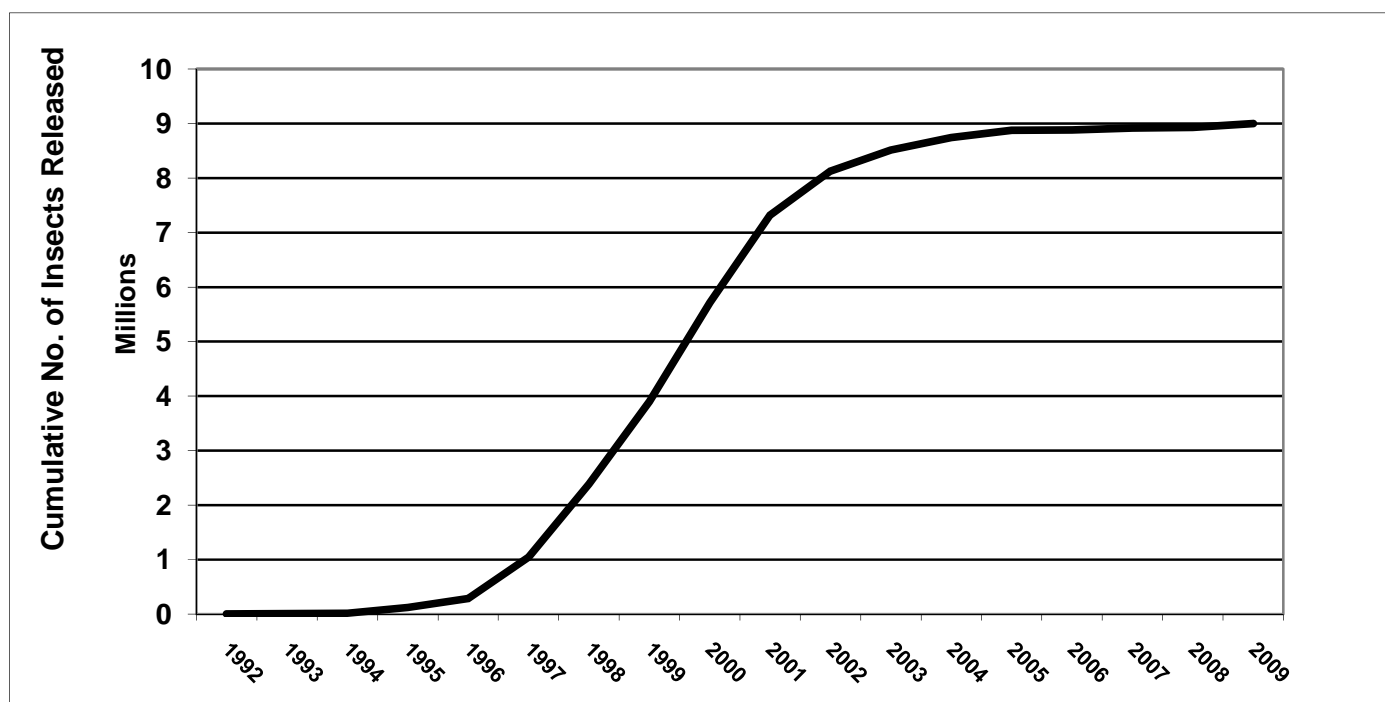


Figure 15. Cumulative number of insects released to control purple loosestrife by year.

With the success of insect establishment in the field, organized rearing efforts came to an end in 2004. Resource managers are able to collect insects from established release sites and redistribute them to new infestations. The “collect and move” method has reduced the effort needed to further distribute leaf-eating beetles in Minnesota.

In 2009, an estimated 68,350 leaf-eating beetles were collected and released on 25 sites. To date, the leaf-eating beetles have been released on 856 sites statewide (see Figure 16, Table 15).

Table 15. Summary of number of insects released in each region to control purple loosestrife (1992-2009).

Minnesota DNR Regions	Number of Release Sites	Number of Insects Released
1 – Northwest	141	1,370,116
2 – Northeast	228	1,638,503
3 – Central	422	5,242,102
4 – South	65	705,304
Totals	856	8,956,025

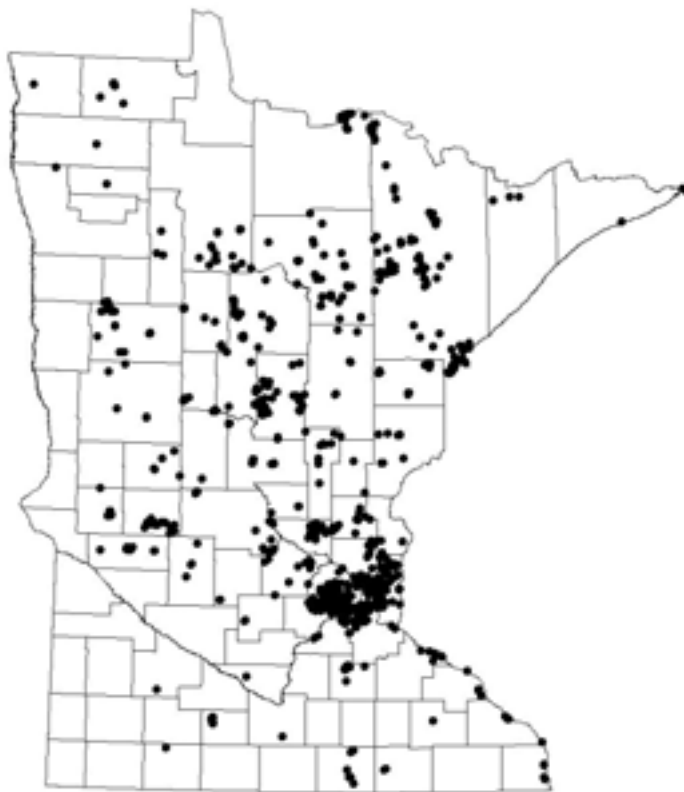
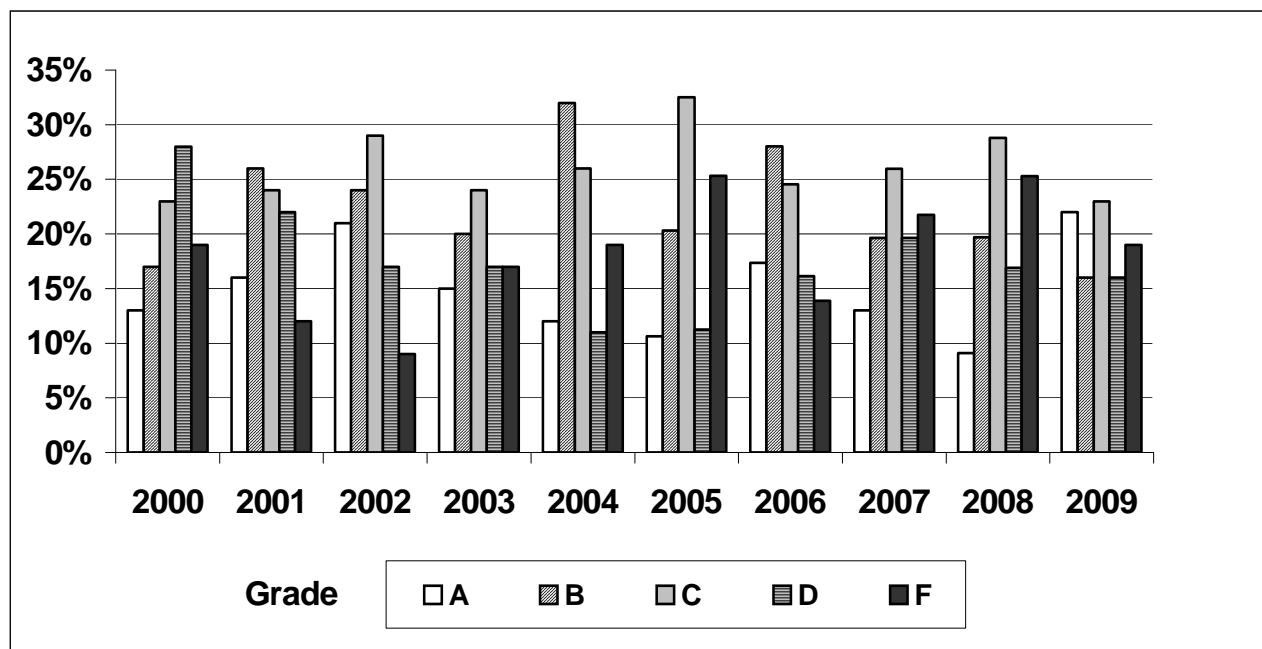


Figure 16. Locations of insects released to control purple loosestrife in Minnesota through 2009.

Biological control insects released between 1992 and 2009 have established reproducing populations at more than 75% of the sites visited. Insect populations increased significantly at many locations with pronounced damage to loosestrife plants. In the summer of 2009, 209 insect release sites were assessed for insect establishment and level of control achieved. At 55% (116 sites) of the sites surveyed, insect populations were increasing and causing damage to the loosestrife infestations. At 19% (41 sites) of all visited sites, the loosestrife was severely defoliated (90-100%) (Figure 17).

A long-term objective is to utilize biological controls to reduce the abundance/impacts of loosestrife in wetland habitats throughout Minnesota. Biological control, if effective, will reduce the impact loosestrife has on wetland flora and fauna. The DNR's goal is to reduce the abundance of loosestrife in wetlands where it is the dominant plant by at least 70% within 15-20 years. Purple loosestrife will not be eradicated from most wetlands where it presently occurs, but its abundance can be significantly reduced so that it is only a small component of the plant community, and not a dominant one. Assessment efforts in 2009 demonstrated that *Galerucella* introductions have caused moderate to severe defoliation of loosestrife populations on 33% (71 sites) of 209 sites assessed in 2009 (Figure 17).



A = 90-100% defoliation, B = 50-89% defoliation, C = damage near release point with insects visible, D = no damage, few insects visible, F = no insects or damage present.

Figure 17. Sites graded for insect establishment and control.

The DNR continues to assess how loosestrife abundance changes over time and to determine what combinations of biological control agents provided the desired level of control. Over the last 12 years (1995-2007), a field study has been conducted within ten purple loosestrife infestations to quantitatively assess the effects of *G. californiensis* and *G. pusilla* on purple loosestrife and non-target native plant communities in Minnesota. The overall results to date suggest that *Galerucella* spp. populations initially peaked between three and five years after establishment. At most sites, purple loosestrife density declined (up to 90%) in response to an increase in *Galerucella* spp. abundance. *Galerucella* spp. appear to have a strong numerical response to purple loosestrife density which led to multiple “boom and bust” cycles occurring on many of the sites during the 12-year period. Declines in *Galerucella* spp. typically allowed purple loosestrife populations to rebound. Generally, *Galerucella* spp. populations rebounded as loosestrife abundance increased. The number and amplitude of the boom and bust cycles appears to be related, in part, to the density of the initial purple loosestrife infestation. Sites where purple loosestrife approached 100% cover tended to cycle more frequently than sites with a higher plant diversity and abundance. It appears that in more diverse sites, increased plant competition prevented purple loosestrife from attaining pre-release densities. As purple loosestrife populations declined, plant species richness and/or abundance increased within release sites.

Research on Insects as Biological Control Agents

No new research is currently underway on purple loosestrife biological control. Research completed in 2007 (See Invasive Species of Aquatic Plants and Wild Animals

in Minnesota Annual Report 2007) is now being revised and submitted for publication in scientific journals.

Future needs for management of purple loosestrife

- Continue implementation and evaluation of biological control of purple loosestrife.
- Continue DNR funding of herbicide control efforts on small, high-priority infestations.
- Continue to assess effectiveness of overall management strategies.
- Continue to collaborate with county agriculture inspectors, MnDOT, DNR area wildlife managers, nature centers, etc., to expand management efforts.

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Other Aquatic Invasive Plant Species in Minnesota

Introduction

Numerous invasive species of aquatic plants exist in the state. The previous chapters described species for which there were continuing efforts. The species listed in Table 16 exist in the state, but there are no ongoing efforts by the DNR to manage them in the wild. They are included because they are or have been of interest within the state, and have been described in previous annual reports.

Brazilian waterweed (*Egeria densa*)

Brazilian waterweed was discovered in Powderhorn Lake in south Minneapolis at the end of August 2007. Brazilian waterweed is classified as a regulated invasive species in Minnesota. It is important to limit the spread of Brazilian waterweed in Minnesota to prevent the development of potential problems. In an attempt to eliminate the plant from the lake, the DNR and the Minneapolis Park and Recreation Board (MPRB) applied herbicide to the Brazilian waterweed during October. In addition, an aeration system usually operated in the lake by the MPRB during winter was not operated during the winter of 2007-2008.

As in 2008, inspection of Powderhorn Lake on July 6, 2009, did not result in the observation of Brazilian waterweed in the lake. The DNR plans to continue to monitor the lake in future years to determine whether Brazilian waterweed is in the lake.

Brittle naiad (*Najas minor*)

At the end of August 2009, Steve McComas of Blue Water Science reported the discovery of brittle naiad in a storm-water pond in Eden Prairie. A sample of the plant was sent to Donald H. Les of the University of Connecticut, in whose laboratory molecular techniques were used to confirm the identification of the plant. Brittle naiad is classified as a prohibited invasive species in Minnesota.

Water lettuce (*Pistia stratiotes*)

In August 2009, staff of DNR Fisheries discovered water lettuce in the Vermillion River west of Farmington. This location was near a property belonging to a plant nursery. The nursery was subsequently visited by a Conservation officer who discussed the discovery with staff of the nursery. They were found to be aware of the risks associated with possession of water lettuce and that the plant cannot be legally introduced into the wild. Water lettuce is classified as an unlisted invasive species in Minnesota.

Table 16. Other Aquatic Invasive Plant Species in Minnesota.

Species	Status	Legal Status	Last annual report to include info on this species
Yellow iris (<i>Iris pseudacorus</i>)	Commonly sold; public education has focused on preventing people from planting it in natural water bodies.	Regulated	2002
Hardy hybrid water lily (<i>Nymphaea</i> spp. hybrid)	Four known wild populations in Minnesota. One new location found in 2007.	Regulated	2004
Reed canary-grass (<i>Phalaris arundinacea</i>)	Widespread in Minnesota.	Unlisted	2004
Salt cedar (<i>Tamarix ramosissima</i>)	One known population that was treated with herbicide and by mechanical methods in 2003-2004. It is believed to have been eradicated from the site.	Unlisted	2004
Introduced subspecies of common reed (<i>Phragmites australis</i> ssp. <i>australis</i>)	Only a few known populations in the state; distribution information is lacking.	Unlisted	N/A

Terrestrial Invasive Plant Management

Overview

Terrestrial invasive plant species are non-native plants that can naturalize, threatening natural resources and their use. Invasive plant species out-compete native plants that provide critical habitat needed to support wildlife species. For example, common buckthorn (*Rhamnus cathartica*) and glossy buckthorn (*R. frangula*) are Eurasian woody species that invade a number of habitat types in the northeast and north-central regions of the United States and Canada. Both species are very adaptable, forming dense thickets that inhibit the growth of native forbs, shrubs, and tree seedlings (Heidorn 1991, Randall and Marinelli 1996) and have been linked to increased predation in songbird populations (Schmidt and Whelan 1999).

The DNR manages approximately 5.7 million acres or 95% of all the state-owned lands including Scientific and Natural Areas (184,000 acres), State Forests (4 million acres), Wildlife and Aquatic Management Areas (1.3 million acres), State Parks and Trails (244,000 acres). Prevention and management of invasive species is an important conservation action needed to protect and/or restore habitats for wildlife species, especially those species in greatest conservation need. Within the DNR, there is a critical need to expand the amount of awareness, data, tools and resources to reduce impacts caused by invasive plants on state-managed lands. The goal is to improve or enhance the ability of DNR staff to effectively manage terrestrial invasive plants on DNR-managed lands through management, inventory, education, and research.

This work is being funded by a combination of sources that includes state funding (General Fund and Environmental and Natural Resources Trust Fund through the Legislative-Citizen Commission on Minnesota Resources), and federal funding (U.S. Forest Service and U.S. Fish and Wildlife Service).

Management

Grant Program

The Invasive Species Program initiated a grant program for the management of terrestrial invasive plant species on state-managed lands in 2006. Grants totaling \$650,000 were awarded to DNR land managers from October 2008-June 30, 2009. . Approximately \$650,000 was awarded to land managers for July 1, 2008-June 30, 2010. The overall goal of this project is to improve and/or protect habitats that have been degraded by terrestrial invasive species on state-managed lands, including State Parks, Forests, Trails, Wildlife Management Areas, and Scientific and Natural Areas.

Management of invasive species is an important conservation action needed to protect and/or restore habitats for wildlife species, especially those species in greatest conservation need. Species in greatest conservation need are defined in Minnesota's Comprehensive Wildlife Conservation Strategy as animals whose populations are rare, declining, or vulnerable to decline, and are below levels desirable to ensure long-term health and stability. Habitats impacted by invasive species include oak savannah,

native prairie, grassland, bluffland, and hardwood forest and wetland habitats. Minnesota's Comprehensive Wildlife Conservation Strategy lists management of invasive species as a Priority Conservation Action for all ecological subsections in the state.

The grants could not be used to substitute for funding current or ongoing activities related to invasive species management within each Division. This funding was meant to allow managers to add or start new invasive species projects or expand on existing projects. Eligible projects/activities include: 1) invasive plant surveys; 2) resources that will help staff implement the Invasive Species Operational Order 113; and 3) planning and implementation of invasive plant management efforts.

Outcome Report 2009 Granting Cycle:

Five divisions in FY09 completed 47 management grant projects (Table 17). The projects implemented treatment or inventory for more than seven different invasive plant species. The majority of the proposals targeted the control of woody invasive species such as buckthorn, exotic honeysuckles, and Siberian elm. Other projects targeted species that typically grow in open areas such as common tansy, leafy spurge, and spotted knapweed. However, these species also pose a threat to forestry because of their effect on tree regeneration in harvested areas. The Division of Forestry implemented a large inventory project on forest roadsides (Table 17). This information is being used to prioritize areas for treatment in the coming years.

Current Grant Proposals ending in June 2010:

In the current FY10 grant cycle, 39 proposals totaling more than \$606,777 were funded in response to a request for proposal for terrestrial invasive plant management (Table 18). The funded proposals included 24 proposals for controlling invasive plants, ten proposals for invasive plant inventories, and five proposals to do both inventories and control.

The majority of the proposals targeted the control of woody invasive species such as buckthorn, exotic honeysuckles, Siberian elm, black locust, and the purchase of survey equipment.

**Table 17. Funded terrestrial invasive plant inventory/management projects
FY09.**

Division/Section	Number of Projects	Project Type	Subtotal
Forestry	14	<ul style="list-style-type: none"> • Buckthorn, tansy and other invasive plant control (7) • Invasives inventory and purchase of inventory equipment (7) 	\$ 205,927
Parks	20	<ul style="list-style-type: none"> • Primarily woody invasives control (buckthorn, honeysuckle, Siberian elm, caryana); some Canada thistle, spotted knapweed and garlic mustard control 	\$ 188,550
Trails and Waterways	1	<ul style="list-style-type: none"> • Tansy control, leafy spurge, and spotted knapweed control (1) 	\$ 2,800
Wildlife	10	<ul style="list-style-type: none"> • Mainly invasive species control • Invasives inventory a part of (2) 	\$ 191,930
Ecological Resources	2	<ul style="list-style-type: none"> • Invasives inventory and equipment a part of (2) 	\$ 21,600
TOTAL	47		\$ 610,807

**Table 18. Funded terrestrial invasive plant inventory/management projects
FY10.**

Division/Section	Number of Projects	Project Type	Subtotal
Forestry	12	<ul style="list-style-type: none"> • Buckthorn, tansy and other invasive plant control (8) • Invasives inventory and purchase of inventory equipment (4) 	\$ 153,767
Parks and Trails	15	<ul style="list-style-type: none"> • Primarily woody invasives control (buckthorn, honeysuckle, Siberian elm, caryana); some Canada thistle, spotted knapweed and garlic mustard control • Invasives mapping and equipment purchase part of 5 projects 	\$ 154,900
Wildlife	9	<ul style="list-style-type: none"> • Mainly invasive species control • Invasives inventory a part of (2) 	\$ 151,110
Ecological Resources	2	<ul style="list-style-type: none"> • Invasives inventory and control on SNAs • Monitoring of spread on Manitou project 	\$ 120,000
Region 3	1	<ul style="list-style-type: none"> • Invasives control Region3 headquarters 	\$ 27,600
TOTAL	39		\$ 606,777

Reducing the Spread and Impact of Invasive Species by DNR Resource Management Activities

Due to the growing threat of invasive species (both terrestrial and aquatic), and the Forest Stewardship Council's Corrective Action Request (CAR) to "implement strategy to identify areas of greatest concern with respect to invasive species and implementation to control," there is a need to address the spread and impact of invasive species by DNR resource management activities from a department-wide perspective. Therefore, the Invasive Species Operational Order 113 identified the need for each DNR Division to develop Invasive Species Divisional Guidelines for their work activities. These were finalized in the spring of 2008 and are currently being implemented at the field level.

Inventory

Using standardized protocols developed by the DNR, 54,000 locations of invasive plant species on state-managed lands have already been mapped using GPS/GIS technologies (Figure 18). This includes surveys conducted in over 25 state parks, 165 wildlife management areas, along 174 miles of state trails and a number of state forests. Data collected in the field is now being sent directly (via the Web) to a central database within DNR where the all-terrestrial invasive plant data is stored and managed. This data is now available to DNR staff through quick themes in ArcView. This terrestrial invasive plant data is updated weekly to ensure managers have the latest available information. Managers are now using this information to target and monitor the results of control efforts on these populations.

Information and Education

The buckthorn brochure was updated and reprinted in fall of 2009. 50,000 copies were purchased and are now ready for dissemination statewide.

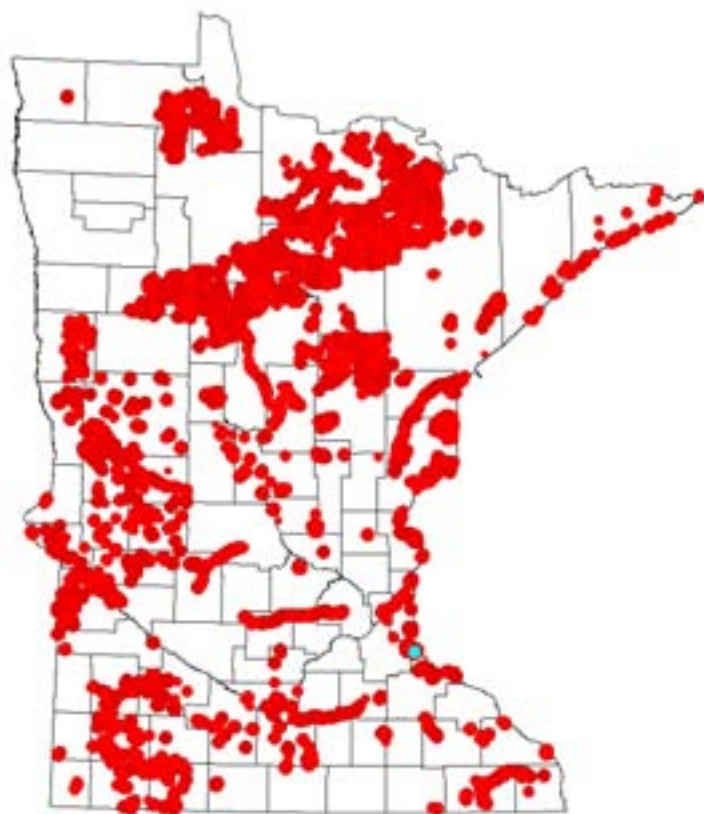


Figure 18. Terrestrial invasive plant inventories (all species), 2009.

Research

Research is being carried out to improve management practices of plant species that pose a serious threat to natural resources and their use. Funds are being provided to support research on biological control methods for garlic mustard and buckthorn.

Buckthorn Biological Control Research

Research in Europe. Over the course of this project, researchers with the CABI Europe-Switzerland (CABI) have surveyed, collected and tested a variety of insects for potential biocontrol of *R. cathartica* and *F. alnus*. These species were tested for their ability to oviposition on these plants and their choice of oviposition plants. These species were also tested for their host specificity preference. These tests help to determine the effectiveness and efficiency of these species as biocontrol agents and any risk associated with other native related shrubs.

Once these surveys and tests were completed, CABI researchers reassessed the data collected and prioritized the species for further testing. Three species were identified as priority species for further work. These species included *Philereme vetulata* (Lep., Geometridae), *Trichohermes walkeri* (Hom., Triozidae), and *Wachtliella krumbholzi* (Dipt.; Cecidomyiidae). These three species vary in the type of damage they do to *R. cathartica* and *F. alnus* ranging from the production of galls to attacking the fruits of the shrubs.

Further funding was secured for the FY09/FY10 biennium which will help to complete the work on these three potential biocontrol agents for *R. cathartica* and *F. alnus* control.

Host specificity studies (make sure the insects will not eat plants native to Minnesota and the U.S.) will continue on the high-priority insect species. Insects will be prioritized based on their perceived potential to cause damage to buckthorn by impairing growth and/or reproduction, reduce vigor, or cause structural damage. Expected results include a priority list of potential control agents with information of their host specificity to native buckthorn species and other plants as determined. This information will guide future research and eliminate candidate insects that are not good potential agents.

The DNR has initiated a research project on biological control of European buckthorn, conducted by CABI in Switzerland. This research is funded by the DNR and the Environmental and Natural Resources Trust Fund recommended by the Legislative-Citizen Commission on Minnesota Resources.

Garlic Mustard Biological Control Research

Summary. Since 1998, a consortium of private, state, and federal sponsors have supported the development of biological control for garlic mustard (*Alliaria petiolata*). Four weevil species attacking seeds, stems, and root crowns of garlic mustard have been selected as the most promising biocontrol agents. Individual and combined impacts of these species can increase rosette mortality and decrease seed output, stem height, and overall performance of garlic mustard. The determination of their host specificity, i.e., restriction to garlic mustard as the only plant allowing complete development without possibility to develop in native North American species, has been the highest priority over the past four years. The focus of this work has been on the root feeder *Ceutorhynchus scrobicollis* followed by the two-stem miners *C. alliariae* and *C. roberti*. The results of these tests show high specificity of all species to garlic mustard. Although three European plant species were also attacked in tests, these species are not recorded as field hosts of the weevils. The implementation of safe garlic mustard biocontrol appears within close reach.

Host specificity testing of the final set of native plant species was completed for *C. scrobicollis*. This included additional native species in several genera now considered closely related to garlic mustard. With testing complete, a petition was submitted in April 2008, to USDA-APHIS to allow state agencies to field release *C. scrobicollis* in the United States. After review of the petition, additional plant species were recommended for host specificity testing. This work is ongoing and should be completed in early 2010. We expect approval for release of this control agent in 2010.

In anticipation of receiving approval, work has been ongoing to develop mass rearing methods for *C. scrobicollis*. Researchers at the University of Minnesota are testing methods to rear *C. scrobicollis* outdoors as well as within the quarantine facility.

Garlic mustard biological control implementation in Minnesota. A garlic mustard project was initiated in 2005 to establish permanent plots to monitor garlic mustard populations in anticipation of biological control insect release. To find potential sites, it was necessary to locate garlic mustard populations of the appropriate size in areas where

management would not be applied. The established plots then had their species composition and garlic mustard abundance recorded in 2005-2009. Garlic mustard monitoring plots were established in 12 sites in central and southeastern Minnesota.

The main focus of this year has been to prepare the results of four years of garlic mustard monitoring data for publication. During March and April 2009, a manuscript was prepared and initial feedback was solicited from co-authors. In May, data was collected on the amount of photo synthetically active radiation (PAR) penetrating the canopy to determine if light differed among the sites since this can potentially influence garlic mustard abundance and cover. All 12 monitoring sites were monitored and data was collected on the garlic mustard population density, percent cover, insect damage, and heights and numbers of siliques of the second year plants. In addition, data was collected on litter cover and depth and the identity and cover of all other plants in the monitoring plots. A garlic mustard monitoring manuscript was submitted to the journal *Invasive Plant Science and Management*. The article is titled: "Population biology of garlic mustard (*Alliaria petiolata*) in Minnesota hardwood forests" by Laura C. Van Riper, Roger L. Becker, and Luke C. Skinner. The article has been accepted for publication. Funding for this effort was from the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources.

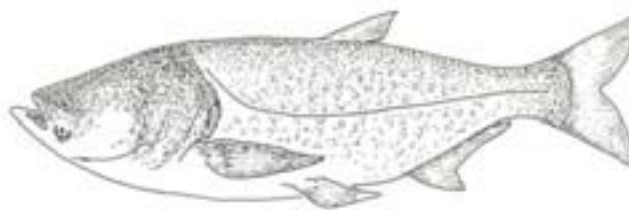
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Management of Asian Carp

Introduction

Four non-native species of carp, collectively known as Asian carp, have significant potential to harm aquatic ecosystems in Minnesota. The species are: bighead carp (*Hypophthalmichthys nobilis*), silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*), and black carp (*Mylopharyngodon piceus*). All four species have escaped from captivity and all but the black carp are known to have established populations in the Upper Mississippi River Basin (UMRB). Monitoring has documented that these populations are expanding their geographic range and are moving up the Mississippi River towards Minnesota. There is heightened concern in 2009 that these fish will enter the Great Lakes through the Illinois waterways that connect the Mississippi River Basin with the Great Lakes Basin.



Resource managers throughout the UMRB are concerned about Asian carp and their associated impacts on natural resources and human safety. The natural ranges of these fish species in Asia and risk assessments suggest that they will thrive in the UMRB. Asian carp are already the most abundant large fish in parts of the Missouri River and are present in large numbers in parts of the Mississippi River and its tributaries. Each of these species has unique characteristics and poses unique threats to fish and other aquatic species. Taken together they appear capable of having profound effects on aquatic resources and recreational opportunities.

A commercial fisherman caught a grass carp in the St. Croix River in spring 2006. A bighead carp was caught by a commercial fisherman in fall of 2007 in Lake Pepin. It was the second bighead carp caught in Lake Pepin. There has been no evidence of reproduction of Asian carp in the state. The closest known reproducing populations are in Iowa waters of the Mississippi River and its tributaries.

In November of 2008, A Wisconsin licensed commercial fishermen caught five Asian carp in seines in Pool 8 of the Mississippi River that extends from La Crosse, Wisconsin to Reno, Minnesota. Three species of Asian carp were found: one silver carp, at least one and likely two bighead carp, and two grass carp. The catch of a 6- to 7-pound, 24-inch silver carp in the Minnesota-Wisconsin border waters represents a large extension in the range of that species in the Mississippi River. The previous northernmost confirmed report of a silver carp was near Clinton, Iowa—more than 150 miles downstream.

Management Goals and Options

There are three general options to manage wild populations of Asian carp:

- 1) no action;
- 2) attempt to prevent further geographical spread; and
- 3) attempt population control after colonization.

Based on results in areas where Asian carp have already become established, it is clear that, if no actions are taken, Asian carp will eventually jeopardize aquatic resources and use of those resources in much of the UMRB. Currently there are no effective measures that would selectively control these species. The Minnesota DNR's goal is to prevent or slow the introduction of Asian carp into state waters and continue to support research efforts to develop new control techniques. To accomplish this goal, states, federal agencies, and Congress will need to act promptly to limit the northern spread of Asian carp in the UMRB.

Distribution - 2009

In March 2009, Asian carp were caught by commercial fishermen in the Mississippi River: two grass carp in Pool 5; a silver carp in Pool 8. There were no additional Asian carp reported in Minnesota waters of the Mississippi River during 2009.

In October 2009 Asian carp were detected in the Chicago Sanitary and Ship Canal through the use of environmental DNA samples. There were concerns that the Asian carp have passed the electrical barriers located in the Sanitary and Ship Canal and could enter Lake Michigan and subsequently the other Great Lakes (see response below).

Progress in Management of Asian Carp - 2009

The plan "Preventing the Introduction of Asian Carp into Minnesota" prepared in 2007 focuses on several pathways of introduction 1) spread of wild populations via interstate waters; 2) spread via wild-caught baitfish; 3) importation; 4) incidental inclusion of Asian carp in shipments of farm-raised fish into the state; and 5) unauthorized releases by individuals. Mixed progress occurred in 2009 to address the following strategy in the plan – *Pursue development, installation, testing, and evaluation of behavioral fish barriers to prevent migration into the Great Lakes and Minnesota from the Mississippi River.*

1) In January 2009, DNR met with the manufacturer of bioacoustics fish barriers and others (e.g., University of Minnesota) regarding barrier needs in Minnesota, available technologies, and barrier research

2) There has been no resolution on how to use the \$500,000 in the state's 2008 bonding bill for pre-design and design work for an Asian carp barrier. The expenditure of this funding is dependant upon a partnership with the U.S. Army Corps of Engineers and no work can be initiated by the Corps until there is an appropriation to implement part of the Water Resources Development Act (WRDA) of 2007 that calls for the Corps to do the following: "*in consultation with appropriate Federal and State agencies, shall study, design, and carry out a project to delay, deter, impede, or restrict the dispersal of aquatic nuisance species into the northern reaches of the Upper Mississippi River system. The Secretary shall complete the study, design, and construction of the project not later than 6 months after the date of enactment of this Act.*"

3) No funds were appropriated in 2009 for a Mississippi River barrier or are included in pending Congressional appropriation bills.

4) The U.S. Army Corps of Engineers announced that it activated a new electric barrier on April 8, 2009 known as Barrier IIA, in the Chicago Sanitary and Ship Canal near Lockport, Ill. The barrier was in full operation along with the original electrical barrier in the canal. A third barrier is planned (Barrier IIB) and its completion date is set for October 2010.

5) In early December 2009, the Illinois Department of Natural Resources oversaw a treatment in the Chicago Sanitary and Ship Canal with Rotenone, a fish toxicant, to kill Asian carp. The treatment of the canal was a precaution to make sure none of the fish breached the electric fish barrier (Barrier IIA) in the canal that had to be shut down for maintenance by the Corps. The effort drew 450 workers from a half-dozen Great Lakes states as well as Canada and cost nearly three million dollars to complete. DNR offered staff assistance, surplus detoxicant from the Division of Fish and Wildlife, and funding from the Invasive Species Program. Officials found one 22-inch Asian carp in the stretch of the canal that had been treated.

Management of Common Carp

Introduction

Issue

The common carp (*Cyprinus carpio*) was intentionally introduced into Minnesota waters before 1900. It remained relatively unnoticed as a threat to environmental quality until after the drought of the 1930s. The drought caused many wetlands and wetland areas around lakes to dry up and set the stage for an explosion of aquatic vegetation and invertebrates. The early wetland drainage efforts also provided connections into many wetlands and shallow lakes previously inaccessible to fish. With the recovery of precipitation and subsequent increase in water levels in wetlands, lakes, and streams, the common carp found an abundance of food and spawning habitat. As early as the 1940s, carp had noticeably damaged aquatic habitat in famous waterfowl lakes such as Heron Lake in southwestern Minnesota. By the 1960s, the common carp was recognized as a major factor in the deterioration of aquatic habitat across southern Minnesota. Carp currently occur in the majority of waters across the southern half of Minnesota.



The role of common carp in causing habitat deterioration is in part related to their search for invertebrates in aquatic vegetation and bottom sediments. The feeding activity of this species disrupts shallowly rooted plants and suspends bottom sediments in the water column. In addition, its consumption of invertebrates "pumps" nutrients from invertebrates into the water column. Carp have high growth rates and their excretion appears to contribute very significantly to internal nutrient loading in many shallow lakes. The additional phosphorus increases the growth of phytoplankton. As water clarity is reduced, the remaining aquatic plants find it difficult to survive. As the rooted plants disappear, more bottom soils are exposed to wave action and further suspension. The cycle continues until the water body is devoid of rooted aquatic plants and phytoplankton thrives in the suspended nutrients. Habitat for most native game fish and aquatic wildlife such as waterfowl is devastated. Since carp do not require clear water to feed and reproduce, they gradually eliminate competition from fish that do.

Common carp are a carrier of a new disease in the state, spring viremia of carp. All *Cyprinids* (minnows) and northern pike are susceptible to the disease.

Goals

The DNR has two goals related to management of common carp:

- Prevent the spread of carp into waters within Minnesota where they do not currently exist or have been successfully removed.
- Remove common carp from high-priority waterfowl waters, such as shallow lakes and wetlands where they are present.

Progress in Management of Common Carp - 2009

Several activities occur to inventory common carp infested waters, limit their spread, and remove carp from waters where they exist. Those activities are primarily conducted by staff of the Division of Fish and Wildlife.

Evaluation of habitat conditions on shallow lakes

Habitat evaluation surveys were conducted on 144 shallow lakes by DNR Wildlife in 2009. These surveys evaluate water clarity, chemistry, and depth along with percent occurrence of rooted aquatic plants.

Evaluation of fish populations

Fish population surveys were proposed at 574 managed fishing lakes by DNR Fisheries in 2009. The results of those surveys are available in June the following year.

Establish and maintain fish barriers

Fish barriers are used in many locations to limit the movement of common carp between connected waters. Seven electric fish barriers are currently operated under contracts with Smith-Root. Other types of fish barriers including velocity tubes continued to be constructed, repaired, and maintained by DNR Fish and Wildlife in 2009. New water control structures including fish barriers were constructed through joint projects with Ducks Unlimited on Buffalo Lake in Waseca County and Perch Lake in Blue Earth County. Construction was started on at least two additional control structures and fish barriers in the fall of 2009.

Four lakes were newly designated for Wildlife Management under M.S. 97A.101 during calendar year 2009. This designation will allow water level management to control carp and improve wildlife habitat. Management on these waters will begin in 2010 once water control structures have been constructed.

Remove carp from priority lakes

In 2009, carp control occurred on several lakes. Rotenone treatments were completed during the winter of 2009 on Teal (Cottonwood County), Augusta (Cottonwood County) and Hjermstad (Murray County) lakes in conjunction with drawdowns at those waters in the fall of 2008. Rotenone treatments were completed on Pickerel and Mud Lakes in Freeborn County in October of 2009. The Shell Rock River Watershed District provided a substantial amount of funding for the project and put in electric fish barrier which was completed in December 2008. The goal of the project was to eliminate carp in the above lakes and above the electric fish barrier. The lakes served as breeding habitats for carp in Fountain and Albert Lea Lakes. The goal was to improve water quality and fish and wildlife habitat in both lakes.

Research

Dr. Peter Sorensen and others from his lab at the University of Minnesota are conducting research on many aspects of common carp biology and management including: aggregation and sex pheromones, spawning biology, movement between connected waters of adults and juveniles, recruitment success, population dynamics and population modeling, removal techniques for adults, impacts on water quality, and barrier development. Their work is being supported by several entities as shown in Table 19.

Table 19. Funding sources, durations of research grants that support the common carp research at Sorensen Lab, and goals.

Time Period	Supporting Entity	Focus of Research
2005 – 2009	Legislative-Citizen Commission for Minnesota Resources	1. Pheromonal attractants 2. Spawning biology / spawning sabotage 3. Population dynamics
2005 - 2009	DNR - Ecological Resources DNR - Fisheries (In-kind field support)	1. Population modeling
2008 - 2011	Legislative-Citizen Commission for Minnesota Resources	1. Effects of gamefish on young carp / controlling recruitment 2. Effects of winterkill on recruitment 3. Preliminary work on sensory deterrents barriers 4. Food and pheromonal attractants for juveniles
2008 – 2011	Riley Purgatory Bluff Watershed District	1. Developing removal techniques for adult carp 2. Impacts of adult carp on water quality 3. Movement of adult carp between lakes 4. Experimental carp barrier design 5. Carp recruitment success in
2006 - 2009	Invasive Animals Cooperative Research Centre (Australia)	1. Sex pheromonal attractants
2009-2011	Legislative-Citizen Commission for Minnesota Resources	1. Controlling the movement of invasive ish species (Vaughn Voller – Project manager)

The Sorenson Laboratory (2009) identifies several research topics for further work. The following is an excerpt for the report.

“Recent studies of carp populations in Minnesota have identified several weaknesses in carp life history that might be exploited to effect a sustainable carp management, particularly in smaller and more isolated systems of interconnected lakes. Key findings to date are that carp are only able to recruit in lakes that experience winter hypoxia and lack predators, and that recruitment is not strongly density dependent. Sustainable carp management schemes can and should focus on recruitment suppression. Specific carp IPM management schemes will vary between individual systems of lakes, depending largely on the number and size of carp nurseries and connections between them. While we believe these ideas are reasonable, a better understanding of carp biology across more lakes and types of watersheds is needed. In particular, several key research needs can be identified as follows:

1) The population dynamics of carp populations in wetlands, marshes and other shallow (<3 m) systems remain unstudied in spite of their importance to waterfowl. Accordingly, it is not clear how many of the ideas proposed in this report might be applicable to these

systems. This question could be addressed by aging carp in well described waterfowl systems, perhaps taking advantage of rotenone treatments. The efficacy of targeted water level draw-downs from an IPM [integrated pest management] perspective needs to be assessed directly and evaluated using carp population dynamic models to determine exactly how and why they might work, and thus might be improved.

2) The damage caused by carp on statewide basis has not been quantified and has been the source of great confusion and misunderstanding. This could be remedied by estimating carp abundance in a range of lakes (perhaps using electro-fishing—a technique the Sorensen laboratory is now quantifying) and then developing correlations between lake type and the abundance of carp. This work might then be complemented by removal studies coupled with efforts to monitor water quality (macrophytes, cyanobacteria, phosphorous, fish). These studies are important to fisheries ecology and gamefish management because of the biomass that carp represent and the fact it likely will be strongly influenced by climate change.

3) There is a strong need to develop affordable barrier systems that work in low-gradient waterways that can stop carp, especially small ones. Ongoing research at the University could be expanded to include acoustical systems that might also be useful for other invasive carps.

4) The movement patterns of young carp need to be described and explained if control schemes are to function effectively. Nothing is known about the movement of young carp at present. Long-term marking and monitoring programs can achieve this goal and should include a range of watersheds.

5) Winter aeration needs to be explored as an affordable technique to suppress carp recruitment thought its ability to enhance survive of predatory game-fish. This could/should be attempted in various types of ecosystems that have well described carp populations. Various technologies (such as adding oxygen) might be pursued to reduce problems with enhanced lake turbidity. An ecosystem level study that involved DNR expertise and examined many ecological parameters could be especially productive.

6) Additional studies of whether and how game-fish, especially sunfish, can control carp in lakes outside of the metro area are needed to expand our knowledge of this topic.

7) An experimental integrated control program for common carp would provide much useful information on how to control this species and provide lessons that might be applied to other invasive fishes such as the Asian carps. Ideally, CarpSim.MN could be developed to guide this application – only minor debugging is needed. Information learned from this experiment would be broadly applicable to developing schemes to manage other invasive fishes including Asian carps.”

Effectiveness of Carp Management

Common carp management has been only modestly effective in all types of waters within Minnesota, which is why research to improve management is ongoing. Nevertheless, in shallow waters where removal of carp has been successful, the aquatic habitat has responded immediately the next spring with improved water clarity and abundant native rooted aquatic plants.

Participation of Others

Participation of others varies, depending on the individual management project for common carp.

Future needs for management of common carp

- Continue support for funding of research related to: development of integrated control strategies including the use of pheromones, gamefish to control recruitment; winterkill to remove carp, new fish barrier designs, common carp life history, and refinements of chemical applications to remove common carp.
- Continue to seek and provide funding for management to accelerate the removal of common carp from high-priority affected waters and/or the construction of barriers to limit natural dispersal.
- Monitor the new disease, spring viremia of carp, to determine how widespread it is in Minnesota and consider new limitations on live carp shipments.

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Management of Mute Swans

Introduction

Issue

Mute swans (*Cygnus olor*) are native to Europe and Asia and were brought to the United States from the mid-1800s through the early 1900s. Populations of mute swans have established in numerous states. These populations have originated from release or escape of individuals from captive flocks. The current population growth in the Great Lakes states is estimated at 10-20% or higher per year (Scott Petrie, Bird Studies Canada, Port Rowan Ontario, presentation to Mississippi River Basin Panel, 8 September 2005). The birds can consume 8 pounds of submersed vegetation and uproot 20 pounds per day causing significant harmful impacts on lake ecosystems.



Mute swans are currently regulated in part by the Minnesota game farm statutes in Minnesota Statutes 97A.105 and they are designated as a *regulated invasive species* in Minnesota Rules 6216.0260. It is illegal to release mute swans into the wild in Minnesota under the game farm and regulated invasive species statutes.

In past years, the DNR has received comments from riparian landowners who are concerned about the presence and increase of mute swans on the lakes where they reside. They are concerned about mute swans interfering with loon nesting that has previously occurred on those lakes. Individuals have also reported seeing the mute swans harassing trumpeter swans. Individuals and lake associations have requested that the DNR remove mute swans from lakes and wetlands where there were birds in the wild.

Goal

The goal for mute swan management is to prevent the establishment of naturalized populations of mute swans in Minnesota.

Distribution

As in previous years, several unconfined mute swans were reported in Minnesota in 2009. Reporting of Monitoring mute swans in the wild is a strategy necessary to help DNR respond to unconfined birds that may establish naturalized populations. During 2009, the DNR compiled reports of wild or escaped mute swans at 12 locations in the state. A total of 14 birds were reported in the wild in 11 counties (Table 20). Sources of the reports include: conservation officers, birders, the public, and other DNR staff who observed unconfined birds.

Progress in Management of Mute Swans - 2009

During 2009, DNR conservation officers removed three mute swans from the wild — one at Lake Rebecca Park Reserve in Hennepin County, one at Snail Lake in Ramsey County and one near Forest Lake in Washington County. The owner of a swan that had been observed in Bloomington in the past, was informed it was illegal to release the swan into the wild as had been done in previous years. It will no longer be released at that location. In Worthington, the owner of two unconfined mute swans was notified and requested that the swans be captured and confined. The swans were captured by the owner and are in confinement.

Table 20. Unconfined mute swans reported in Minnesota counties during 2009.

County	Number of Mute Swans Reported	Months Reported
Carver	1 – Minnesota Valley Refuge	June, August
Hennepin	1- Lake Rebecca Park Reserve	November
Lake	1 - Burlington Bay, Agate Bay	February
McLeod	2	March
Meeker	1 – Collinswood Twp	March
Nobles	2 - Lake Okabena	August, September
Ramsey	1 - Snail Lake	November
Rice	1 – Wells Lake	March
Scott	1 – Louisville Swamp	May, October
Washington	1 - Columbus	May
Wright	2	June
Total for all counties	14	

Future needs for management of mute swans

- Encourage reporting and verify occurrences of mute swans in the state.
- Take appropriate actions to have the birds confined under game farm licenses or remove the birds from the wild.
- Develop and distribute informational materials about mute swans and related state and federal laws.

Management of Zebra Mussels

Background

The zebra mussel (*Dreissena polymorpha*) is a small striped invasive mussel that was brought to North America in the ballast waters of trans-Atlantic freighters in the late 1980s. Unlike our native mussels, zebra mussels secrete sticky threads that are used to firmly attach to any hard surface in the water. The ability of these mussels to attach in large clumps can create numerous problems, such as clogging intake pipes for industry or killing native mussels. Attachment of the adults to recreational boats or aquatic vegetation (which may be transported by boaters) can serve to move zebra mussels to other waters.



Zebra mussels have a microscopic free-living larval stage (veliger), which may float in the water for two to three weeks. This larval stage ensures widespread distribution in lakes, and downstream of any established zebra mussel populations in rivers. Additionally, this microscopic life stage may also be moved to other water bodies in any water (such as bait buckets) and transported over land. The high reproductive capacity and free-living veligers of the zebra mussel allows for rapid dispersal within a water body.

Zebra mussels feed by filtering algae and other small particles out of the water. These same small food particles are the food base for zooplankton and larval fish in our lakes and rivers. Hundreds of thousands of zebra mussels may filter so much of this food that it could interfere in the aquatic food chain, reducing the food availability for larval fish and impacting fish populations.

Zebra Mussels - 2009

New Infestations: This year saw the largest increase in infested waters for the state since the first occurrence in the state. The first new infestation for the year occurred in the spring, when reports from a lakeshore resident on Prior Lake were confirmed as empty zebra mussel shells. Shoreline surveys soon after found attached zebra mussels scattered in sites around the lake. Summer dive surveys found more attached mussels in the lake. Prior Lake has an engineered outflow which maintains water levels. The outflow leads through small ponds, with no public access, to the Minnesota River, just upstream of Shakopee. However, low water levels early in the summer resulted in no outflow from the lake during the summer.

After this find, Lake Le Homme Dieu was confirmed to have zebra mussels in June. Le Homme Dieu is one of several lakes in a chain near Alexandria. Other lakes in the chain are Jessie, Victoria, Geneva, Carlos, Darling, and Alvin. Extensive channels exist that allow boaters to navigate among all of these lakes. Therefore, all seven of these lakes were designated as infested with zebra mussels. By the end of the summer, zebra mussels had been found downstream of Le Homme Dieu in Lake Carlos, and upstream in Geneva Lake. Sampling near the end of summer found extensive reproduction and settlement in areas throughout Lake Le Homme Dieu.

Zebra mussels were also reported and confirmed during the summer from Pike Lake near Duluth and Rebecca Lake in Hastings. Both lakes are close to other major infested waters (Pike Lake is near the Duluth Harbor, Rebecca Lake is adjacent to the Mississippi River). Finally, zebra mussels were confirmed from a public report in Pelican Lake, on the Pelican River, near Pelican Rapids. The presence of zebra mussels in the lake was confirmed in mid-September. Similar to Lake Le Homme Dieu, Pelican Lake is connected to several other lakes. Little Pelican, Bass, and Fish lakes are connected to Pelican Lake and boaters can navigate between them. Reports of zebra mussels on boat lifts have been received from Fish Lake. In early October, DNR personnel found two zebra mussels attached to a private boat lift in Lake Lizzie, which is downstream of Pelican, Little Pelican, Bass, and Fish lakes. The eventual connection of these waters to the Red River of the North provides a natural pathway to Canadian waters (Figure 19).

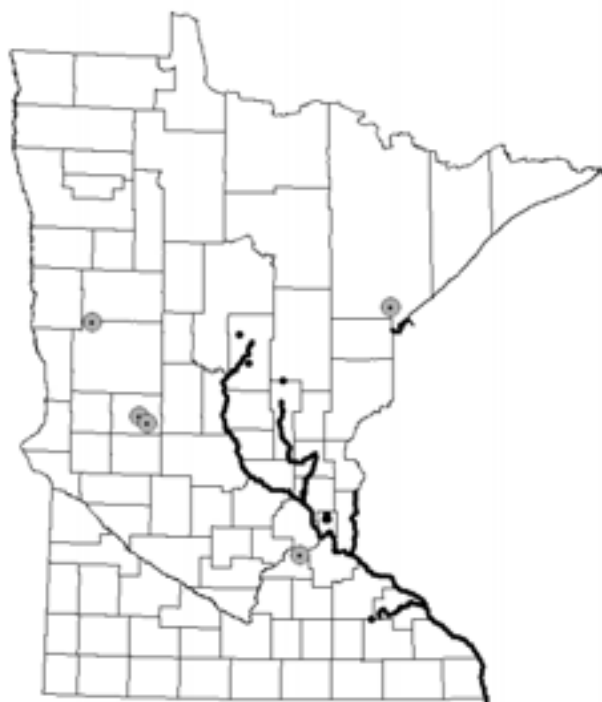


Figure 19. Zebra mussel infestations in Minnesota confirmed by the DNR. Gray circles indicate new infestations in 2009. Bold, black lines indicate infested river areas and Lake Superior.

Existing infestations: Downstream expansion continued to occur in the Mississippi River below Rice Lake (Brainerd). Reports of zebra mussels from the municipal water treatment plant intake in St. Cloud extended the known downstream distribution in the river. Settlement and downstream movement will continue in the river until the upstream population merges with existing zebra mussel occurrences in the metropolitan area.

Dive surveys in Mille Lacs Lake by DNR Fisheries and Ecological Resources staff found a ten-fold increase in zebra mussels over numbers from 2008. Veliger numbers were significantly higher than the previous years. All plankton samples collected in August and September had veligers present, indicating widespread reproduction in the lake. All data suggest that the zebra mussel population in Mille Lacs has expanded enormously and is reproducing and settling at a high rate.

A dive survey was done in Lake Zumbro on a site that has been regularly surveyed since the infestation. Three seasons prior, zebra mussels had experienced a massive die-off. Evidence of high levels of reproduction and settlement suggest that the population in the lake is rebounding from the crash.

The Volunteer Zebra Mussel Monitoring Program continued with mailing of report forms and results from the previous year to all lakeshore residents who had participated last year. Information on the program as well as reporting forms have been placed on the DNR Web site to allow users to report electronically.

Prevention of spread

The continued rapid population increase in Mille Lacs creates serious concerns over potential spread from this heavily used water body. The number of hours of watercraft inspections increased substantially on the lake, as well as inspection time spent in these areas (see Watercraft Inspections and Awareness Events). Public awareness efforts continued (see Watercraft Inspections and Awareness Events) as well as enforcement efforts. The downstream spread in the Mississippi River seen in the St. Cloud area may expose a different set of boaters to large numbers of mussels and veligers. A short DVD was created on zebra mussel biology and ecology, using underwater video footage shot in Lake Ossawinnamakee. Invasive species specialists have used this video in lake association meetings, and copies were distributed on request to Minnesota Waters board members and education staff for their use.

A significant investment of time by invasive species specialists and watercraft inspection supervisors and staff occurred in the west-central area, (see Summary, Regional Highlights) with the infestations in Le Homme Dieu and Pelican lakes. Lake association and general public contacts increased with media exposure of these infestations. Presentations, signing of access sites, talks with dock installation companies, and personal communications helped answer questions and disseminate information on zebra mussels. Cross-border contacts (North and South Dakota, Manitoba) rapidly passed along information on the Pelican Lake infestation to help resource officials in these areas prepare for possible downstream transport.

A permit was issued for pumping water from Sucker Lake (infested water) to Snail Lake (non-infested water) to maintain water levels in Snail Lake. The permittee was required to use fine micron level filtration to eliminate all possible life stages of zebra mussels.

Participation of Others

Monitoring efforts for zebra mussels continued by lakeshore residents throughout Minnesota. Approximately 140 people annually have participated in the Volunteer Zebra Mussel Monitoring Program, checking lakes across the state for zebra mussels. These efforts provide a much more extensive examination of Minnesota waters for this

invasive than could be conducted by the Invasive Species Program alone. The importance of volunteer monitoring is emphasized by the fact that the new infestations this season were initially reported by lake users and residents.

Future needs for management of zebra mussels

- Continue monitoring zebra mussel populations in various Minnesota waters.
- Continue the Volunteer Zebra Mussel Monitoring Program.

Other Invasive Animal Species in Minnesota

Introduction

Numerous invasive wild animals exist in the state. The previous chapters described species for which there were ongoing efforts. The species described in this chapter exist in the state, but there are no ongoing efforts by the DNR to manage them in the wild. They are included because they are or have been of interest within the state. In addition to the information presented on Eurasian collard-dove, faucet snail, New Zealand mudsnail, rusty crayfish, and spiny waterflea in this chapter, Table 21 presents a summary of other invasive animal species in Minnesota.

Eurasian Collared-dove

Species and origin - The Eurasian collared-dove (*Streptopelia decaocto*), a bird native to the Indian subcontinent and Turkey, was first described as a new, non-native bird species in the state in the annual report for 1999. It arrived from expanding wild populations that are spread across the country.

Distribution - The bird has been observed in 52 Minnesota counties from 1999 to 2009: Big Stone, Blue Earth, Brown, Carver, Chippewa, Clay, Cottonwood, Dakota, Dodge, Faribault, Fillmore, Freeborn, Goodhue, Grant, Hennepin, Houston, Itasca, Jackson, Kandiyohi, Koochiching, Lac qui Parle, Lincoln, Lyon, Martin, McLeod, Meeker, Mower, Nicollet, Nobles, Otter Tail, Pennington, Pipestone, Polk, Pope, Redwood, Renville, Rice, Rock, Roseau, Sibley, Stearns, Steele, Stevens, Swift, Todd, Traverse, Wabasha, Waseca, Washington, Wilkin, Winona, and Yellow Medicine. The birds are likely to be in other Minnesota counties and to continue spreading throughout the state.

Management - The DNR is not attempting to eliminate or control the population of Eurasian collared-doves in Minnesota. There are several reasons: it would be difficult to prevent their continued introduction from adjoining states; the birds look similar to mourning doves; and there is no regional or national effort to stop their spread.

Faucet Snail

Species and origin - The faucet snail (*Bithynia tentaculata*), is an aquatic snail native to Europe and was introduced to the Great Lakes in the 1870s. It was probably brought to North America unintentionally with the solid ballast used in large timber transport ships or perhaps with vegetation used in packing crates.

Native snail species and young non-native mystery snails could look similar to faucet snails. Adult faucet snails can grow up to ½-inch in length, but are generally smaller. They are light brown to black, with 4-5 whorls and a cover on the shell opening. The shell opening is on the right when the shell pointed up (see drawing at right).



Impacts - Faucet snails are hosts to three parasitic trematodes or flukes (*Sphaeridiotrema globulus*, *Cyathocotyle bushiensis*, *Leyogonimus polyoon*), that have contributed to the deaths of about 9,000 scaup and coots in 2007 and 2008 on Lake Winnibigoshish. Since 2002, they have had similar impacts along the Mississippi River at Lake Onalaska near Lacrosse, WI. These parasites have a complex life history and

require two intermediate hosts, such as the faucet snail to develop. When waterfowl consume the infected snails, the adult trematodes attack the internal organs and cause lesions and hemorrhage. Infected birds appear lethargic and have difficulty diving and flying before eventually dying.

Distribution - Known faucet snail populations in Minnesota waters are at Lake Winnibigoshish (Cass County) and connected waters, Upper Twin Lake (Hubbard County) and Lower Twin Lake (Wadena County), downstream of Upper Twin in the Shell River, and in border waters of the Mississippi River near LaCrosse, Wisconsin. They can live in rivers and streams, lakes, ponds, ditches, marshes and canals and may be found on variety of substrates, including gravel, sand, clay, mud, and the exposed undersides of rocks.

A survey for the faucet snail in Winnibigoshish, its connected waters, and Bowstring Lake in Itasca County was completed in 2009 in cooperation with Leech Lake Band of Ojibwe natural resource staff and the DNR. Densities ranged widely from dense to almost absent throughout Winnibigoshish and its connected waters and no faucet snails were found in Bowstring Lake.

A November 2009 survey of the Shell River, downstream of Lower Twin Lake in Wadena County resulted in the verification of presence of the faucet snail. This river will be included in the next commissioner's order to designate infested waters (Figure 20).

Management - There are not any good management tools to eliminate faucet snails from an infested lake. Any potential chemical control would eliminate fish and other aquatic species, so control of existing populations is not recommended.

Actions that have been taken in 2009 to help prevent the spread of faucet snails include:

- Designating Upper and Lower Twin lakes, Lake Winnibigoshish, and connected waters as *infested waters* and posted Invasive Species Alert signs and Help Stop Aquatic Hitchhikers signs at water accesses on those waters;
- Monitoring current distribution and assess changes;
- Working with the Leech Lake Band of Ojibwe-Division of Resource management on containment options;
- Supporting research about the snail by writing a letter of support for a Leech Lake grant proposal; and
- Providing information on faucet snail infestations, impacts, and action items that should be taken to prevent the spread in the *2009 Minnesota Waterfowl Hunting Regulations*.
- Developing a factsheet, Web information, and a regulations card with information about preventing its spread and regulations that apply.

In 2010, the DNR is planning to designate faucet snail as a *prohibited invasive species* in Minnesota. When it is designated it will be illegal to import, possess, transport, and introduce.

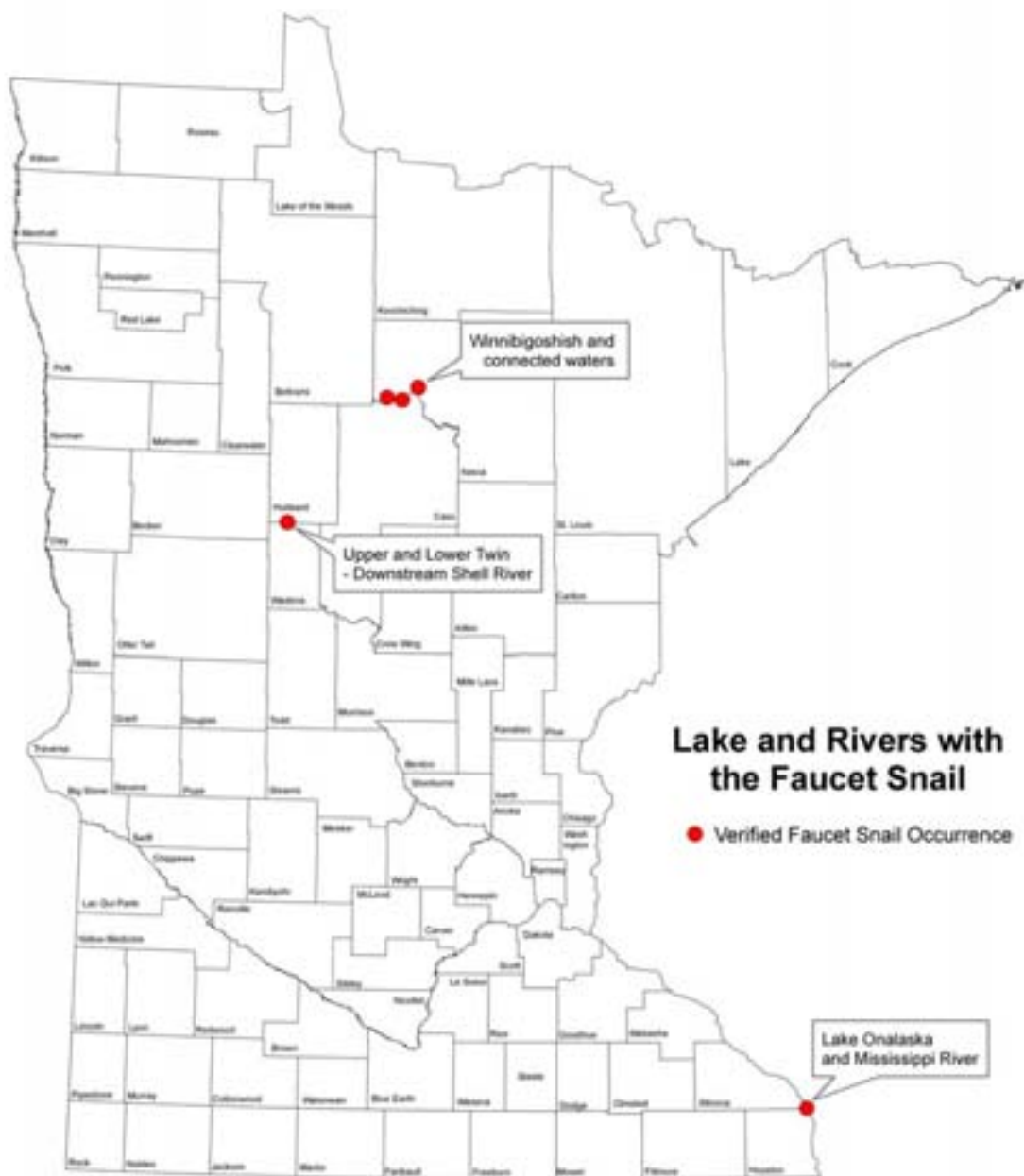


Figure 20. Distribution map of where faucet snails (*Bithynia tentaculata*) have been found as of November 2009.

Mystery Snails (Chinese, banded)

Species and Origin - The Chinese mystery snail (*Bellamya* [= *Cipangopaludina*] *chinensis*) is native to eastern and southeastern Asia. This snail is large (up to 2-½ " long), has a globose spiral shell with an operculum (hard plate-like cover closing the opening), and is olive green, green-brown, or brownish colored. The shell has 6-7 whorls and is broadly rounded. The Chinese mystery snail was originally brought to California in 1892 as a food source, and was later found in Massachusetts in 1915 after

a suspected aquarium release. It is widely spread across North America, with larger concentrations occurring on the coasts.

The banded mystery snail (*Viviparus georgianus*) is native to south and eastern North America, up along the Mississippi River drainage to Iowa and Illinois. This snail is globose, spiral shaped, and has an operculum, similar in appearance to the Chinese mystery snail but smaller (less than 1 ½ " long). The shell color is light brown to yellow-green and has four thin parallel reddish bands that wrap parallel to the whorl of the shell. The snail is now being found more frequently in Minnesota lakes and rivers, particularly in the central region of the state. Recent information suggests that this taxa may actually be a species complex of three species.

Both Chinese and banded mystery snails can produce large populations under the appropriate environmental conditions. Negative impacts from high densities of the Chinese mystery snail were reported for one native snail species, but no impacts were seen for a different species. High densities of either of these snails may have impacts on nutrient cycling and could potentially interfere with other benthic grazers and filter feeders, but this has not been shown. While laboratory and pond trials have shown that high numbers of banded mystery snails can prey heavily upon largemouth bass eggs if they invade nests, this has not been documented in field studies. Mallard ducks were seen feeding heavily upon the banded mystery snails in one report, suggesting that waterfowl may use this snail as another food item. *Viviparus georgianus* is host to a number of parasites in its natural range, and may also serve as an intermediate host in Minnesota waters. Mass die-offs of *V. georgianus* have been seen in a number of Minnesota lakes where it has established populations with large numbers of shells washing ashore and creating nuisances. This "synchronized" die-off of larger banded mystery snails has been previously reported in some studies.

Distribution - There are over 90 reported occurrences for the Chinese mystery snail in Minnesota waters. The distribution of this snail appears to be increasing in Minnesota. There are over 60 reports of waters containing the banded mystery snail in Minnesota and others most likely exist, but have not been reported. As with the Chinese mystery snail, the distribution of the banded mystery snail appears to be increasing.

Management - There are currently no environmentally acceptable control methods specific for mystery snails. Control of native snails in the lakes has been directed at control of swimmers itch situations and is regulated by the Aquatic Plant Management Program. The control method approved is copper sulfate products, which are highly toxic to molluscs. However, this type of control is generally over a smaller area, and effective only for a limited time, as snails can move into the treated area shortly after treatment. Copper sulfate is also toxic to some algae, various zooplankton taxa, crustaceans, and some aquatic insect taxa. With the broad toxicity of the control material and the slight possibility of eliminating snails from a lake, no lake-wide control is conducted.

New Zealand Mudsnail

Species and origin - The New Zealand mudsnail (*Potamopyrgus antipodarum*), a tiny snail native to New Zealand, was collected for the first time in Minnesota waters during fall of 2005. Hundreds of the



snails were found by a research scientist who was surveying for new invaders in the Duluth Harbor for the U.S. Environmental Protection Agency's Mid-Continent Ecology Division.

New Zealand densities can reach 100,000 to 700,000 per square meter in preferred habitats. They may out-compete species that are important forage for trout and other fishes and provide little nutrition to fish that eat them. Another concern is that they can spread easily in water, as well as on aquatic plants, waders, and other gear used in infested waters. They are able to close their shells, allowing them to survive out of water for days.

Distribution - The mudsnails were first discovered in the U.S. in the late 1980s in the Snake, Idaho, and Madison rivers; they quickly spread to other western rivers. They were discovered in Lake Ontario, and later in Thunder Bay, Lake Superior in 2001. No new infested waters in the state were discovered in 2009.

Management - In 2007, DNR designated the New Zealand mudsnail as a *prohibited invasive species* and designated Lake Superior and the St. Louis River below the Fond du Lac Dam as waters infested with the mudsnails. The designation as *prohibited* means the mudsnails will be illegal to transport, possess, and place into other waters in the state. Waters with populations of New Zealand mudsnails are also designated as *infested waters* and posted with Invasive Species Alert signs.

Rusty Crayfish

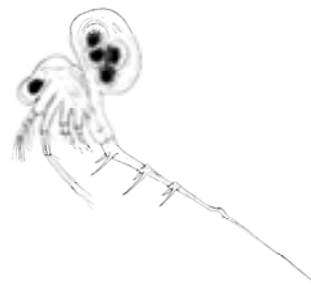
Species and origin - The rusty crayfish (*Orconectes rusticus*) is an invasive species that is native to the eastern and mid-eastern United States. It has been spread across the Midwest through human activities, likely through release of bait by anglers. This invasive can out-compete native crayfish and may interbreed with our native species. It can displace native crayfish, reduce or eliminate aquatic vegetation, and may interfere with warm water fish populations.

Distribution - These crayfish have been reported from more than 40 lakes and eight rivers in the state, scattered from northeast to south-central Minnesota. DNR Fisheries staff encounter rusty crayfish in their lake sampling gear and report findings. Judging from the widespread reported distribution, it is highly likely that rusty crayfish are present, but unrecorded in more waters in the state.

Management - There are currently no selective or effective control methods once the rusty crayfish become established in lakes or rivers. A report on crayfish control (*Investigation of Crayfish Control Technology*, M. W. Hyatt, Arizona Game and Fish Department) looked at varying methods of control and came to the conclusion that non-specific biocides might work in very limited circumstances, but no other control method (manual removal, trapping, predator management) would eliminate crayfish. Populations in larger lakes may be too widespread to initiate any future control methods, and will likely remain in large lakes. With the lack of any selective or even effective control methods, the Invasive Species Program does not conduct any active management of rusty crayfish.

Spiny Waterflea

Species and origin - The spiny waterflea (*Bythotrephes longimanus*) is an invasive cladoceran zooplankton native to Europe. It was brought to the Great Lakes in ballast water in the late 1980s. This zooplankton is a predaceous cladoceran, feeding on other smaller zooplankton. The long, barbed tailspine on this invasive can prevent predation by small larval fish as well as other aquatic animals. Some species of larger fish have been shown to feed heavily on the spiny waterflea. This invasive may interfere with lake food webs by preying heavily on and reducing the number of other zooplankton. Some research suggests that the most significant impacts will occur in larger, oligotrophic (lacking nutrients) lakes with simpler fish communities. The spiny waterflea produces resting eggs similar to those of native Cladocera, which have some resistance for limited desiccation and temperature extremes, providing a long-range dispersal method for overland spread. Adults may become entangled in fishing and boating gear and moved to other water bodies, or transported in infested water moved between water bodies. Ephyppia (resting eggs) can remain viable after passage through fish.



Distribution - The discovery of spiny waterflea in Mille Lacs Lake in fall 2009 by Fisheries staff established a population at a distance from other known locations. This infestation could be a major source for other waters, given the high boating use of this popular lake. Initial infestations were confined to Lake Superior and a few nearby waters (Fish and Island lakes). Since that time, monitoring by area DNR Fisheries staff reported that it disappeared from Fish Lake, but remained in Island Lake. However, in the past several years more northern waters have been discovered with populations of *Bythotrephes longimanus*. Populations are established in many large northern border lakes, such as Rainy Lake, Lake of the Woods, and Saganaga Lake. Other infested lakes in the vicinity of the Boundary Waters Canoe Area (BWCA) suggest that lakes may be supporting populations that have not been discovered. The level of use, interconnections between waters, and inability to contact BWCA users at access areas suggest that other waters in the BWCA may well become infested. Many of the infested waters are large, often deep, and support cool- or cold-water fisheries communities. Spread may be occurring through natural water movement between lakes, via fish or wildlife spreading ephyppia, or inadvertently by recreational anglers or boaters. However, users of the BWCA represent a group that has received little focus and may need concerted efforts to try to prevent further spread in this area (Figure 21).



Figure 21. Distribution map of where spiny waterflea (*Bythotrephes longimanus*) has been found as of November 2009. Bold black lines indicate rivers that are infested, black polygons indicate large lakes that are infested, and gray dots indicate other lakes that are infested.

Research - DNR biologists are assisting National Park Service staff from Voyageurs National Park in processing zooplankton samples collected in the Rainy Lake system as part of a large federal study to assess potential impacts of *Bythotrephes*. Zooplankton samples from Lake of the Woods collected over the summer by Baudette area fisheries staff are being analyzed by DNR biologists to provide information on zooplankton communities as well as spiny waterflea abundance. This data can assist in determining if impacts may be occurring in the lake from the infestation. Area fisheries managers in the northern part of the state have sent zooplankton tows from lakes used for aerial stocking operations to check if these lakes are infested, with negative results to date. A current effort in Mille Lacs Lake investigating possible impacts from zebra mussel populations may also provide useful information on zooplankton-spiny waterflea interactions.

Prevention - In 2009, the DNR and others took many steps to help prevent the spread of spiny waterflea to additional waters in the state. A variety of public awareness efforts such as signs, newspaper articles, and billboards were some of the tools used to raise awareness on this issue. Access inspection efforts and related public awareness in the Rainy/Lake of the Woods area continued (see Watercraft Inspections and Awareness Events). Cross-border cooperation on issues such as watercraft inspection and coordination between state, local, federal, and Canadian biologists and managers helped enhance such efforts. Increased watercraft inspection efforts at Mille Lacs Lake, while aimed at the zebra mussel infestation, also likely aided in prevention efforts.

Efforts focusing on public awareness of this new invasive in Mille Lacs will be investigated for the coming season.

Research and Monitoring

Didymo

Responding to citizen concerns of algal growth on rocky shoreline along Lake Superior's North Shore, Minnesota Sea Grant partnered with U.S. Environmental Protection Agency-Duluth to investigate. Results revealed didymo (*Didymosphenia geminata*) at 14 locations from Grand Portage to Duluth. Didymo is an algal diatom that attaches to hard substrates that can form mats that look slimy, hence the name "rock snot." Where it is not native, it can cover the bottoms of streams and rivers impacting habitat and water quality. Through consultation with diatom experts and a literature search, it was found that didymo has been a resident of Lake Superior's North Shore for at least 40 years. At this time, there is no evidence to suggest that it poses a risk to Lake Superior; however, it may pose threats to inland waters if spread. A proposal by the U.S. Geological Survey was submitted in part to conduct genetics work on specimens collected from the North Shore aimed at determining if the Lake Superior variety is native or a non-native invasive.

Sea lamprey, round goby, and spiny waterfleas

Some Sea Grant-sponsored research efforts are aimed at helping gain a better understanding for control and impacts of AIS discussed in this chapter:

1. Sea Grant-sponsored researchers are examining the cost-effective synthesis of a pheromone component for sea lamprey control. The synthetic pheromone could be used to help control sea lamprey, one of the most damaging AIS in the Great Lakes.
2. Sea Grant-sponsored research suggests no measureable effect of invasive zooplankton, spiny waterflea (*Bythotrephes longimanus*), on diet or mercury levels of yellow perch health in Island Lake Reservoir near Duluth.
3. Sea Grant-sponsored research showed that, contrary to previous claims, round gobies (*Apollina melanostomus*) do not possess superior sensory advantages. Competitive advantages for round goby to out-compete native bottom-dwelling fishes point to their aggressive behavior.

Table 21. Other invasive and non-native wild animal species that have been found in the wild in Minnesota.

Species	Status	Legal Status	Last annual report to include info on this species
Two earthworm species in the genus <i>Amyntas</i>	University of Minnesota researchers reported that two species used in composting were discovered in the Twin Cities area of the state.	Unlisted	2007
Annelida (<i>Pristina acuminata</i>)	U.S. Environmental Protection Agency in Duluth reported that its monitoring efforts during 2006 in the Duluth-Superior Harbor detected this oligochaete that was first noted as a non-native to the Great Lakes in the late 1970s in Lake Erie.	Unlisted	2007
Cnidaria (<i>Cordylophora caspia</i>)	U.S. Environmental Protection Agency in Duluth reported that its monitoring efforts during 2006 in the Duluth-Superior Harbor detected this invasive invertebrate (a hydroid) that is known in other Great Lakes.	Unlisted	2007
<i>Daphnia lumholtzi</i>	<i>D. lumholtzi</i> were first found in reproductive densities in Lake Pepin in 2003. Samples from 2005 found a single specimen from the main channel in mid-September.	Unlisted	2005
European earthworms (various genera)	Continued public education has focused on preventing the release of earthworms.	Unlisted	2003
Eurasian swine (<i>Sus scrofa</i>)	No confirmed reports of wild Eurasian swine in the wild in 2009.	Prohibited	2002
Fallow deer (<i>Dama dama</i>)	Several escapes in past years.	Unlisted	2001
Orange-banded arion (<i>Arion fasciatus</i>)	This non-native slug that is invading forests, is found across the northeastern U.S.; records in Wisconsin since 1948; one of the most common slugs in Ontario. Minnesota infestations include Wood Rill SNA and Chippewa National Forest; otherwise little is known about its distribution in Minnesota. This slug is well established at this site and is a strong herbivore on various understory wildflower species.	Unlisted	2007
Red deer (<i>Cervus elaphus</i>)	Report to DNR of one escaped in 2009. It was dispatched by DNR.	Unlisted	1999
Round goby (<i>Neogobius melanostomus</i>)	No new water bodies in 2008.	Prohibited	2005
Ruffe (<i>Gymnocephalus cernua</i>)	No new water bodies since 1988.	Prohibited	2002

Table 21. (Continued)

Species	Status	Legal Status	Last annual report to include info on this species
Sika deer (<i>Cervus nippon</i>)	Several escapes in past years. Reports to DNR of three in the wild in 2009. One of those was dispatched.	Unlisted	2001
Three spine and four spine stickleback (<i>Gasterosteus aculeatus</i> and <i>Apeltes quadracus</i>)	In Lake Superior.	Unlisted	2000
Tubenose goby (<i>Proterorhinus marmoratus</i>)	The tubenose goby was first discovered in the St. Louis River estuary in 2001. It has also been documented in several other lakes and rivers within the Great Lakes Basin.	Prohibited	2005
Sea Lamprey	Sea lampreys are present in Lake Superior and portions of its tributaries. Their management is done by the USFWS and the Great Lakes Fishery Commission.	Prohibited	

Appendix A - Invasive Species Program efforts that address specific invasive species

A = public information and education B = watercraft inspections to prevent spread
 C = population surveys and monitoring D = technical assistance for control by others
 E = control to reduce populations, escapes, and nuisance conditions
 F = research on biology and management G = regulations

Invasive Species of Aquatic Plants and Wild Animals in Minnesota	Efforts of DNR's Invasive Species Program						
	A	B	C	D	E	F	G
Aquatic Plants							
Curly-leaf pondweed (<i>Potamogeton crispus</i>)	X	X	X	X	X	X	X
Eurasian watermilfoil (<i>Myriophyllum spicatum</i>)	X	X	X	X	X	X	X
Flowering rush (<i>Butomus umbellatus</i>)	X	X	X	X	X	X	X
Other non-native aquatic plants	X		X	X	X	X	X
Purple loosestrife (<i>Lythrum salicaria</i>)	X		X	X	X	X	X
Animals							
Common carp (<i>Cyprinus carpio</i>)			F		F/W	F/W	X
Mystery snails (<i>Bellamya</i> [=Cipangopaludina] <i>chinensis</i> ; <i>B. japonica</i> ; and <i>Viviparus georgianus</i>)	X	X	E				X
Mute swan (<i>Cygnus olor</i>)	X		X		X		X
New Zealand mudsnails (<i>Potamopyrgus antipodarum</i>)	X	X	X				X
Round goby (<i>Neogobius melanostomus</i>)	X	X	F/O		NIF		X
Ruffe (<i>Gymnocephalus cernuus</i>)	X	X	F/O		NIF		X
Rusty crayfish (<i>Orconetes rusticus</i>)	X						X
Spiny waterflea (<i>Bythotrephes longimanus</i>)	X	X	F				X
Zebra mussel (<i>Dreissena polymorpha</i>)	X	X	X			X	X

- E - DNR Ecological Resources staff in addition to those in the Invasive Species Program monitor these species
 F - DNR Fisheries monitors these species
 F/O - DNR Fisheries and other agencies monitor these species
 F/W - DNR Fisheries and/or Wildlife occasionally manage this species at priority sites
 NIF - Inland waters will be addressed as outlined in a Nonindigenous Fish (NIF) plan

Appendix B - Invasive Species Program Staff

Title / Area of Responsibility	Name	Phone	E-mail
Invasive Species Program Staff (Central Office)			
Invasive Species Program Supervisor - supervision of overall program, policy and direction, legislative issues	Luke Skinner	651-259-5140	luke.skinner@state.mn.us
Invasive Species Prevention Coordinator - education and public awareness, permits, regulations and prevention grants	Jay Rendall	651-259-5131	jay.rendall@state.mn.us
Aquatic Invasive Species Management Coordinator - technical and financial assistance for aquatic invasive plant management	Chip Welling	651-259-5149	chip.welling@state.mn.us
Terrestrial Invasive Species Management Coordinator - technical assistance and biological control programs	Vacant		
Grants Coordinator - administers invasive species management and prevention grants	Wendy Crowell	651-259-5085	wendy.crowell@state.mn.us
Watercraft Inspection Program Coordinator - supervise program staff; awareness events at water accesses; and cooperative inspector hires	Heidi Wolf	651-259-5152	heidi.wolf@state.mn.us
Research Scientist - zebra mussels, spiny waterflea, rusty crayfish, and other invasive aquatic invertebrates	Gary Montz	651-259-5121	gary.montz@state.mn.us
Enforcement - statewide coordination of enforcement of invasive species regulations for aquatic plants and wild animals	Phil Meier	507-359-6040	phil.meier@state.mn.us
Invasive Species Specialists (Field Staff) - Primary contact for aquatic invasive species issues at the local level. Provide technical assistance for invasive species management and prevention activities for their respective work areas.			
Northwest MN (Park Rapids)	Darrin Hoverson	218-699-7293	darrin.hoverson@state.mn.us
West-Central MN (Fergus Falls)	Nathan Olson	218-739-7576 ext. 259	nathan.olson@state.mn.us
Northeast MN (Grand Rapids)	Rich Rezanka	218-999-7805	richard.rezanka@state.mn.us
Central MN (Brainerd)	Dan Swanson	218-833-8645	dan.swanson@state.mn.us
Central and Southeast MN (St. Paul)	Brittany Hummel	651-259-5828	brittany.hummel@state.mn.us
Southern MN (New Ulm)	Joe Eisterhold	507-359-6079	joe.eisterhold@state.mn.us
Watercraft Inspection Program Assistants (Field Staff) - Supervise local watercraft inspectors and provide outreach for awareness events at water accesses			
Northern MN (Park Rapids - seasonal)	Bruce Anspach	218-699-7295	bruce.anspach@state.mn.us
West-Central MN (Fergus Falls - seasonal)	Anna Ness	218-739-7576 ext. 247	anna.ness@state.mn.us
Central MN (Brainerd - seasonal)	Keri Hull	218-833-8737	keri.hull@state.mn.us
Central and Southeast MN (St. Paul)	Maureen Ziskovsky	651-259-5146	maureen.ziskovsky@state.mn.us
General Information		651-259-5100	

Appendix C - Other State Contacts for Invasive Species Prevention and Control Programs and Interagency Groups

Department of Natural Resources - Forest Pest Program

DNR's Division of Forestry, working in cooperation with the MDA, is charged with surveying and controlling forest pests, including invasive organisms such as gypsy moth and several bark beetles. An annual report is prepared by the DNR Forest Health Protection Team on those issues.

Forestry Division Contacts

Metro/Southern Forest Health Specialist	Ed Hayes	507-206-2834
Northeast Forest Health Specialist	Mike Albers	218-327-4115
Northwest Forest Health Specialist	Jana Albers	218-327-4234
Forest Health Program Coordinator	Val Cervenka	651-259-5296
Silviculture Lands and Roads Supervisor	Al Jones	651-259-5271
Invasive Species Coordinator	Susan Burks	651-259-5251

U of Minnesota Sea Grant - Aquatic Invasive Species Information Center

The Aquatic Invasive Species Information Center at the University of Minnesota Sea Grant Program provides research, outreach, and education in collaboration with the DNR's Invasive Species Program. The Center has served as an important resource on aquatic nuisance species (ANS) and provides information to the public to prevent and slow their spread.

Center Coordinator - Duluth	Doug Jensen	218-726-8712
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Minnesota Department of Agriculture - Invasive Species Programs

The MDA is responsible for the prevention and early detection of new and emerging terrestrial plant pests and management of noxious weeds. MDA's Invasive Species Exclusion Unit addresses species such as emerald ash borer, potato cyst nematode, and Asian long-horned beetle. The Gypsy Moth Unit coordinates all aspects of survey, treatment, and regulatory work pertaining to gypsy moth. The Noxious and Invasive Weed Unit oversees the Minnesota Noxious Weed Law, coordinates weed biological control efforts, and assists land managers with general weed management and early detection efforts. MDA prepares an annual report for these programs.

Plant Protection Division Contacts

Invasive Species Exclusion Unit	Teresa McDill	651-201-6448
Gypsy Moth Unit	Lucia Hunt	651-201-6329

Noxious and Invasive Weed Unit Contacts

Noxious Weed Law and General Management	Anthony Cortilet	651-201-6538
Early Detection and Biological Control	Monika Chandler	651-201-6537

Interagency Invasive Species Groups

There are several invasive species committees or work groups that facilitate coordination between the involved agencies.

Weed Integrated Pest Management Committee - Jeanne Ciborowski, MDA - Integrated Pest Management Coordinator, Agricultural Development and Financial Assistance Division, 651-201-6217.

Gypsy Moth Program Advisory Committee - Lucia Hunt, MDA - Gypsy Moth Unit, Plant Protection Division, 651-201-6329.

St. Croix River Zebra Mussel Task Force - Includes these primary members and other less active members: Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources, Great Lakes Indian Fish and Wildlife Commission, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and the National Park Service.

Minnesota Invasive Species Advisory Council - Co-chairs: Teresa McDill, MDA - Invasive Species Exclusion Unit, Plant Protection Division, 651-201-6448 and Jay Rendall, DNR Invasive Species Program, Ecological Resources Division, 651-259-5131.