Invasive Species of Aquatic Plants and Wild Animals in Minnesota

Annual Report 2012

Minnesota Department of Natural Resources
Invasive Species Program
500 Lafayette Road
St. Paul, Minnesota 55155-4025

contributing authors and editors*
Bruce Anspach
Susan Balgie*
Nick Brown
Marjorie Casey
Bernice Cramblit
Adam Doll
Joe Eisterhold
Evan Freeman
Christine Herwig
Christine Jurek
Keegan Lund
Phil Meier
Gary Montz
Nathan Olson
Ann Pierce*
Jay Rendall
Rich Rezanka
Tim Schlagenhaft
Dan Swanson
Laura Van Riper
Chip Welling
Heidi Wolf
Maureen Ziskovsky

Submitted to
Environment and Natural Resources Committees of the Minnesota House and Senate

This report should be cited as follows:
Invasive Species Program. 2012. Invasive Species of Aquatic Plants and Wild Animals in Minnesota: Annual Report for 2012. Minnesota Department of Natural Resources, St. Paul, MN.

The total cost to produce this report: Preparation $7,262.50 Printing $960.00 for 100 copies; $677.73 for printing 500 copies of the Summary.

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.

Table of Contents

Page

Table of Contents (Continued)

Page

List of Tables

Page

List of Tables (continued)

Page

List of Figures

Page

List of Figures

Page

Invasive Species of Aquatic Plants and Wild Animals in Minnesota: Annual Report for 2012 Summary

Invasive species are non-native species that 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 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.

Status of Invasive Species in Minnesota: 2012

Aquatic Plants

Eurasian watermilfoil was discovered in 16 additional water bodies during 2012. The total number of milfoil infested water bodies is 273.

Purple loosestrife is known to infest 2,412 locations in Minnesota. In 2012, purple loosestrife was found in four new sites, bringing the total number of known infestations to 2,412.

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

Flowering rush is known to occur in 27 water bodies in 10 counties. No new infestations were reported in 2012.

Wild Animals

During 2012, 14 new lakes were designated as being infested with **zebra mussels:** Pelican, Gilbert, and Buck lakes (Becker County); Lake Minnewaska and Lake Emily (Pope County); Lake Miltona (Douglas County); Orwell Reservoir, Dayton Hollow Reservoir, and Paul, Rusch, Little McDonald, and Kerbs lakes (Otter Tail County); Ida Lake (Douglas County); and Breckenridge Lake (Wilkin County).

Three species of **Asian carp** were caught in Minnesota in 2012. One adult bighead carp was caught in the St. Croix River in April 2012; and a grass, bighead, and silver carp were caught by commercial fishermen in Mississippi River Pool 6 near Winona in March 2012.

One new **spiny waterflea** infested water was discovered in Trout Lake (Cook County) in 2012. With the interconnections between many infested lakes in northern Minnesota, more infestations are likely to be discovered in future seasons.

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. By the end of the 2012 open water season, 41 potential leech ponds across four counties in northwest Minnesota had been searched for the presence of faucet snails. Only eight were confirmed to have faucet snails.

During 2012, the DNR recorded reports of wild or escaped mute swans at multiple locations in the state. A total of 23 birds were reported in the wild in 14 counties**.**

Hot Topics

Asian carp

During 2012, work was underway to implement many elements of the action plan released by the Asian Carp Task Force that was formed in January 2011 to address Asian carp issues in Minnesota. The plan can be viewed at the following link: http://files.dnr.state.mn.us/natural_resources/invasives/aquaticanimals/asiancarp/asiancarpactionplan.pdf

In April 2012, an adult bighead carp was caught in the St. Croix River, and a grass, bighead, and silver carp were caught by commercial fishermen in Mississippi River Pool 6 near Winona in March 2012. While individual collections of Asian carp are increasing, in Minnesota, there is no evidence that they are naturally reproducing in the state. The closest known reproducing populations are in Iowa waters of the Mississippi River near Pool 17.

Environmental DNA, or eDNA, testing was completed for the first time in Minnesota waters in 2011. This technology was developed out of Notre Dame University to determine if DNA from Asian carp is present in water samples. Positive eDNA results alone do not confirm the presence of live silver carp. To test for false positives, additional water samples were collected in spring 2012 from a lake in the Twin Cities metropolitan area where Asian carp were very unlikely to be present. Twenty samples analyzed by the Corps of Engineers tested negative, while one sample out of 20 analyzed by the DNR contractor tested positive for silver carp. This one sample is most likely a false positive. To improve confidence in eDNA results, the University of Minnesota, National Park Service, U.S. Geological Survey, and DNR are working together to complete additional eDNA testing. Funding from the Legislative-Citizens Commission on Minnesota Resources is being provided through the University of Minnesota to the U.S. Geological Survey to conduct analysis following federal protocols. Approximately 500 samples were collected in September 2012 from a variety of locations including negative controls (i.e., well water), positive controls (i.e., tanks containing live Asian carp), and from many of the same locations where positive samples were reported on the Mississippi and St. Croix rivers in 2011. Results will improve confidence in eDNA testing and help determine future sampling strategies.

The Minnesota state legislature provided $7.5 million from the Outdoor Heritage Fund during 2012 to complete Asian carp barrier work, as well as $3.8 million to establish a new Aquatic Invasive Species Research Center at the University of Minnesota to accelerate research on long-term controls for Asian carp.

During 2011, Minnesota Gov. Mark Dayton hosted a series of three Asian Carp Summits which included representation from the congressional delegation, state and federal partners, and non-governmental organizations. Gov. Dayton presented an action plan that included many of the actions recommended by the Asian Carp Task Force. The DNR and other partners are currently in the process of implementing the Action Plan. For more information, visit www.dnr.state.mn.us/asian-carp .

New Legislation in 2012

Legislation aimed at strengthening Minnesota's ability to prevent the spread of aquatic invasive species was signed into law in 2012 by Gov. Mark Dayton. Among the results is the requirement that boat lifts and docks cannot be placed into another water body within 21 days of removal.

The new law, which received bipartisan support in the Legislature, is the product of a year-long effort in 2011 by the DNR to gather input from stakeholders, including lake associations, cabin owners, angler groups, conservation organizations, counties, and local units of government. That input was the key to developing legislative support, according to DNR Commissioner Tom Landwehr.

One of the key components includes increased civil penalties effective July 1, 2012. Also a new requirement for an AIS trailer decal replaced the 2011 AIS rules decal. A person must complete training to obtain an AIS trailer decal and this requirement becomes effective July 1, 2015.

Other aspects of the 2012 new legislation enhance the DNR's ability to work in partnership with local units of government. DNR can enter into delegation agreements with tribal and local governments to authorize mandatory inspection programs at public water access sites or in locations that allow for servicing multiple water bodies (approved plan required).

In 2012, an expedited emergency rule was adopted that designates several additional non-native species into invasive species classifications:

- **Prohibited Invasive Species—**faucet snail, large-scale silver carp, quagga mussel, red swamp crayfish, and western mosquito fish
- **Regulated Invasive Species—**banded mystery snail

Watercraft Inspections

Early in 2011, the DNR made significant changes to the way that it allocated hours of watercraft inspection within the state, in response to the growing number of infested waters. These adjustments emphasized containment at zebra mussel-infested waters, with the goal to becoming more effective with available staff time. The tiered system developed for this effort was very successful and helped the Watercraft Inspection Program to increase the number of inspections from 66,000 in 2010 to 76,000 in 2011; this increase occurred even though DNR hours of inspection were reduced by 5,500 in 2011 from 2010.

The biggest challenge the Watercraft Inspection Program faced in 2012 was the inability to meet original goals of hiring 100 Level 1 watercraft inspectors and 46 Level 2 watercraft inspectors. This lack of staff reduced the total number of hours of inspection and decontamination that the DNR was able to do around the state. The DNR responded to this issue by hiring an additional 30 staff through the emergency hiring process at the end of the season.

The Watercraft Inspection Program underwent several changes in the 2012 season. The Program was regionalized, which meant the addition of four regional watercraft inspection supervisors, who will be supervised at the regional level. The Program was unable to hire the approximately 100 Level 1 watercraft inspector interns that had originally been outlined as a goal. The DNR did purchase an additional 20 decontamination units and used them at high-use, zebra mussel-infested waters.

Planning for the 2013 Watercraft Inspection Season

The Watercraft Inspection Program's goal for 2013 is to complete 60,000 hours of watercraft inspection with the equivalent of 2,400 days of Level 2 watercraft inspection at watercraft accesses around the state. The Watercraft Inspection Program will continue to operate regionally and grow in that new structure. As a part of the regional structure, each regional supervisor will receive some discretionary hours in addition to those designated by the tier system to assign work based on regional issues and feedback.

Zebra Mussel Early Detection and Rapid Response in Rose Lake and Lake Irene

In response to new zebra mussel infestations, local partners were informed about the discoveries, signs were installed at public accesses, and press releases were issued. Increased watercraft inspections and enforcement also occurred.

Due to the possibility of boats moving upstream into Buck Lake in Becker County from zebra mussel infested-waters (Pelican and Little Pelican lakes, Otter Tail County), Buck Lake was designated as infested with zebra mussels in summer 2012.

Zebra mussels continued to expand their range in the Northwest Region. Dramatic increases in zebra mussel reproduction and settlement were seen in several lakes in the region. Lake Darling in Douglas County and Prairie Lake in Otter Tail County were found to have their highest production of zebra mussels since the discovery of these infestations in 2009.

Pelican Lake in Crow Wing County was listed as infested following the finding of two zebra mussels on the lake bed by DNR scuba divers on July 9, 2012. Gilbert Lake (also called Lake Ore-Be-Gone) in St. Louis County was listed as infested after recreational divers discovered zebra mussels near the public access.

In October, a lakeshore owner on Lake Miltona was removing lake equipment when the owner noticed several small zebra mussels attached to the base of one of the docks. As

a result of this find, Lake Miltona was designated as infested with zebra mussels. Lake Ida, less than one and a half miles downstream of Lake Miltona, also was designated as infested with zebra mussels due to the high likelihood of zebra mussel veligers traveling downstream into the lake.

Zebra mussel densities continue to increase in Mille Lacs Lake. Divers noted that zebra mussels were beginning to create a layer on softer sediments by attaching to scattered solid objects and other zebra mussels.

Water samples collected from Carlos Lake were analyzed for veliger and zooplankton densities and showed an increase in veligers, suggesting increasing reproduction in the lake.

Many boaters report no zebra mussels or very few on their watercraft in the Lake Pepin area. This die-off is similar to those seen in the past in the Mississippi River as well as Lake Zumbro. Such die-offs seem to coincide with times of extremely low water coupled with high summer temperatures. It is important to note that despite massive population declines, the zebra mussel populations rebound in subsequent years-thus, this has not in the past been the "end" of zebra mussel infestations and it is very likely that the populations will rebound in future seasons

DNR scuba divers from the Aitkin Area Fisheries office and Ecological and Water Resources counted zebra mussels along 15 established transects in August. These 600-foot transects have been surveyed yearly since 2005 when zebra mussels were first reported in Mille Lacs Lake.

Brainerd DNR Area Fisheries and Invasive Species Program staff met with the Gull Lake Association board in the fall to report on the 2012 zebra mussel monitoring results. Zebra mussel populations appear to be increasing throughout the lake.

Zebra mussel research: Recent work and progress in the potential for bacterial control of zebra mussels has raised the possibility of use of such a method in Minnesota lakes. Marrone Bio-Innovations has been testing and refining the use of a strain of *Pseudomonas flourescens* (a common soil bacteria), trade named Zequanox, for zebra mussel control. This bacterial strain was shown to kill zebra mussels when high enough doses were consumed. Future research directions for this material include more non-target toxicity data, as well as micro- and mesocosm trials in natural lake conditions. Questions remain on the potential use, as initial trials have shown high-dose rates and long exposure times necessary to obtain zebra mussel mortality.

Additional Program Activities

Education and Public Awareness

The DNR's Prevention Grant Program awarded grants to lake associations and other groups for public awareness projects and watercraft inspections at the local level. The grants provided an opportunity for the recipients to develop new customized products and to expand ongoing public awareness activities.

The DNR revised the invasive species web pages on its website to present more information and make that information easier to find.

Invasive species were the theme at the DNR's Minnesota State Fair exhibit with invasive species awareness promoted through stage events, new displays and banners, and presentations.

In 2012, the Invasive Species Program hired an aquatic invasive species information officer and a training coordinator. These positions are focused on education and public awareness efforts.

Management of Invasive Aquatic Plants

In 2011, the DNR initiated an effort to engage stakeholders to help the Department improve its role in management of existing infestations of invasive aquatic plants. These meetings resulted in several recommendations to improve management:

- Streamline permitting by making organizational and operational changes,
- Increase efficiency by use of a standardized, short-form Lake Vegetation Management Plan,
- Improve the DNR's grant program by simplifying of application, expanding of eligibility of projects, and increasing the level of funding,
- Continue to conduct and support research on management, and
- Improve communications and public education related to management.

In 2012, the DNR implemented these changes. The streamlining process of the Invasive Species Aquatic Plant Management permits was successful and went smoothly. More than 210 permits were issued along with 150 management grants totaling over $900,000.

Enforcement

From January 1, 2012 through the end of the year, Minnesota conservation officers provided 18,857 hours of invasive species enforcement resulting in 36,685 contacts for AIS education and enforcement.

During the year, officers performed 17,700 law compliance checks resulting in 998 citations and 1,550 written warnings, resulting in a 14.4% violation rate.
This was the fourth full year that included nine officers who dedicated a significant portion of their work toward invasive species enforcement. This change was implemented as part of an increased focus on enforcement of invasive species laws and the need to have coordinated efforts. Conservation officer (CO) hourly goals also were increased to manage the added work load.

Lake Service Provider Training

In 2011, the Legislature passed a law requiring lake service providers (LSP) to take aquatic invasive species (AIS) training and obtain a permit prior to working in waters of the state. Additionally, the employees of lake service providers are required to obtain a certificate showing that they have completed AIS training. In 2012, DNR began the process of training and issuing these permits and certificates.

To date, 41 LSP trainings have been offered: 768 permits have been issued, and 2,142 employees have been certified. A list of permitted lake service providers is available at the DNR website. This list is updated frequently as applications, course attendance, test scores, and payments are processed. Lake service provider training courses and permit applications are ongoing.

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, Heritage Enhancement 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 $7,237,000 for all invasive species prevention and management activities for the 2012 fiscal year.

The distribution of aquatic invasive species spending ($7,237,000) for fiscal year 2012 is shown in Figure 1. The Management/Control and Inspections/Enforcement categories account for 67% 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 for aquatic invasive species prevention and management.

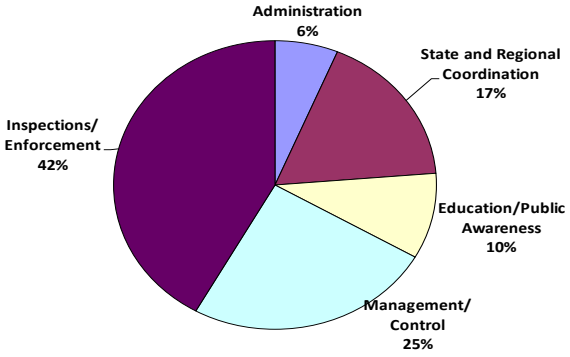


Figure 1. Aquatic Invasive Species Program spending (Invasive Species Account, General Fund, Heritage Enhancement Fund, and the Environment and Natural Resources Trust Fund only) in FY12 by major categories.

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 (Minnesota Statutes 84D).

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's Invasive Species Program addresses many invasive species that are present in Minnesota such as Eurasian watermilfoil, purple loosestrife, zebra mussels, and spiny waterfleas. The Program also attempts to prevent the introductions of invasive species that have the potential to move into Minnesota such as hydrilla and water chestnut. 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. 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 and Water Resources—Invasive Species Program (see Appendix A). In addition, the Invasive Species Program hires about 120 seasonal staff 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 Office of Communication and Outreach, also contribute significantly to the implementation and coordination of invasive species activities. In total, the equivalent of more than 25 full-time positions is focused on invasive species work.

The Program also addresses 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 Invasive Species Program continues to build capacity for the future, reacts quickly to new threats, and provides more support to those trying to manage invasive species. The DNR expanded activities focused on both aquatic and terrestrial species. Specific target areas included increased or expanded:

1) enforcement efforts by DNR conservation officers;
2) watercraft inspection;
3) efforts to work and collaborate with local units of government and organizations;
4) public awareness efforts;
5) grants for local prevention efforts;
6) grants to help groups manage invasive aquatic plants;
7) 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.

Many of these program expansions have been implemented, and are covered 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 Office of Communication and Outreach contribute significantly to the implementation and coordination of invasive species activities.

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 Office of Communication and Outreach provides support for the Invasive Species Program's public awareness activities (see Education and Public Awareness).

DNR Fisheries assists 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 and Water Resources contribute by providing biological expertise, assisting with control efforts, conducting inventory and public awareness activities, and providing additional avenues for public input.

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. The 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 Invasive Species Program and other agencies in the state participate in statewide groups such as the Minnesota Invasive Species Advisory Council (MISAC) and the Noxious Weed Advisory Committee.

The 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 are not limited to:

- Asian Carp Regional Coordination Committee;
- Association of Fish and Wildlife Agencies - Invasive Species Committee;
- 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.

Implementation 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 MISAC, co-chaired by the DNR and the MDA, 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: prevention of 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 non-governmental organizations. The Plan also provides 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. DNR continues to work to implement the Plan.

Prior to completion, 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 generated approximately $400,000 in FY12. 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. In 2012, an additional $1,000,000 was appropriated from the Heritage Enhancement Fund.

Table 1. State and local funding (in thousands of dollars) received by the Invasive Species Program, fiscal years 2007-2012.

Fiscal Year	Surcharge[2]	Invasive Species Acct	General Fund	Legislative-Citizen Commission on Minnesota Resources[1]	Local Contributions	Heritage Enhancement	Total
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
2010	53	2,142	2,640	100	--		4,935
2011	53	2,142	2,401	100	--		4,696
2012	53	2,742	1,674	2,177	74	1,000	7,720

[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, FY08/09, FY10/11, and FY12/13 bienniums. The 2012 budget also includes a substantial one-time appropriation from the Environment and Natural Resources Trust Fund of $ 2,177,000 for AIS activities.

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 and inspection efforts in the NE are paid from these funds. 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.

	Federal Fiscal Year[1] Grant Awarded	Calendar Year(s) Used	Grant Amount (1000s of $)	Source
Implement St. Croix Management Plan for aquatic nuisance species				
	2009	2010	28	USFWS
	2010	2011		USFWS
Implement State Management Plan for aquatic nuisance species				
	2010	2010-12	792	USFWS
	2011	2012-2013	1,040	USFWS
	2012	2013-2014	901	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 2012, 27 local groups provided funding so that the number of watercraft inspections on specific lakes could be increased.

Timeframe

This report covers activities in calendar year 2012, which includes the last half of the Minnesota fiscal year 2012 (FY12), January 1-June 30, 2012, and the first half of fiscal year 2013 (FY13), July 1-December 31, 2012. To provide a comprehensive review of expenditures and to meet the report's January 15, 2013 due date, we report on expenditures that were incurred in FY12 (July 1, 2011-June 30, 2012).

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 and Water 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 and Water 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 and Water 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. "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 website.

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 2012 (FY12) Expenditures

Expenditures on aquatic invasive species activities during FY12 (July 1, 2011-June 30, 2012) totaled $7,720,000. 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, $355,485 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 following chapters.

The $2,440,000 of "Invasive Species Account" expenditures during FY12 (Table 3) were less than the $2,742,000 appropriated by the Legislature (Table 1). The unspent FY12 funds remain in the Invasive Species Account. General Fund expenditures were $1,799,313 slightly above the $1,674,000, due to roll forward of unspent funds in FY11.

Figure 2 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 2, the Management/Control category and Inspections/ Enforcement category represent the

two largest segments of the budget; these two categories accounted for 67% of aquatic invasive species expenditures in FY12. The focus on those two categories, plus Education/Public Awareness which represents an additional 10% of FY12 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.

A majority of the funding for management and control was spent on Eurasian watermilfoil and curly-leaf pondweed. Funding was used for inventory, control, and grants for management of these two species. Spending also substantially increased for enforcement and watercraft inspections related to prevention efforts. Individual chapters of this report provide details on the activities accomplished with those funds.

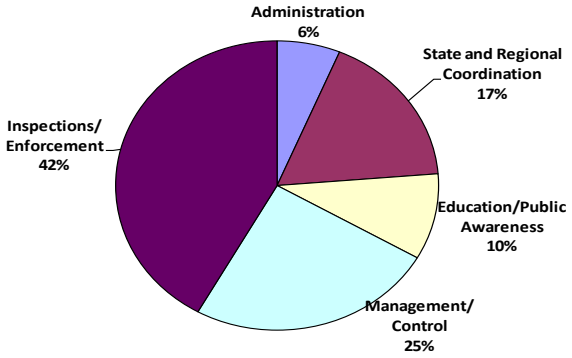


Figure 2. Aquatic Invasive Species Program spending (Invasive Species Account, General Fund, Heritage Enhancement Fund, and the Environment and Natural Resources Trust Fund only) in FY12 by major categories.

Fiscal Year 2013 (FY13) Future Expenditures

Since this report is due in the middle of FY13, projected expenditures for that fiscal year are not reported. A comprehensive review of FY13 expenditures will be provided in the 2013 Annual Report.

Table 3. Invasive species related expenditures in fiscal year 2012 (FY12) (in thousands of dollars).

Categories of Expenditures	Invasive Species Account	General Fund	Other Funding Sources
	FY12	FY12	FY12
Administration			
Division Support Costs			
Clerical			
Administrative Support			
Subtotal	**121**	**326**	**0**
State and Regional Coordination			
State coordination			
Support regional/federal activities			
Training, supervising, related work			
Equipment and services			
Other			
Subtotal	**1,200**	**0**	**[2]30**
Education/Public Awareness			
Radio spots, TV, website development			
Other			
Subtotal	**300**	**0**	**[2,3]380**
Management/Control			
Aquatic			
Eurasian watermilfoil	819	525	
Purple loosestrife			
Zebra mussel			
Curly-leaf pondweed			
Flowering rush			
Terrestrial invasive species	--	178	
Subtotal	**819**	**703**	
Inspections/Enforcement			
Watercraft inspections	0	0	[1,2,3]1,582
Enforcement - access checks	--	770	[1,]547
Subtotal	**0**	**770**	**2,129**
Research			
Aquatic species	0		[3]85
Terrestrial Invasive Plants			[1,2, 3]182
Subtotal			**267**
Total	**2,440**	**1,799**	**2,806**

[1]Other DNR funding, [2]LCCMR funding, [3]federal funding
*Subtotals are rounded to the nearest thousand

Regional Highlights

Region 1- Northwest

New infestations

- Discovered zebra mussels in Lake Minnewaska (Pope County) and Lake Miltona (Douglas County). Also found zebra mussels downstream of the already designated portions of the Otter Tail River (Otter Tail and Wilkin counties). In addition, zebra mussel veligers were found in Paul, Rush, Kerbs, and Little McDonald lakes (Otter Tail County).
- Discovered Eurasian watermilfoil in Lake Le Homme Dieu (Douglas County).
- With the help of the White Earth Nation, faucet snails were discovered in Becker, Otter Tail, and Norman counties.

Prevention activities

- Enforcement officers conducted 5,116 inspections at 232 locations and made 4,080 educational contacts between May 1 and August 16. Fourteen AIS check stations were conducted.
- The Watercraft Inspection Program conducted 24,603 inspections at 72 accesses.
- A total of 10 public awareness grants were awarded ($46,400) to counties, lake associations, and other citizen organizations.
- Provided training to 48 local units of government, inspectors, and 197 AIS volunteers. Conducted bait harvest training with the White Earth Nation Natural Resource Department. Conducted a citizen AIS monitoring training, as well as seven lake service provider trainings.

Management activities

- Issued 21 permits and 11 grants ($93,685) to treat curly-leaf pondweed, Eurasian watermilfoil, and flowering rush.
- Provided staff and equipment to gather, seed, test, and follow up on USGS Zequanox trials. Also assisted Pelican River Watershed District, Mississippi State University, and Concordia College with flowering rush research in the Detroit Lakes area.
- Conducted surveys for zebra mussels on Irene and Rose Lakes (previously designated). Discovered adult zebra mussels, indicating eradication attempts (2011) with copper sulfate were not effective.

Region 2 - Northeast

New infestations

- DNR scuba divers found zebra mussels in Pelican Lake (Crow Wing County). Zebra mussels also were found in Gilbert (Ore-Be-Gone) Lake (St. Louis County).
- Found Eurasian watermilfoil in McCormack Lake (St. Louis County) and Coon Lake (Itasca County).

Prevention activities

- Trained and tested bait dealers in Brainerd and Baudette who harvest bait in infested waters.
- Trained conservation officers on AIS issues related to bait dealers and trained incoming conservation officers at the CO Academy in Little Falls.
- Conducted six lake service provider trainings and trained 192 AIS volunteers.
- AIS information was presented to over 21 lake association and community groups.

Management activities

- Inspected curly-leaf pondweed and Eurasian watermilfoil on 27 lakes.
- Issued 33 Invasive Aquatic Plant Management permits to control invasive aquatic plants.
- Sampled for zebra mussel veligers and monitored zebra mussel densities on Pelican, Gull, and Mille Lacs lakes.
- Inspected 61 purple loosestrife sites and collected beetles to be released at five sites.

Region 3 - Central

New infestations

- Discovered Eurasian watermilfoil in Shamineau Lake (Morrison County); Camp Lake (Wright County); Horseshoe Lake, Lake Jane, and Lake Alice (Washington County); Weaver Lake (Hennepin County); Lake Josephine (Ramsey County); Pike Lake (Scott County); Hydes Lake (Carver County); and Alimagnet Lake (Dakota County).

Prevention activities

- Provided eight invasive species awareness sign grants to be posted at public accesses throughout the region.
- Participated in 14 public outreach events and technical assistance was provided to numerous LGUs and citizen organizations.
- Conducted over 37,000 hours of inspection, and one AIS check station was conducted.
- Conducted three lake service provider trainings and eight LGU watercraft inspector trainings.
- Watercraft inspectors prevented a watercraft from entering Lake Minnetonka after unknown mussels (not part of the dreissenid family) were found attached to the hull.
- Level 2 inspectors responded to conservation officer reports and decontaminated (hot water and high pressure) a boat lift with zebra mussels before it was placed into Medicine Lake.

Management activities

- Issued 127 Invasive Aquatic Plant Management permits.
- Conducted 13 point-intercept aquatic plant surveys.

Region 4 - South

New infestations

- Discovered Eurasian watermilfoil in Cedar Lake (McLeod County) and Ballantyne Lake (Blue Earth County).
- Water hyacinth was discovered in Lac Qui Parle Lake (Lac Qui Parle County).

Prevention activities

- Conducted over 1,600 hours of inspections in the region; two AIS check stations were conducted.
- Performed public awareness activities and provided technical assistance to numerous local units of governments and citizen organizations.
- Public awareness grants were awarded to local partners ($8,200).
- Conducted eight lake service provider trainings.

Management activities

- Provided 29 Invasive Aquatic Plant Management permits for curly-leaf pondweed and Eurasian watermilfoil.
- Grants were awarded to 18 lake associations and property owners for control of curly-leaf pondweed and Eurasian watermilfoil.
- Provided technical assistance to a number of citizen organizations regarding AIS management.
- Monitored and controlled purple loosestrife populations.

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. These elements fit into the overall approach to invasive species in the Minnesota State Management Plan for Invasive Species (Plan). The Plan's four elements are:

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

Goals

The desired outcomes of the Plan 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 - 2012

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

- DNR Enforcement activities continued to significantly increase (18,857 hours) and result in more citations being issued.
- DNR identified and designated additional infested waters.
- Funding for public awareness projects was provided to lake associations and other local groups for a fourth year through the DNR's Prevention Grant Program. A total of $74,452 was awarded to 22 groups to initiate new or continue public awareness projects, an additional $77,531 worth of watercraft inspection time was awarded to 28 entities at the local level for 10,004 hours of watercraft inspections, and $131,250 for 14 local government entities to hire their own watercraft inspectors during 2012
- DNR watercraft inspectors logged over 65,880 inspection hours.

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

Early Detection and Rapid Response

In 2012, there were no new aquatic invading species discovered in the waters of the state.

Response to New Infestations of Aquatic Invasive Species

There were numerous responses to the discovery of new infestations of species such as zebra mussels and Eurasian watermilfoil, already known to occur in the state. There

also were new infestations of faucet snails, water hyacinth, and parrot's feather described below and in the chapter on Other Aquatic Plant Species in Minnesota.

Faucet snail - On July 9, 2012, a faucet snail was reported among some leeches for use as fishing bait that were purchased from a local bait shop. The faucet snail was originally identified and reported to a DNR invasive species specialist by a DNR intern. The faucet snail was given to the specialist for species verification.

DNR Enforcement was notified of the snail. Enforcement started an investigation to determine the source of the faucet snails by contacting the bait shop to determine the source of the leeches. During the investigation, it was determined that the source of the faucet snails may be within the White Earth Nation Reservation and White Earth Nation Enforcement and Natural Resources Department staff were contacted. Both the DNR and White Earth Nation worked in collaboration on this rapid response.

Unlike a typical rapid response when an AIS is detected and reported in a water body, this incident required investigation to help determine the source of the faucet snails in the leeches, and if and where new faucet snail populations existed. DNR conservation officers visited the bait shop to determine the source(s) of the leeches. The bait shop voluntarily suspended leech sales while the investigation was ongoing. Officers examined the leeches in the store to look for non-target invertebrates among the leeches. They found snails and collected samples for examination. The invasive species specialist determined that faucet snails and native snails were contained with the leeches. The investigating officers also determined the names of the suppliers for the bait shop and contacted them. The investigation was long and complicated; a number of leech harvesters and bait dealers and bait sellers were questioned and their respective facilities examined for the presence of faucet snails.

The holding tanks and leech trapping ponds used by the bait shops were examined for faucet snails. Tank inspections were conducted by visually looking for faucet snails contained with the leeches as well as manually sorting through leeches. Suspect snails were collected for further examination or for documentation. The field inspection was completed from kayaks or along shore. Visual inspection of submerged vegetation was primarily used along with sweeping plants or sediment with a fine-mesh net. The shoreline also was examined for the shells of dead snails. If leech traps were available, they were examined as well.

On July 13, 2012, the first pond with faucet snails was located in Becker County on White Earth Nation land. A large number of faucet snails were found on a leech trap as well as faucet snail eggs. The trap was confiscated and brought back to the office so that the snails could be confirmed under a dissecting scope. By the end of November, a total of 41 ponds were examined and eight were found to have faucet snails.

Several statewide and regional meetings/conference calls were held to discuss the findings of the faucet snails, responses, and implementation of actions. The actions included:

Infested Waters and Prohibited Species Designation - The faucet snail was designated as a *prohibited invasive species* in Minnesota Rules, Chapter 6216 using expedited emergency rules. The newly confirmed infested waters were designated as infested waters via Commissioner's Order.

Bait shop - The bait shop had on hand a few gallons of leeches worth a few thousand dollars. It was decided that the bait shop had options including: removing and destroying all leeches in the shop or sorting the leeches to remove any snails before sale. Ultimately, a decision was made that it would be appropriate if the bait shop sorted the leeches before sale. The bait shop hand-sorted the leeches to remove any remaining faucet or native snails and sold the leeches.

White Earth Nation - White Earth Nation wanted to review its invasive species laws and update them where necessary to handle this new infestation. For ponds with faucet snails found on White Earth Nation land, a temporary closure was issued preventing public access and leech harvest. Ponds were still posted with closures as of early October 2012. No action was taken to remove or eradicate the snails.

News releases - Press releases were issued by both the DNR and the White Earth Nation to inform the public of this infestation.

Presentation to tribal members - The DNR and White Earth Nation collaborated to present information to tribal members on preventing the spread of invasive species with an emphasis on preventing the spread of AIS during leech trapping and wild rice harvest activities. DNR and Minnesota Sea Grant provided AIS brochures and information at this event.

Waterfowl regulations booklet - Waterfowl hunters are one user group that may interact with this species and may notice die-offs of waterfowl. To inform this user group, information on the faucet snail was added to the Minnesota Hunting Regulations Waterfowl 2012 handbook.

Letter and poster to bait shops - Minnesota Sea Grant produced a poster that was about to be distributed to hundreds of bait dealers throughout the state. The poster had several AIS

shown, but did not have faucet snails. It was decided that the DNR would have the faucet snail printed on the poster before it was distributed. To inform bait dealers that may be unaware of faucet snails and because of the concern that this species could be transmitted to new waters through the bait industry, the DNR sent a letter and a copy of the Minnesota Sea Grant poster (previous page) to all licensed bait dealers in the state.

Prevention Grants

In 2012, the DNR continued providing grants to local groups and governments to help prevent the spread of aquatic invasive species 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 dove-tail 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. A total of $74,452 was awarded to 22 groups to initiate new or continue public awareness projects and an additional $77,531 worth of watercraft inspection time was awarded to 28 entities at the local level for 10,004 hours of watercraft inspections, and $131,250 for 14 local government entities to hire their own watercraft inspectors during 2012 (Tables 4, 5, 6).

The five types of grants or partnership projects eligible in 2012 are described below:

<u>Watercraft Inspections - DNR Watercraft Inspectors</u>

In this grant type, the local organization provides funding for salaries (at $15/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 grantee 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 $15/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.

Table 4. Grants awarded for DNR Watercraft Inspector staff time. (Total inspection hours including hours paid by the DNR and hours paid by the grantee. DNR paid for half the cost of total inspection hours.)

Applicant	Requested Inspection hours	Total Inspection hours	Value of DNR paid hours
Aitkin/Crow Wing Round Lake Association	100	80	$620
Bad Medicine Lake Area Association	1000		$0
Bay Lake Improvement Association (BLIA)	500	400	$3,100
Beebe Lake Improvement Association	70	56	$434
Belle Taine Lake Association Organization	500		$0
Big Cormorant Lake Association	1000	800	$6,200
Big Fish Lake Association	500		$0
Big Sandy Lake Association	500		$0
Big Swan Lake Association	190		$0
Carnelian-Marine-St. Croix Watershed District	1000	601	$4,658
Chisago County	645		$0
Christmas Lake Homeowners Association	1000		$0
Chub Lake Association	64		$0
City of Big Lake (Big Lake - Lake Association)	200		$0
City of Burnsville	100	80	$620
City of Chanhassen	1000		$0
City of Detroit Lakes	1000	200	$1,550
Comfort Lake-Forest Lake Watershed District	838	286	$2,217
Coon Lake Improvement Association	560		$0
Cormorant Lakes Watershed District	1000	266	$2,062
Crowdry, Taylor, Stony, and Union Lakes Association	64.5		$0
Emily Lakes and Rivers Association	65		$0
Farm Island Lake Improvement Association	40	32	$248
Friends of Lake Bavaria	765		$0
Friends of Lower Hay Lake (FOLH)	1000	292	$2,263
Greater Lake Sylvia Association	1000		$0
Green Lake Property Owners	325	250	$1,938
Gull Chain of Lakes Association	1000	932	$7,223
Horseshoe Lake Property Owners Association	80	64	$496
Lake Hubert Conservation Association (LHCA)	500	400	$3,100
Lake Independence Citizens Association	552	441	$3,418
Lake Lida Property Owners Association	1000	800	$6,200
Lake Miltona Association	500	400	$3,100
Lake Plantagenet Landowners Association	248		$0
Lake Sarah Improvement Association	200		$0
Lake Washburn Association	500		$0

Table 4. Continued.

Little McDonald-Kerbs Lakes Association	600		$0
Lone Lake Property Owners Association	150		$0
Long and Crooked Lakes Association	100		$0
Long Lake Area Association of Hubbard County	1000		$0
Lotus Lake Conservation Alliance	1000		$0
Maple Lake Improvement District	130		$0
Minneapolis Park and Recreation Board	500	134	$1,039
North Long Lake Association	716		$0
Otter Tail County Pine Lakes Improvement District	500	200	$1,550
Otter Tail Lake Property Owners Association Foundation, Inc.	1000	229	$1,775
Otter Tail County	1000		$0
Pelican Group of Lakes Improvement District (PGOLID)	644	515	$3,991
Pelican Lakes Association	1000	866	$6,712
Pike Lake Area Community Association (PLAA)	1000		$0
Pleasant Lake Association	384		$0
Potato Lake Association	1000		$0
RALALA (Roosevelt and Lawrence Area Lakes Association)	500		$0
Round Lake Improvement District	600	480	$3,720
Ruth Lake Association	66		$0
Sand Lake Property Owners Association	500		$0
Sportsmen's Club of Lake Vermilion	516		$0
Sugar Lake Association	775	310	$2,403
Tri-Lakes Improvement Association	600	160	$1,240
WAPOA (Whitefish Area Property Owners Association)	1000	420	$3,255
Waterville Lakes Association	650		$0
White Bear Lake Conservation District	387	310	$2,403
Total Amount	35,925	10,004	$77,531

Watercraft Inspections - Non-DNR Watercraft Inspectors

Local government units (LGU) can hire watercraft inspectors for work at local waters. DNR trains the inspectors and provides grant funds of $7.50 per hour of inspection toward the local inspection costs. The LGU must recruit, hire, and schedule the inspectors, and provide supervision, insurance, social security, and potential unemployment costs. There were 14 participants in this type of grant during 2012.

Table 5. Grants awarded to Local Government Units to hire Level 1 or Level 2 watercraft inspectors.

Government Unit	Requested Funds	Grant Amount
Ida Township Board	$5,500	$5,500
Carver County WMO	$7,750	$7,750
City of Chanhassen	$7,750	$7,750
City of Emily	$7,750	$7,750
Crow Wing County Environmental Services	$7,750	$7,750
Douglas County Lake and Resource Management Department	$32,750	$32,750
City of Greenfield	$7,750	$7,750
Minneapolis Park and Recreation Board	$7,750	$7,750
Lake Minnetonka Conservation District	$7,750	$7,750
Hubbard County SWCD	$7,750	$7,750
Leech Lake Temporary Employment Program	$7,750	$7,750
Otter Tail County	$7,750	$7,750
South St. Louis SWCD	$7,750	$7,750
Three Rivers Park District (Level 1)	$7,750	$7,750
Total Amount	**$131,250**	**$131,250**

Public Awareness - Projects with standard designs or audio/video provided by DNR
DNR provides newspaper, TV, and radio ads, and billboards and gas pump ad designs that include local grantee names/logos. The 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.

DNR Signs at Water Accesses
The DNR will provide Stop Aquatic Hitchhikers! signs to successful applicants at no cost. The applicant will arrange for permission to post the signs at water accesses. The number of signs that will be available to each successful applicant will depend upon the number of lakes and accesses in the project. These signs can be used at both public and private water accesses on uninfested and infested waters.

Table 6. Grants awarded for Public Awareness Projects

Applicant	Requested Funds	Grant Amount
Aitkin County Soil and Water Conservation District	$1,800	$1,800
Becker County	$7,500	$7,500
Becker County COLA	$7,500	$7,500
Beebe Lake Improvement Association	$300	free materials
Big Sand Lake Association	$1,960	$1,960
Big Sandy Lake Association	$1,239	$700
Christmas Lake Homeowners Association	$5,197	$2,845
City of Big Lake	$700	$0
City of Chisago City	$6,365	$0
City of Lakeville	$5,663	$4,588
Douglas County Lakes Association	$7,500	$6,820
Hubbard County COLA	$3,957	$3,537
Lake Emma Township	$1,912	$0
Lake Minnewashta Preservation Association	$7,424	$7,424
Long Lake Improvement District	$7,500	$1,500
McDonald-Kerbs Lakes Association	$158	$158
Middle Fork Crow River Watershed District	$4,700	$3,100
Minneapolis Park and Recreation Board	$4,175	$4,175
Opportunities in Science DBA Headwaters Science Center	$5,500	$5,500
Otter Tail County	$7,500	$7,500
RALALA (Roosevelt and Lawrence Area)	$1,750	$1,750
Sand Lake Property Owners Association	$550	$550
Sportsmen's Club of Lake Vermilion	$4,090	$3,545
Ten Mile Lakeshore Preservation	$4,195	$0
University of Minnesota-Duluth	$7,500	$0
Waterville Lakes Association	$1,000	$1,000
Wright County COLA	$1,400	$1,000
Total Amount	**$109,035**	**$74,452**

The following criteria were established prior to the grant applications being submitted to evaluate grant proposals if there were more applications received than funds available (excluding standard signs for water accesses that had separate criteria):

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

These criteria were used in 2012 to rank and award the grants because there was a much higher demand for grants than funds available. Not all of the eligible applications were not funded.

Infested Waters Permits
Minnesota Rules, Chapter 6216 prohibits the diversion and transport of water from designated infested waters except by permit. In 2012, there were several permit requests to transport infested water and to divert infested waters. The following entities obtained infested waters permits in 2012 from the DNR Invasive Species Program:

- Mille Lacs Soil and Water Conservation District to transfer infested water for water quality sampling
- Central Landscaping Inc. to transport infested water for watering installed sod
- University of Minnesota for transport of infested water for common carp research
- University of Minnesota for transport of infested water for Asian carp eDNA sampling
- University of Minnesota for transport of native fish used in mussel research
- U.S. Fish and Wildlife Service for transport of water for transport of native mussels
- DNR Ecological Water Resources for transport of water for transport of native fish used in mussel research
- Minnehaha Creek Watershed District to transfer infested water for water quality sampling
- USGS. Upper Midwest Environmental Sciences Center to transport infested water for evaluating the effectiveness of Zequanox for zebra mussel control
- St. Paul Regional Water Services to transport infested water for maintenance of supply pipes.

There were also other situations where the DNR hydrologists addressed transport of infested water in existing and new water appropriation and public waters work permits.

Prohibited Invasive Species Permits
State law prohibits the possession, transport, sale, purchase, and import of prohibited invasive species except by permit. In 2012, several permits were issued to entities that carried out 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:

- Cloquet High School - zebra mussels
- Century High School - zebra mussels
- Commercial Fishing Licensees - prohibited aquatic plants
- DNR - Office of Communication and Outreach - zebra mussels
- Alex Rubbish and Recycling - zebra mussels
- Douglas County Public Works - zebra mussels
- Natural Resources Research Institute - purple loosestrife
- Marrone Bio Innovations - zebra mussels
- University of Minnesota - curly-leaf pondweed, Eurasian watermilfoil
- DNR Watercraft Inspection Program - zebra mussels, faucet snails, Eurasian watermilfoil, curly-leaf pondweed, flowering rush, native aquatic plants

- Great Lakes Institute for Environmental Research - round and tubenose gobies
- DNR Wildlife - faucet snail
- University of Minnesota - Eurasian watermilfoil
- USGS. - zebra mussels
- DNR Fisheries - zebra mussels, Eurasian watermilfoil, curly-leaf pondweed, brittle naiad, flowering rush, faucet snails, New Zealand mudsnail, quagga mussels
- Chisago Lindstrom Lake Association - curly-leaf pondweed, Eurasian watermilfoil
- MNDOT - zebra mussels, Eurasian watermilfoil, curly-leaf pondweed
- Minnehaha Creek Watershed District - zebra mussels
- Concordia College - Eurasian watermilfoil
- Carver County WMO - zebra mussels
- University of Minnesota - curly-leaf pondweed, Eurasian watermilfoil
- EnviroScience, Inc - Eurasian watermilfoil
- University of Minnesota - silver and bighead carp
- St. Paul Regional Water Services - zebra mussels
- AW Research Laboratory - zebra mussels
- Central Lakes College - Eurasian watermilfoil, curly-leaf pondweed, flowering rush, purple loosestrife
- Minnesota State University-Mankato - curly-leaf pondweed

In addition, many permits to transport boats and equipment from zebra mussel-infested waters for cleaning and winter storage were issued as part of service provider permits to lake service providers (see below).

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.

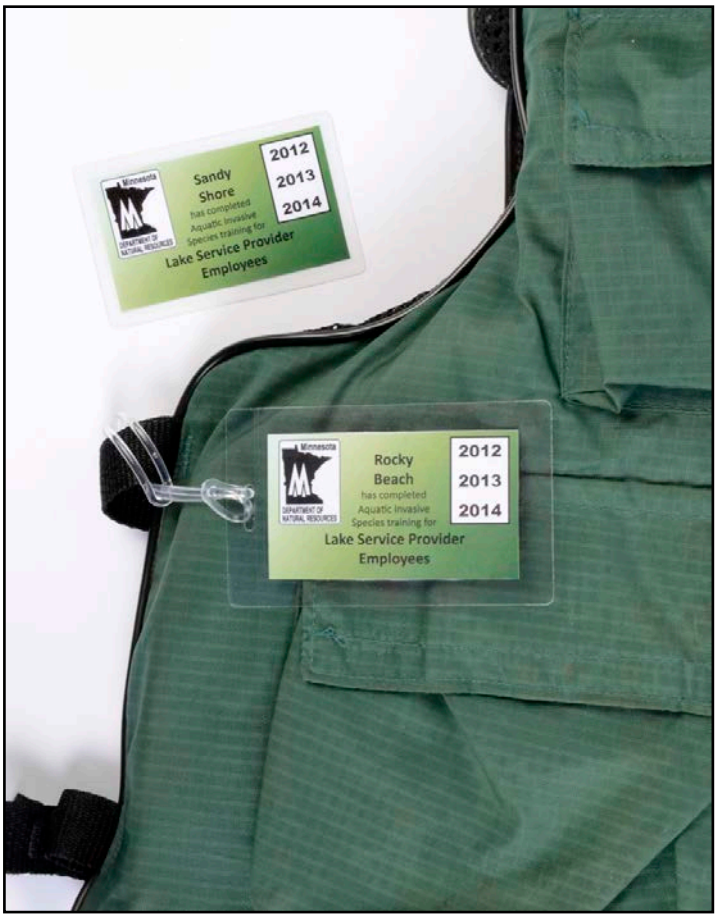
Lake Service Provider Training, Permits, and Certificates

In 2011, the Legislature passed legislation authorizing a permit program pertaining to lake service providers to help prevent the spread of aquatic invasive species between waters in the state. Service providers (definition below) are required to have a service provider permit before conducting work that includes placing or removing water-related equipment from any state waters (see definitions in state statute below). Individuals who work for a service provider must take online training and receive a training certificate (see photo on next page). Permits and certificates are valid for three calendar years.

> **Service provider** means an individual who or entity that installs or removes water-related equipment or structures from waters of the state for hire or as a service provided as a benefit of membership in a yacht club, boat club, marina, or similar organization. Service provider does not include a person working under the supervision of an individual with a valid service provider permit issued under section 84D.108.

Water-related equipment as defined in state law means a motor vehicle, boat, watercraft, dock, boat lift, raft, vessel, trailer, tool, implement, device, or any other associated equipment or container, including but not limited to portable bait containers, live wells, ballast tanks (except those with an MPCA permit), bilge areas, and water-hauling equipment that is capable of containing or transporting AIS, aquatic macrophytes (plants), or water.

In 2012, implementation of the statewide lake service provider training and permitting program began. A website (www.mndnr.gov/lsp) was created to provide information on the program. For a business to receive a permit, the owner or manager must attend an in-person training course, pass a test, apply for a permit online, and pay a $50 permit application fee. During 2012, 45 in-person training sessions were offered throughout the state. Individuals from more than 800 businesses attended the trainings, completed the permit process, and received lake service provider permits. Permittees are required to place a decal on their vehicles to indicate they have their permit (above).



An online training also was developed for lake service provider employees. More than 2,400 employees took and passed the online training and received their certificates (left) in 2012.

Education and Public Awareness

2012 Highlights

- DNR's Prevention Grant Program awarded 22 grants to lake associations and other groups for public awareness projects at the local level. One important outcome of the grant program was the completion and distribution of 11 new 30-second video public service announcements (PSAs).
- Invasive species was the theme of DNR's Minnesota State Fair exhibit with interactive displays, stage events, banners, scavenger hunts, and boat inspection demonstrations.
- A new DVD, *Aquatic Invasive Species: Minnesota Waters at Risk* was produced and distributed to more than 2,500 lake associations, conservation groups, and tourism organizations.
- Through a partnership, billboards were posted with the "Stop Hitchhiking Zebra Mussels" message at 47 locations along key state travel routes to and from lake 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 invasive species;
- 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 - 2012

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 website, 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 targeted locations during the weeks preceding the Minnesota Fishing Opener, Memorial Day, and the Fourth of July to reach the large numbers of recreational boaters using Minnesota waters during these peak times. 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 nearly 60 commercial radio stations throughout greater Minnesota in May, June, and late summer. Ads also were placed in the Duluth market, Brainerd Lakes area, southeastern Minnesota, and Twin Cities. A special program covering fishing issues, including invasive species, aired in the Brainerd Lakes area just prior to the Fishing Opener.

In addition, 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 website, making them readily accessible to station managers when needed. PSAs were distributed throughout the spring, late summer, and into fall for the waterfowl hunting season.

Television

Paid television advertising was used again this year to remind viewers of the continuing concerns about invasive species in the state. The completion of 11 new 30-second PSAs in late 2011 provided an opportunity to target high priority areas of the state with specific messages. The PSAs were produced in four different formats for distribution to broadcast stations and as a YouTube link so that individuals can view the spots on home computers. The messages cover several topics including Eurasian watermilfoil, spiny waterfleas, zebra mussels, AIS laws, and steps for inspecting a boat before leaving the access. The series also addresses the effects of flowering rush on recreation and how to transfer bait to prevent the spread of invasive species.

The spots aired throughout the spring and summer and into the fall with a special message to waterfowl hunters. The spots also aired on "Minnesota Bound," a popular half-hour program that appeals to both outdoor enthusiasts and general audiences in the greater Twin Cities area as well as other stations on numerous fishing and outdoor shows, during morning and evening newscasts in major television markets, .

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.

Each version shows boaters, angles, and other water recreationists the simple steps they can take to help stop the spread of invasive species. The entire series can be viewed at http://www.naturalinnovations.org/aispsa/

Special Programming

More than 2,500 copies of the new program, *Aquatic Invasive Species: Minnesota Waters at Risk* were distributed on DVD to lake associations, conservation groups, and other partners. The DVD contains a full-length 25-minute program as well as an 11-minute version, and a 1-minute trailer for viewing in various settings The program was featured at the DNR's State Fair exhibit where invasive species was the theme.

Newspapers and informational materials

Newspaper advertising was an important tool in this year's public awareness activities. One 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. The ads also ran in several specialty newspapers and magazines reaching boaters, campers, anglers, outdoor enthusiasts, and tourists. Print ads also appeared in specialty publications for boating interests.

An AIS rules decal capturing information on state aquatic invasive species laws was distributed to more than 400,000 boat operators and owners throughout Minnesota. The decal included a tear-off portion for placement near the drain plug to remind boaters to remove the plugs when transporting watercraft on public roads (see Regulations).

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 also was 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 2012 *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. The outside back cover of this year's regulations book featured an invasive species message with actions required by law to prevent the spread of aquatic invasive species. 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 2011-2012 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 infested waters.

Outdoor media

DNR partnered with Wildlife Forever, U.S. Forest Service, USFWS, Coalitions of Lake Associations in Hubbard and Becker counties, Kandiyohi County Lakes Association, and Minnesota Sea Grant to develop and post billboards with the "Stop Hitchhiking Zebra Mussels" message at 47 locations along key state travel routes to and from lake areas. The billboards were placed beginning in May and continued through September, creating nearly 83 million impressions along key travel corridors throughout the state. (Figure 5).

Figure 3. Stop Hitchhiking Zebra Mussels! billboards were placed at 47 primary travel corridors in 2012.

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 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.

News conferences

Several news conferences this year focused on the Department's efforts to prevent the spread of invasive species and, in particular, the efforts to keep Asian carp species from spreading further into Minnesota waters. The news conferences were well attended by the major broadcast stations in the Twin Cities and statewide outlets as well as print media, providing excellent coverage of the issues.

DNR website

The DNR's website pages covering invasive species and related information were updated to provide the most current information available (visit www.dnr.state.mn.us/invasives/index.html). Information is now divided into two main categories: Aquatic Invasive Species and Terrestrial Invasive Species, making it easier for visitors to the site to find information on a specific species. 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, invasive species specialists, and volunteers from partnering organizations staffed the invasive species display throughout the State Fair providing a venue for visitors to ask specific questions while visiting the exhibit. "Stop the Invaders" was the theme for the DNR exhibit at this year's State Fair. The former theater space was converted to enhance the invasive species theme in 2012 with an interactive "Invasive Species Investigation" exhibit, scavenger hunt offered every day of the Fair, boat cleaning demonstrations, outdoor stage presentations, and informational displays and handouts. 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 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 (Table 7).

Table 7. Major statewide events staffed by DNR Invasive Species Program and Water Resources Enforcement Officers.

Event	Date	Location
Minneapolis Boat Show	Jan. 19-22	Minneapolis
Sportsmen's Boat, Camping and Vacation Show	Feb. 10-12	St. Cloud
Lake Home and Cabin Show	Feb. 10-12	Minneapolis
Duluth Boat, Sport, and Travel Show	Feb. 15-19	Duluth
Red River Valley Sportsmen's Boat, Camping, and Vacation Show	Mar. 1-4	Fargo, ND
Douglas County Sports Show	Mar. 23	Superior, WI
Great Waters Fly Fishing Expo	Mar. 23-25	Blaine
Northwest Sportshow	Mar. 28-Apr. 1	Minneapolis
George's Minnesota Muskie Expo	Apr. 13-15	St. Paul
Minnesota Bass Expo	Apr. 20-22	Blaine
Tracy Area Sportsmen's Show	Apr. 28-29	Tracy
Minnesota Waters Lakes and Rivers Conference	Apr. 28-29	St. Cloud
Minnesota Governor's Fishing Opener	May 11-12	Lake Waconia
Lake Superior Days	July 13-15	Duluth
Farmfest	Aug. 2-4	New Ulm
Game Fair	Aug. 10-12, 17-19	Ramsey
Minnesota State Fair	Aug. 25-Sept. 5	St. Paul
Minnesota Resort and Campground Association Fall Conference	Oct. 23-25	Breezy Point
Minnesota Association of Watershed Districts	Nov. 29-Dec. 1	Alexandria
Minnesota Association of Soil and Water Conservation Districts Annual Convention	Dec. 2-4	Bloomington

Presentations

Presentations were given by DNR Invasive Species Program staff to university classes, conferences, annual meetings, training sessions, service and professional organizations, sportsmen's groups, county coalitions of lake associations, and lake associations.

Grants

Prevention grants were offered and awarded again this 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 2012 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 run local ads, produce customized informational materials, and increase watercraft inspection efforts in their respective areas (see Prevention and Containment).

Public water accesses
DNR watercraft inspectors completed nearly 66,000 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 18,857 hours enforcing regulations and invasive species laws (see Enforcement).

Help Stop Aquatic Hitchhikers! signs are posted at public and private water accesses in the state. Local partners have helped post dozens of the signs at accesses around many lakes. New large size access signs were available through the ongoing Sign Grant Program (see Prevention and Containment).

Participation of Others in Public Awareness Activities
Other agencies and organizations in Minnesota have been cooperatively involved with public awareness activities for more than a decade and continue to conduct public awareness efforts throughout the state. Local organizations and agencies have conducted public awareness efforts with support from DNR Prevention Grants (see Prevention and Containment).

Minnesota Invasive Species Advisory Council
The Minnesota Invasive Species Advisory Council (MISAC) produced a 2013 invasive species wall calendar highlighting 12 non-native invasive species that are current or potential threats in Minnesota. The calendar, which was distributed to natural resource, agricultural, highway, and other professionals throughout the state, 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 website where they can obtain further information and report potential sightings. The DNR is a member and co-chair of MISAC.

MISAC co-hosted the Upper Midwest Invasive Species Conference, which was held October 29-31, in LaCrosse, Wisconsin. The event featured more than 150 experts presenting research to improve management of terrestrial and aquatic invasive species. The conference was attended by nearly 600 people from Minnesota and surrounding states. DNR staff conducted a watercraft inspection training workshop as well as other sessions at the conference.

Wildlife Forever
Wildlife Forever continued to be a key partner to raise awareness in Minnesota and other states during 2012. They lead a cooperative effort to place "Stop Aquatic Hitchhikers!" billboards along key travel corridors in Minnesota and other states. . 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 83 million impressions in Minnesota.

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 32 university-based programs administered through the National Oceanic and

Atmospheric Administration. Several highlights of Minnesota Sea Grant's AIS activities in 2012 are listed below:

Leadership and Service

Sea Grant staff serve on state, regional, and national task forces and committees including MISAC; DNR's AIS Prevention Stakeholder Team; DNR's Live Fish Transportation Risk Assessment Task Force and Risk of Introducing Invasive Carp Through Live Fish Movement Core Group; 2012 Upper Midwest Invasive Species Conference Executive Planning Committee; Lake Superior AIS Prevention Team; Binational Program's Lake Superior Lakewide Management Program Work Group; Great Lakes Ballast Water Collaborative; Great Lakes Maritime Task Force; Academic Advisory Board, Hwy H_2O; Great Lakes Panel on ANS and Information/Education Committee; International Association of Great Lakes Ports; Environmental Advisory Board, Green Marine; Duluth-Superior Harbor Technical Committee and Dredging Subcommittee; Minnesota Clean Marina Steering Committee; Recreational Activities Committee of the Aquatic Nuisance Species Task Force; and Prevention Committee of National Invasive Species Council.

Outreach

Sea Grant and its partners educated nearly 16,000 people through direct programming at 77 events. More than 35 talks were given to groups, communities, businesses, industries, agencies, and task forces across Minnesota.

Sea Grant provided leadership and support at more than a dozen events related to ballast water and maritime commerce, participating in many activities related to ballast water AIS outreach, education, and policy development across the Great Lakes.

Staff worked collaboratively with the University of Minnesota Extension's Shoreland Education Team to promote workshops for lake associations concerning best management practices, plant identification, and AIS awareness.

Special Funded Outreach Projects

Based on funding through the Great Lakes Restoration Initiative (GLRI), Sea Grant partnered with the National Park Service to promote *Stop Aquatic Hitchhikers!* awareness to communities along the North Shore of Lake Superior.

The Great Lakes Sea Grant Network (GLSGN) project continues to implement a comprehensive outreach initiative targeting 15 pathways aimed at preventing the spread of AIS. It features *Stop Aquatic Hitchhikers!, Nab the Aquatic Invader, Habitattitude, AIS-Hazard Analysis and Critical Control Point* (*HACCP)* program, and social media communications. Last year, the GLSGN delivered 105 talks at meetings and other events; supported mass media communications efforts by Wildlife Forever and other partners; coordinated production of 37 new *Stop Aquatic Hitchhikers!* educational resources, co-hosted 69 displays at boat, sports, and travel shows; posted education messages via social media; and issued nine news releases that generated 116 story placements in newspapers, radio, television, and e-news. The youth education component, *Nab the Aquatic Invader* featuring *SAH!*, taught nearly 17,600 students and teachers through teacher education workshops, stewardship projects, and AIS service learning courses.

Building upon this successful effort, EPA awarded Minnesota Sea Grant, a second two-year GLRI grant to strengthen and broaden regional AIS outreach efforts. Working with partners in the pet and plant industries, the GLSGN is using a variety of marketing and education techniques to broaden the *Habitattitude* campaign partnership. *Habitattitude* was promoted at ten events.

Based on a grant from the National Oceanic and Atmospheric Administration-National Sea Grant Program, GLSGN, continued a two-year, multi-state outreach effort in partnership with fishing tournament organizers and professional anglers. At least 33 tournaments were attended by GLSGN staff. Sea Grant worked with tournament organizers to identify critical control points based on operations.

Youth Education

Sea Grant reached nearly 3,381 students and teachers about AIS in the Duluth area and beyond.

New Grants

GLRI awarded the Sea Grant Program two-year funding through the U.S. Environmental Protection Agency. This funding extends education efforts that span the Great Lakes states with messages about preventing the spread of aquatic invasive species.

Future needs for public awareness in Minnesota

- Increase spending on paid public awareness radio/TV spots and newspaper ads to reinforce the high awareness of invasive species by watercraft users.
- Continue to make public awareness of zebra mussels in Minnesota near Alexandria, Brainerd, Detroit Lakes, the Twin Cities, Lake Superior, the Mississippi River, and the Zumbro and St. Croix rivers a high 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, aquarium trade, and lake service providers.
- 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 through grants and other means.
- Increase information about invasive species available through various communication channels such as the DNR website, publications, and media outlets.
- Continue to work collaboratively with Minnesota Sea Grant staff, Wildlife Forever, and other stakeholders to pursue research and outreach funding through National Sea Grant, the Great Lakes Restoration Initiative, USFWS, foundations, and other sources.
- Continue to provide funding for public awareness grants for lake associations and groups to produce locally-focused communication projects.

Enforcement

Introduction

Enforcement of Minnesota's invasive species regulations is key to the ultimate goal of preventing the spread into and throughout Minnesota. Enforcement activities, whether educational opportunities or issuing citations and warnings, are geared toward compliance to help control the spread of aquatic invasive species (AIS). Enforcement is a primary motivator to changing the behavior of those who may intentionally or unintentionally move invasive species.

This past year has provided several new initiatives to aid the Division of Enforcement in its endeavors. AIS laws were analyzed by the Department with input from stakeholders and portions were rewritten to address the activity that likely will prevent the spread of AIS. The amended regulations not only give conservation officers (COs) valuable enforcement tools, but provide an effective measure in preventing the spread. Officers continue to work 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 Division 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
- Implementing saturation details statewide to target high-priority areas
- Providing advanced training to all conservation officers to ensure they have the knowledge they need to effectively enforce the laws and to provide relevant information to the public
- Assisting Level 1 and Level 2 inspectors with decontamination efforts at public access sites
- Developing protocols and equipment to safely and effectively administer AIS checkpoints

Progress in Enforcement Efforts - 2012

Expanded Enforcement
This was the fourth full year during which nine conservation officers dedicated a significant portion of their work toward invasive species enforcement. This change was implemented as part of an increased focus on enforcement of invasive species laws and the need to coordinate efforts. COs hourly goals also were increased to manage the added work load.

The efforts to increase enforcement of invasive species laws for the 2012 open water season began long before the ice went out. Enforcement and Ecological and Water Resources management and field staff met to create strategies and prepare an enforcement plan on a statewide level, as well as on regional and district levels. At joint staff meetings, and informally in each region, Water Resource Enforcement Officers (WREOs) were able to meet with their field staff counterparts from Ecological and Water Resources to discuss the best course of action for their respective areas. These ideas were brought back to the districts for implementation. Statewide public input meetings were attended by WREOs along with other enforcement staff to increase dialog and to gain input from concerned citizens and user groups.

From January 1, through the end of the year, conservation officers provided 18,857 hours of invasive species enforcement resulting in 36,685 contacts for AIS education and enforcement.

Regional Enforcement Highlights

Region 1
As they traveled from lake to lake during the summer, WREOs along with COs assisted watercraft inspectors in educating the public about how to prevent the spread of invasive species. Officers also educated the public about the use of hunting equipment such as boats and trailers, boots, waders, dogs, and other gear that can transport invasive species while waterfowl hunting. An investigation into a faucet snail discovery at a bait dealer was conducted with White Earth Tribal officials to determine the source. As a result, several bait dealers were interviewed and inspected to assess the scope of the problem and ensure that bait dealers are educated about invasive species and the risks of spreading AIS (see Prevention and Containment).

Throughout 2012, WREOs and COs attended community meetings focusing on aquatic invasive species. The meetings included representatives from the Pelican River Watershed District, DNR officials, and lake associations. AIS enforcement began with the early opening of the Rainy River and continued for the extended open water angling season. A concentrated effort to enforce the water transportation laws occurred in Lake of the Woods County. COs also assisted staff from Ecological and Water Resources with lake service provider and bait harvester training.

WREOs facilitated several training sessions of conservation and peace officers. Peace officers from Becker, Otter Tail, and Polk counties, along with White Earth Tribal officers, were trained in AIS laws. COs provided coverage for numerous work crews at public water accesses at both infested and non-infested lakes. WREOs and COs

worked together on investigating the sale of frozen herring from VHS-infested waters. In addition, they investigated the arrival of a houseboat transported with questionable decontamination actions, and worked with Ecological and Water Resources staff with decontamination units at water access sites.

WREOs and regional conservation officers staffed AIS booths at many sport and outdoor shows and events (see Education and Public Awareness). They also attended the Second Annual Legislative Summit on AIS awareness. Presentations on AIS law were given to the Alexandria Young Professional Club and the Douglas County Lakes Association. WREOs reviewed Lake Service Provider (LSP) training materials, assisted training county watercraft inspectors and AIS volunteer instructors, and coordinated several AIS enforcement work crews. Conservation officers, in partnership with Ecological and Water Resources staff, conducted four AIS check points.

Region 2

AIS Enforcement work included various outreach projects and attendance at city, county, and state events such as law enforcement expos in the Duluth area, staffing AIS booths at numerous county fairs, and various sports shows (see Education and Public Awareness). Officers also continued work with other organizations such as Minnesota Sea Grant, 1854 Treaty Authority, and University of Minnesota-Duluth, to name a few. They attended an annual two-day event with the University of Minnesota-Duluth Forestry here an AIS booth was set up to teach fifth graders about AIS issues. There also was a significant increase in the number of officers attending lake association meetings.

Officers attended Lake Service Provider training to present enforcement information to the attendees. Training for the 1854 Treaty Authority was conducted with Minnesota Sea Grant. Officers worked with watercraft inspectors to ensure compliance with AIS and infested waters transportation laws and rules. Officers also trained respective COs, staff from local and federal law enforcement agencies, and others about invasive species-related enforcement, using cross enforcement efforts when appropriate.

Officers participated in several work details from spring to early fall, focusing on AIS information for anglers and boaters as well as waterfowl hunters for the waterfowl season opener. An AIS road check was conducted in the Duluth area in mid-August with very high compliance of AIS laws and rules. Officers also increased respective district commercial bait harvest monitoring, Aquatic Plant Management permit compliance monitoring, and respective tribal gill netting and bait harvest monitoring at priority infested waters.

Region 3

Region 3 conservation officers worked hard to combat the invasive species threat, specifically around large infested lakes that have a lot of recreational activity– Mississippi River, St. Croix River, Lake Minnetonka, and Prior Lake. COs met with lake service providers and facilitated training to these businesses to ensure they have all the information available regarding the spread of invasive species. Officers documented contacts and enforcement action related to invasive species from May through October. Region 3 COs contacted 6,975 boaters during this time and issued 514 citations and

376 warnings. The most common violation was failing to pull the boat plug and leave it out while transporting.

Invasive species training also was given to local law enforcement agencies that have recreational lakes within their jurisdiction. Two AIS check stations were conducted within the region. Region 3 has made it a priority to work closely with the DNR's decontamination units and has conducted several follow-up investigations on non-compliant boaters. Region 3 COs are continuing to work on AIS issues through the 2012 waterfowl season.

Region 4

AIS enforcement was a priority around the southern region over the past year. Booths were staffed at take-a-kid-fishing events and sports shows (see Education and Public Awareness). Staff also worked at a shooting event that draws people from the entire Midwest, as well as at local sporting goods stores during major weekends. Partnerships continue with the Pest Risk Committee, Kandiyohi County AIS Task Force, and the Region 4 AIS Committee. Officers attended district enforcement meetings to help clarify changes and additions in AIS laws and fine amounts.

Enforcement staff attended Lake Service Provider training to answer questions from service providers pertaining to workers and AIS issues. Enforcement also monitored service provider compliant training lists and provided non-compliant service providers with training session information. Officers also attended lake association meetings to provide information to property owners on AIS issues. AIS Level 1 training was provided for city and county law enforcement agencies so that AIS laws and rules could be administered through the civil and criminal process.

Officers participated in AIS work details supporting and assisting Level 1 and Level 2 watercraft inspectors (using decontamination equipment when appropriate) and citizen groups to ensure compliance with AIS and infested waters transportation laws and rules. Five AIS road checks were conducted in the Litchfield, Waterville, Spicer/Green Lake, and Lake Benton areas. Increased AIS efforts continue during the fall hunting seasons with checks being made on anglers, waterfowl hunters, trappers, and their equipment. Region 4 officers contacted over 7,000 recreationalists for AIS compliance and education.

Enforcement Check Stations

The 2011 legislative session granted statute authority to the Enforcement Division to perform AIS check stations. The Enforcement Division's management team created an Operation Plan and work parameters for the check stations. The division contacted all 87 county attorneys across the state to inform them of our plan and to ensure all legal requirements were meet. All AIS check stations were staffed with enforcement officers and supervisors, along with invasive species staff from the Ecological and Water Resources Division and a mobile decontamination unit. These check stations proved to be an effective tool in detecting AIS violations throughout the state.

Goals for 2013

The Division of Enforcement continues to focus its efforts towards enforcement and education, which have been proven as critical tactics in reducing the spread of invasive species. Historically, this type of natural resource enforcement has never been experienced by officers so updates and training are mandated by the division. We will continue to monitor and evaluate our actions to provide the most effective measures available. We will work with the public and private entities on legislative issues to provide enforcement with the tools necessary to prevent the spread of AIS. We will continue to emphasize this as priority work, and we have now included it in our core responsibilities.

During 2013, WREOs will develop plans for education and enforcement of invasive species laws that are customized to the geographic areas they patrol. These plans focus on both species and activities that are unique to these areas. All enforcement districts will be hosting AIS check stations in 2013. Enforcement and educational efforts are directed toward the goal of compliance to prevent the future spread of AIS and to receive complete buy-in from all involved parties.

Participation of Others

Conservation officers continue to work with lake associations and other user groups to assist in sharing information about controlling the spread of invasive species. Officers are working closely with Ecological and Water Resources staff to evaluate their efforts to become as effective as possible.

Officers will continue to work with other department staff to develop a training schedule for local law enforcement. 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

Table 8. Invasive species violations in 2011 and 2012.

Statewide Open Water Season

Violation Type	January 1, 2011 to November 30, 2011	January 1, 2012 to November 30, 2012
Transportation of Aquatic Invasive Species	159	312
Fail to Drain Water/Pull Plug	681	2,177
Miscellaneous	4	25

In 2011, officers performed 5,463 law compliance checks resulting in:

- 121 Citations
- 427 Written Warnings
- 431 Verbal Warnings
- Resulting in an 18% violation rate.

In 2012, officers performed 17,700 law compliance checks resulting in:

- 998 Citations
- 1,550 Written Warnings
- Resulting in a 14.4% violation rate

Statewide AIS Check Stations

- 9 check stations were performed statewide
- Resulting in 44 hours of operation
- 139 various water-related equipment were inspected
- The average delay was 3.9 minutes for no violation
- The average delay was 10.72 minutes with a violation
- The violation rate for check stations was 31.3%

The data for this year, although still preliminary, is only lacking citations and warnings that have not been sent in for entry into the Department's records. No major changes to the numbers are anticipated. In 2012, verbal warnings were not documented.

Regulations

Introduction

Issue

Minnesota's regulations related to invasive species of aquatic plants and wild animals, currently found 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 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 snails, flowering rush, New Zealand mudsnails, ruffe, round goby, spiny waterfleas, white perch, or zebra mussels. The most current list of infested waters is posted on the DNR website.

The DNR also is 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 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 more restrictive ballast discharge regulations including "lakers" and designations of injurious wildlife.
- Continue to adopt state 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.
- Per the strategies in the state invasive species plan, *"Review state regulations to optimize legal authority for prevention of the import and introduction of invasive species*; and *"Establish new and maintain / revise / improve existing regulations that address pathways of spread in the state …"*

Progress in Regulations - 2012

State Statute Changes

The legislature passed legislation that made several modifications and added numerous new authorities and requirements to state statutes related to AIS in 2012. Minnesota Statutes, Chapter 84D, was amended as described below (modifications are shown in strike and underline):

Boating

• The legislature repealed an earlier law requiring watercraft owners or operators to obtain an AIS rules decal issued by the DNR and display the decal on the watercraft prior to launching on, entering into, or operating on any waters of the state.

> ***86B.508 AQUATIC INVASIVE SPECIES RULES DECAL. [Repealed]***
> ~~*(a) A watercraft owner or operator must obtain and display an aquatic invasive species rules decal issued by the commissioner on the owner or operator's watercraft prior to launching on, entering into, or operating on any waters of the state.*~~
> ~~*(b) The aquatic invasive species rules decal must be attached to the watercraft.*~~ ***[Effective 7-1-2012]***
>
> ***86B.811 CRIMINAL PENALTIES.***
> ~~***Subd. 1a. Petty misdemeanor.*** ***[Repealed]***~~
> ~~*A watercraft owner who fails to obtain or display an aquatic invasive species rules decal or a person who operates a watercraft that does not display an aquatic invasive species rule decal in violation of section 86B.508 is guilty of a petty misdemeanor.*~~

• The following law was passed as an alternative to the watercraft decal that was repealed.

> ***86B.13 AQUATIC INVASIVE SPECIES PREVENTION PROGRAM.***
> ***Subdivision 1. Establishment.***
> *The commissioner shall establish a statewide course in preventing the spread of aquatic invasive species. The commissioner must develop an educational course and testing program that address identification of aquatic invasive species and best practices to prevent the spread of aquatic invasive species when moving water-related equipment, as defined under section 84D.01, subdivision 18a.*
> ***[Effective 7-1-2015]***
>
> ***Subd. 2. Aquatic invasive species trailer decal.***
> *The commissioner shall issue an aquatic invasive species trailer decal for each trailer owned by a person that satisfactorily completes the required course of instruction.*
> ***[Effective 7-1-2015]***
>
> ***Subd. 3. Contracting for services.***
> *The commissioner may contract for services to provide training and testing services under this section.* ***[Effective 7-1-2015]***
>
> ***Subd. 4. Aquatic invasive species trailer decal display required.***
> *(a) A person may not transport watercraft or water-related equipment, as defined under section 84D.01, subdivision 18a, with a trailer unless the person has an aquatic invasive species trailer decal issued under this section. Temporary authorizations valid for seven days can be requested by persons that have not completed the required course of instruction.*
> *(b) Aquatic invasive species trailer decals are valid for three years.*

(c) The aquatic invasive species trailer decal must be adhered to the side of the trailer frame tongue near the hitch in a manner that it is readily visible and does not interfere with the display of any registration requirements under section 169.79.

(d) Aquatic invasive species trailer decals are not transferable.

(e) Violation of this section shall not result in a penalty, but is punishable only by a warning. ***[Effective 7-1-2015]***

Lake "Service Providers", Riparian Owners, and Ice Fishing

• The definition of service providers was amended to include yacht clubs, boat clubs, marinas, and similar organizations. The law now requires, and allows, service providers to place a decal on the windshield of their vehicles.

"Service provider" *means an individual who or entity that installs or removes water-related equipment or structures from waters of the state for hire or as a service provided as a benefit of membership in a yacht club, boat club, marina, or similar organization. Service provider does not include a person working under the supervision of an individual with a valid service provider permit issued under section 84D.108.* ***[Effective 7-1-2012]***

84D.108 SERVICE PROVIDER PERMIT.

Subdivision 1. Service provider permit required.

(a) Service providers must apply for and obtain a permit from the commissioner before providing any services described in section 84D.01, subdivision 15a.

(b) Service providers must have a valid permit in possession while providing services described in section 84D.01, subdivision 15a.

(c) Service providers must display the service provider permit decal issued with their permit. The decal must be completely affixed by its own adhesive on the inside of the extreme lower corner of the driver's windshield of the vehicle being operated while providing services described in section 84D.01, subdivision 15a. ***[Effective 7-1-2012]***

• Two changes were made to law that are related to movement of equipment and water. It is no longer necessary to drain portable bait containers when leaving a water body after fishing through the ice. It is now required to leave boat lifts, docks, and swim rafts out of the water for 21 days before placing them into another water body.

84D.10 WATERCRAFT AND WATER-RELATED EQUIPMENT REQUIREMENTS AND PROHIBITIONS.

Subd. 4. Persons transporting water-related equipment.

(a) When leaving waters of the state a person must drain water-related equipment holding water and live wells and bilges by removing the drain plug before transporting the water-related equipment off the water access site or riparian property.

(b) Drain plugs, bailers, valves, or other devices used to control the draining of water from ballast tanks, bilges, and live wells must be removed or opened while transporting water-related equipment.

(c) Emergency response vehicles and equipment may be transported on a public road with the drain plug or other similar device replaced only after all water has been drained from the equipment upon leaving the water body.

(d) Portable bait containers used by licensed aquatic farms, portable bait containers when fishing through the ice except on waters designated infested for viral hemorrhagic septicemia, and marine sanitary systems are exempt from this subdivision.

(e) A person must not dispose of bait in waters of the state.

(f) A boat lift, dock, swim raft, or associated equipment that has been removed from any water body may not be placed in another water body until a minimum of 21 days have passed. ***[Effective 7-1-2012]***

Bait Harvesting

• Two areas of law were changed to address issues related to harvest of bait in infested waters. The first, in 84D.03, allows certain species of fish to be caught by hook and line primarily to allow them to be used on the same waters when fishing for catfish. And the second, in 97C.341, requires that any bait originating from VHS infested waters must be processed before imported or possessed in the state.

84D.03 INFESTED WATERS; RESTRICTED ACTIVITIES.

Subd. 3 Bait harvest from infested waters.

(a) Taking wild animals from infested waters for bait or aquatic farm purposes is prohibited, except as provided in paragraph (b) and section 97C.341.

(b) In waters that are designated as infested waters, except those designated because they contain prohibited invasive species of fish or certifiable diseases of fish, as defined under section 17.4982, subdivision 6, taking wild animals may be permitted for:

(1) commercial taking of wild animals for bait and aquatic farm purposes according to a permit issued under section 84D.11, subject to rules adopted by the commissioner; ~~and~~

(2) bait purposes for noncommercial personal use in waters that contain Eurasian water milfoil, when the infested waters are designated solely because they contain Eurasian water milfoil and if the equipment for taking is limited to cylindrical minnow traps not exceeding 16 inches in diameter and 32 inches in length; and

(3) harvest of bullheads, goldeyes, mooneyes, sheepshead (freshwater drum), and suckers for bait from streams or rivers designated as infested waters, by hook and line for noncommercial personal use. Other provisions that apply to this clause are:

(i) fish taken under this clause must be used on the same body of water where caught and while still on that water body;

(ii) fish taken under this clause may not be transported live from or off the water body;

(iii) fish harvested under this clause may only be used in accordance with this section;

(iv) any other use of wild animals used for bait from infested waters is prohibited;

(v) fish taken under this clause must meet all other size restrictions and requirements as established in rules; and

(vi) all species listed under this clause shall be included in the person's daily limit as established in rules, if applicable.

(c) Equipment authorized for minnow harvest in a designated infested water by permit issued under paragraph (b) may not be transported to, or used in, any waters other than waters specified in the permit. ***[Effective 7-1-2012]***

97C.341 CERTAIN AQUATIC LIFE PROHIBITED FOR BAIT.

(a) A person may not use live minnows imported from outside of the state, game fish, goldfish, or carp for bait. The commissioner may, by written order published in the State Register, authorize use of game fish eggs as bait and prescribe restrictions on their use. The order is exempt from the rulemaking provisions of chapter 14 and section 14.386 does not apply.

(b) A person may not import or possess live, frozen, or processed bait from known waters where viral hemorrhagic septicemia has been identified as being present~~,~~; (1) unless the bait has been processed to inactivate viral hemorrhagic septicemia in a manner prescribed by rules adopted by the commissioner; or (2) except as provided in paragraph (c). For purposes of this paragraph, "bait" includes fish, aquatic worms, amphibians, invertebrates, and insects used for taking wild animals in waters of the state.

Local Government Inspections of Watercraft and Other Water-related Equipment

• New authority was provided to the DNR to delegate watercraft inspection authority to tribal or local governments.

84D.105 INSPECTION OF WATER-RELATED EQUIPMENT.

Subd. 2. Inspector authority.

(a) The commissioner shall train and authorize individuals to inspect water-related equipment for aquatic macrophytes, aquatic invasive species, and water. The commissioner may enter into a delegation agreement with a tribal or local government where inspection authority as provided under paragraphs (b), (g), and (h) is delegated to tribal and local governments that assume all legal, financial, and administrative responsibilities for inspection programs on some or all public waters within their jurisdiction.

(b) Inspectors may visually and tactilely inspect watercraft and water-related equipment to determine whether aquatic invasive species, aquatic macrophytes, or water is present. If a person transporting watercraft or water-related equipment refuses to take required corrective actions or fails to comply with an order under section 84D.10, subdivision 3, an inspector who is not a licensed peace officer shall refer the violation to a conservation officer or other licensed peace officer.

(c) In addition to paragraph (b), a conservation officer or other licensed peace officer may inspect any watercraft or water-related equipment that is stopped at a water access site, any other public location in the state, or a private location where the watercraft or water-related equipment is in plain view, if the officer determines there is reason to believe that aquatic invasive species, aquatic macrophytes, or water is present on the watercraft or water-related equipment.

(d) Conservation officers or other licensed peace officers may utilize check stations in locations, or in proximity to locations, where watercraft or other water-related equipment is placed into or removed from waters of the state. Any check stations shall be operated in a manner that minimizes delays to vehicles, equipment, and their occupants.

...

(g) The commissioner may authorize tribal and local governments that enter into a delegation agreement with the commissioner to conduct mandatory inspections of water-related equipment at specified locations within a defined area before a person places or removes water-related equipment into or out of a water body. Tribal and local governments that are authorized to conduct inspections under this paragraph must:

(1) assume all legal, financial, and administrative responsibilities for implementing the mandatory inspections, alone or in agreement with other tribal or local governments;

(2) employ inspectors that have been trained and authorized by the commissioner;

(3) conduct inspections and decontamination measures in accordance with guidelines approved by the commissioner;

(4) have decontamination equipment available at inspection stations or identify alternative decontamination equipment locations within a reasonable distance of the inspection station that can bring water-related equipment into compliance;

(5) provide for inspection station locations that do not create traffic delays or public safety issues; and

(6) submit a plan approved by the commissioner according to paragraph (h).

(h) Plans required under paragraph (g) must address:

(1) no reduction in capacity or hours of operation of public accesses and fees that do not discourage or limit use;

(2) reasonable travel times between public accesses and inspection stations;

(3) adequate staffing to minimize wait times and provide adequate hours of operation at inspection stations and public accesses;

(4) adequate enforcement capacity;

(5) measures to address inspections of water-related equipment at public water accesses for commercial entities and private riparian land owners; and

(6) other elements as required by the commissioner to ensure statewide consistency, appropriate inspection and decontamination protocols, and protection of the state's resources, public safety, and access to public waters.

(i) A government unit authorized to conduct inspections under this subdivision must submit an annual report to the commissioner summarizing the results and issues related to implementing the inspection program.

(j) The commissioner may waive the plan requirement in paragraph (g) for inspection programs where authorized inspectors are placed directly at one or more water access sites,

with no requirement for a person to travel from the water access for inspection or decontamination, and no local ordinance or other regulation requiring a mandatory inspection before placing watercraft or water-related equipment into a water body or after watercraft or water-related equipment are removed from a water body. ***[Effective 7-1-2012]***

Enforcement and Inspections

• Additional authorities were provided related to enforcement and watercraft inspections.

84D.105 INSPECTION OF WATER-RELATED EQUIPMENT.

Subd. 2. Inspector authority …

(e) Conservation officers or other licensed peace officers may order water-related equipment to be removed from a water body if the commissioner determines such action is needed to implement aquatic invasive species control measures.

(f) The commissioner may require mandatory inspections of water-related equipment before a person places or removes water-related equipment into or out of a water body. Inspection stations may be located at or near public water accesses or in locations that allow for servicing multiple water bodies. The commissioner shall ensure that inspection stations:

(1) have adequate staffing to minimize delays to vehicles and their occupants;

(2) allow for reasonable travel times between public accesses and inspection stations if inspection is required before placing water-related equipment into a water body;

(3) are located so as not to create traffic delays or public safety issues;

(4) have decontamination equipment available to bring water-related equipment into compliance; and

(5) do not reduce the capacity or hours of operation of public water accesses.

Penalties

• Several civil penalties were doubled from their previous amounts in an attempt to increase compliance with AIS laws.

84D.13 ENFORCEMENT; PENALTIES.

Subd. 5. Civil penalties.

(a) A civil citation issued under this section must impose the following penalty amounts:

(1) for transporting aquatic macrophytes in violation of section 84D.09, ~~$50~~ $100;

(2) for placing or attempting to place into waters of the state water-related equipment that has aquatic macrophytes attached, ~~$100~~ $200;

(3) for unlawfully possessing or transporting a prohibited invasive species other than an aquatic macrophyte, ~~$250~~ $500;

(4) for placing or attempting to place into waters of the state water-related equipment that has prohibited invasive species attached when the waters are not designated by the commissioner as being infested with that invasive species, $500 ~~for the first offense and $1,000 for each subsequent offense~~;

(5) for intentionally damaging, moving, removing, or sinking a buoy marking, as prescribed by rule, Eurasian water milfoil, $100;

(6) for failing to have drain plugs or similar devices removed or opened while transporting water-related equipment or for failing to remove plugs, open valves, and drain water from water-related equipment, other than marine sanitary systems, before leaving waters of the state, ~~$50~~ $100; and

(7) for transporting infested water off riparian property without a permit as required by rule, $200.

(b) A civil citation that is issued to a person who has one or more prior convictions or final orders for violations of this chapter is subject to twice the penalty amounts listed in paragraph (a). ***[Effective 7-1-2012]***

Technical Changes

• Three parts of law were modified for technical reasons to clarify the original intent or make it consistent with other wording in Chapter 84D.

84D.05 PROHIBITED INVASIVE SPECIES.

Subdivision 1. Prohibited activities.

A person may not possess, import, purchase, sell, propagate, transport, or introduce a prohibited invasive species, except: …

(5) when being transported for disposal as part of a harvest or control activity when specifically authorized under a permit issued by the commissioner according to section 103G.615, when being transported for disposal as specified under a commercial fishing license issued by the commissioner according to section 97A.418, 97C.801, 97C.811, 97C.825, 97C.831, or 97C.835, or when being transported as specified by the commissioner; ***[Effective 7-1-2012]***

84D.09 AQUATIC MACROPHYTES.

Subdivision 1. Transportation prohibited.

A person may not transport aquatic macrophytes, except as provided in this section.

Subd. 2. Exceptions.

Unless otherwise prohibited by law, a person may transport aquatic macrophytes:

…

(2) for disposal as part of a harvest or control activity ~~conducted~~ when specifically authorized under an aquatic plant management permit pursuant to section 103G.615, under permit pursuant to section 84D.11, or as specified by the commissioner; …

84D.10 WATERCRAFT AND WATER-RELATED EQUIPMENT REQUIREMENTS AND PROHIBITIONS.

Subdivision 1. Launching prohibited.

A person may not place or attempt to place into waters of the state ~~a watercraft, a trailer, or~~ water-related equipment, including aquatic plant harvesting or control equipment that has aquatic macrophytes, zebra mussels, or prohibited invasive species attached except as provided in this section. ***[Effective 7-1-2012]***

DNR Rulemaking

In 2012, new emergency rules were adopted to designate several non-native species into invasive species regulatory classifications. The following species were designated as *prohibited invasive species*:

- largescale silver carp (*Hypophthalmichthys harmandi*)
- western mosquitofish (*Gambusia affinis*)
- faucet snail (*Bithynia tentaculata)*
- quagga mussel (*Dreissena bugensis*)
- red swamp crayfish (*Procambarus clarkii*)

This species was designated as *regulated invasive species*.

- banded mystery snail (*Viviparus georgianus)*

The species below was previously designated as a *regulated invasive species* and the scientific name was changed to the current name:

- spiny waterflea (*Bythotrephes longimanus*)

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 300 vessels have applied to MPCA and are now covered by the Permit. Several Permits were issued in 2012.

DNR Commissioner's Orders
Two Commissioner's Orders were issued in 2012 to designate additional infested waters. The orders were published in the *State Register* on April 24 and July 24, 2012. Another will be issued in early 2013 to cover new infested waters determined in late 2012.

Future needs for regulations and proposed changes

- 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 the establishment of state and federal ballast water regulations protective of Minnesota and the nation's waters.
- Seek legislative changes on AIS prevention in 2013 that build on 2012 legislation.

Watercraft Inspections

Introduction

Issue

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 waterfleas, and zebra mussels. The DNR Watercraft Inspection Program has met the statutory requirements each year and inspection hours have been increasing as additional staff have been added (see Table 9). As of 2011, the statutory requirement was repealed and additional inspection authorities were granted to the Commissioner of Natural Resources.

New legislative authority in 2011

New legislation aimed at strengthening Minnesota's ability to prevent the spread of aquatic invasive species was signed into law May 27, 2011. As a result of this legislation, the DNR hired and trained new authorized inspectors to ensure compliance with invasive species laws. These new authorized inspectors, along with conservation officers, can visually and tactilely inspect water-related equipment. Those inspections can include the removal, drainage, decontamination, and/or treatment of water-related equipment to prevent the transportation of aquatic invasive species.

DNR authorized inspectors can prohibit the launching or operation of water-related equipment if a person refuses to allow an inspection, or refuses to remove and dispose of aquatic invasive species, aquatic plants, and water. Authorized inspectors also can require a watercraft to be decontaminated prior to launching into Minnesota waters, or prior to leaving an access (Figure 8). The DNR has created two levels of authorized inspectors: Level 1 will be able to inspect watercraft visually and tactilely and deny access if necessary. Level 2 inspectors have the same authorizations and also will be trained to use decontamination equipment at the access.

Goals

The goal the Watercraft Inspection Program helps to achieve is the second goal of the Invasive Species Program: preventing the spread of invasive species within Minnesota. The inspectors do this by:

- Conducting watercraft inspections at public water accesses across the state and requiring watercraft users to decontaminate their watercraft if AIS or water are found;
- Increasing public awareness about invasive species and the potential for boaters to transport invasive species between water bodies;
- Increasing education efforts with citizen groups;
- Distributing information at local events around the state.

Progress in Watercraft Inspections - 2012

Complete watercraft inspections

In 2012, approximately 121 watercraft inspectors worked the majority of the open water season and an additional 30 watercraft inspectors worked one month inspecting boats and providing information to the public on watercraft inspections and invasive species. Inspections began in late April and continued though the end of October. Within this 25-week period, watercraft inspectors logged over 62,300 inspection hours (Table 9). A total of 102,600 watercraft/trailers were inspected throughout the state (Figure 6).

Although our primary audience is recreational boaters, watercraft inspections also continued through October in order to reach waterfowl hunters. Inspectors also worked to clear aquatic plant fragments from the public water accesses at which they were stationed.

Table 9. Number of watercraft inspections conducted by watercraft inspectors and the total number of inspection hours accomplished in Minnesota in 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, and 2012. (*Totals are rounded values*).

Year	DNR Region				Total	Hours	Insp. Per hr
	1	2	3	4			
2001	1,700	4,000	27,200	5,800	39,000	20,000	1.95
2002	660	3,100	32,300	7,700	44,000	20,700	2.13
2003	760	5,600	29,700	5,500	42,000	19,400	2.16
2004	1,200	6,800	35,600	6,800	50,000	20,400	2.45
2005	1,500	8,300	39,500	5,800	55,000	19,900	2.76
2006	1,900	9,900	25,600	3,200	41,000	25,000	1.64
2007	3,100	7,900	25,700	4,900	42,000	24,000	1.75
2008	5,400	10,100	29,400	4,100	49,000	35,000	1.40
2009	7,900	14,100	39,600	4,300	66,000	42,000	1.57
2010	15,600	10,500	33,900	6,200	66,000	50,000	1.32
2011	15,600	12,900	38,600	8,500	76,000	44,500	1.70
2012	24,600	11,500	64,800	1,700	102,600	62.300	1.65

The Watercraft Inspection Program has primarily focused on water bodies with:

- infestations of aquatic invasive species; and
- special emphasis on high-use lakes infested with zebra mussels, spiny waterfleas, and Eurasian watermilfoil.

This is an effective approach to target the high-risk lakes from which invasive species could spread. As more lakes become infested, the number of accesses each inspector is responsible for increases (Figure 4). This trend led to fewer available inspection hours per infested water access in 2005 through 2010 than we had from 2000 to 2004. In order to strategically adapt to this development, the DNR created a tiered system which further refined the method to allocate hours of watercraft inspection during the 2011 season. The tiered system shifted focus onto accesses that had at least 0.9 inspections per hour and away from accesses that had lower use, even if they were on infested water bodies. The tiered system also highlighted accesses that were high use (over 1.2 inspections per hour) and determined to be destinations for watercraft users leaving zebra mussel; and spiny waterflea-infested water bodies (based on previous years inspection data). This focus on high-use waters significantly increased the total number of inspections done in 2011 when compared to 2010 (Table 9), increased the number of inspections per hour, increased the number of hours done at infested waters, and lowered the number of infested accesses per inspector (Figure 4). In 2012, the number of inspections per hour decreased slightly, while the number of infested waters per inspector dropped significantly. This can be attributed to the increase in the number of Level 2 watercraft inspectors who work in partnership with a Level 1 inspector at the access. The presence of a Level two watercraft inspector with a decontamination unit at the access effectively doubles the number of hours of watercraft inspection while only minimally impacting the number of inspections.

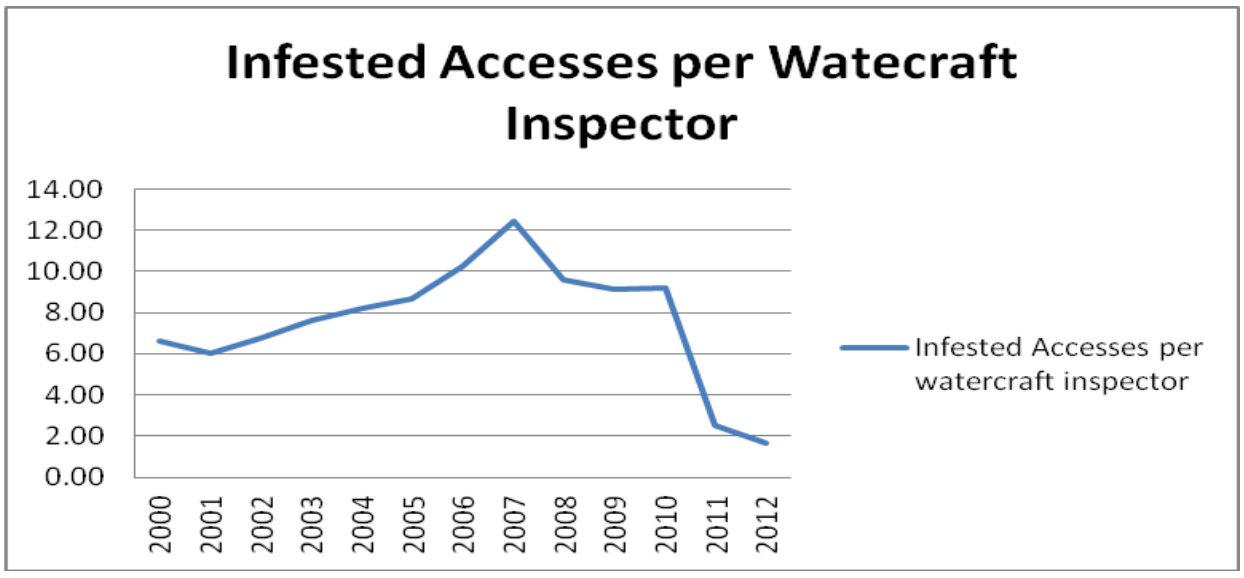


Figure 4. Watercraft accesses on infested waters per watercraft inspector.

In addition to the hours of watercraft inspection that are directed by the goals of the Invasive Species Program, the DNR also offered about 10,000 hours of watercraft inspection through grants to local groups. Typically, citizen groups want additional hours of inspection on lakes where they live or recreate. In order to address this, watercraft inspection grants are offered annually, and provide a one-to-one match for hours paid by citizen groups. Organizations that have been granted inspection hours have been allowed to use them on non-infested waters, however, applications for water bodies that are infested or are near infested waters are given a higher grant rating. This provides local entities the opportunity to intercept watercraft coming to local water bodies that could be carrying aquatic invasive species. (Figure 5).

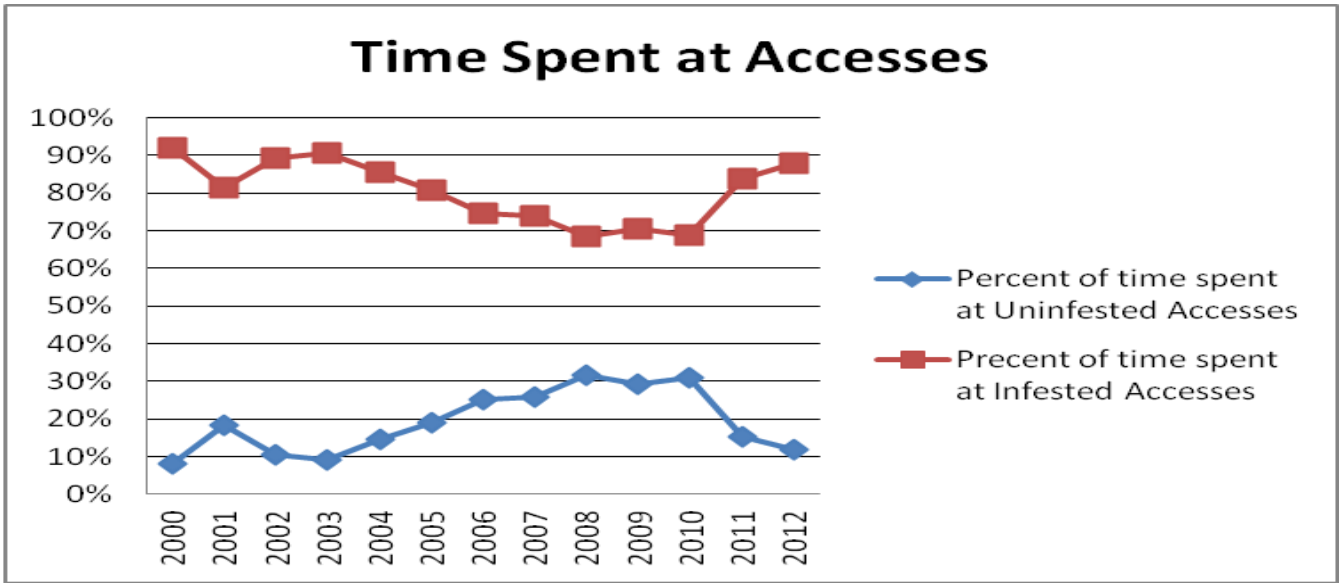


Figure 5. Percent of watercraft inspection hours spent at infested and non-infested water bodies.

The use of a tiered system to allocate watercraft inspection hours helped make the overall inspection effort more efficient by reducing the amount of time spent at very low-use, non-infested water bodies. In 2012, 7,453 hours were spent at non infested, high use accesses with a total of 13,051 inspections completed during that time (or 1.75 inspections per hour) and 55,000 hours were spent at high-use infested accesses completing 89,600 inspections (or 1.63 inspections per hour). The inspections per hour at non-infested waters are higher because we require the non-infested accesses to be higher use than the infested accesses to receive hours of watercraft inspection per our tier system.

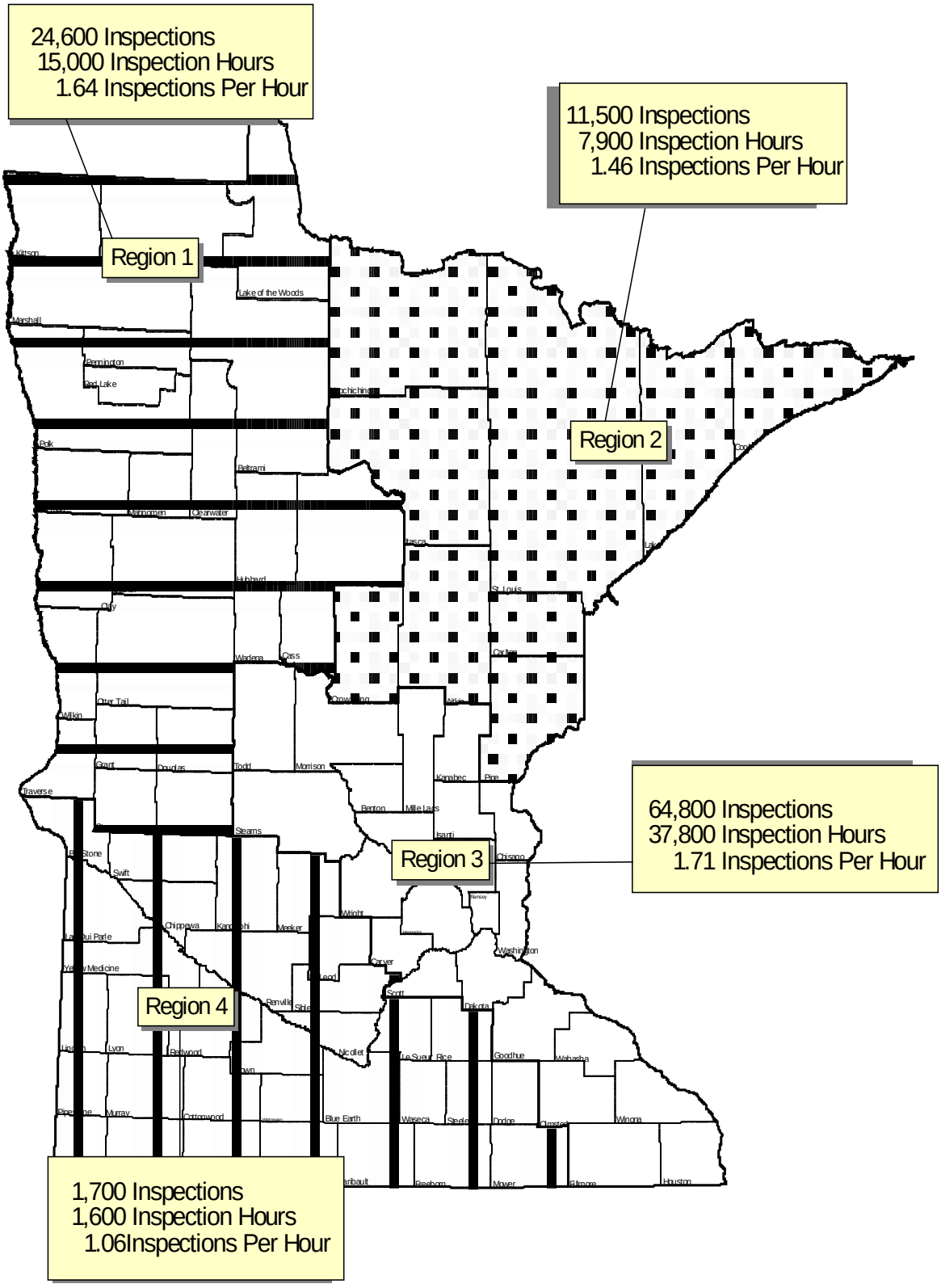


Figure 6. DNR watercraft inspections at public water accesses in 2012.

Increase public awareness

Each boater contacted by a watercraft inspector is asked a standard series of questions. These surveys provide important information on watercraft users' behaviors and travel patterns. With the information collected, the DNR can identify non infested water bodies that have a high number of watercraft coming from zebra mussel or other infested waters. We also track data on the number of watercraft users who arrive at the access with their drain plugs out, as required by law. In 2012, approximately 4% of the watercraft inspected had the drain plug in when they arrived at the water access.

Partnerships with citizen groups in 2012

During the 2012 season, the Invasive Species Program granted 25,985 hours of watercraft inspection time to Minnesota citizen groups. Of the 25,985 hours, 10,004 hours to be performed by DNR staff were granted to 28 different citizen groups around the state. In addition to offering grants for watercraft inspection hours performed by the DNR, grants to local units of government (LGU) were offered to help fund local watercraft inspection efforts. This grant was piloted in 2011 and was initially awarded to six LGUs; in 2012, 15,981 hours were awarded to 14 LGUs. The 2012 season was the first time that the DNR was able to delegate authority to LGUs so that they were able to hire authorized Level 1 watercraft inspectors. The LGUs hired a total of 212 employees that were trained and authorized by the DNR and managed by the LGU that employed them. As a part of the grant, these LGU employees used DNR survey questions and reported their surveys to the Watercraft Inspection Program. A total of 36,202 surveys were completed by LGUs in the grant program. Other LGUs who did not receive grants were able to complete a joint powers agreements and receive the ability to hire Level 1 watercraft inspectors to support local watercraft inspection programs.

The Watercraft Inspection Program also helped citizen groups increase the number of hours of watercraft inspection at watercraft accesses by conducting AIS volunteer training sessions so that citizens could educate watercraft users at waters where they live or recreate. In 2012, the Watercraft Inspection Program conducted 18 AIS volunteer training sessions that resulted in 401 trained AIS volunteers around the state. Watercraft inspectors also worked at the Minnesota State Fair and other local events, speaking to the public about invasive species.

Transportation of Invasive Species

One of the challenges the Watercraft Inspection Program currently faces is the detection of zebra mussels, spiny waterfleas, and other invasive species on or in watercraft. As more water bodies have become infested with zebra mussels and spiny waterfleas, the concern over transport of infested water has become even greater. The initiation of the "pull the plug" law (see Regulations) continues to help the DNR educate boaters about the importance of draining all water before transporting their watercraft.

In 2012, inspectors intercepted numerous watercraft arriving at accesses in violation of state laws. Statewide, 526 watercraft users were found to have vegetation attached to their watercraft when entering water accesses, with the highest number occurring in Region 3 (Figure 7). Ninety-four watercraft came to the access with zebra mussels in or on their watercraft in 2012, compared to 24 in 2011. The highest number occurred in Region 3, with 70 watercraft arriving with zebra mussels; there were also 14 in Region 1 and eight in Region 2. All watercraft attempting to enter a water body with attached

vegetation or zebra mussels were required to have their watercraft decontaminated either by hand removal, draining, or a high-pressure, hot-water treatment.

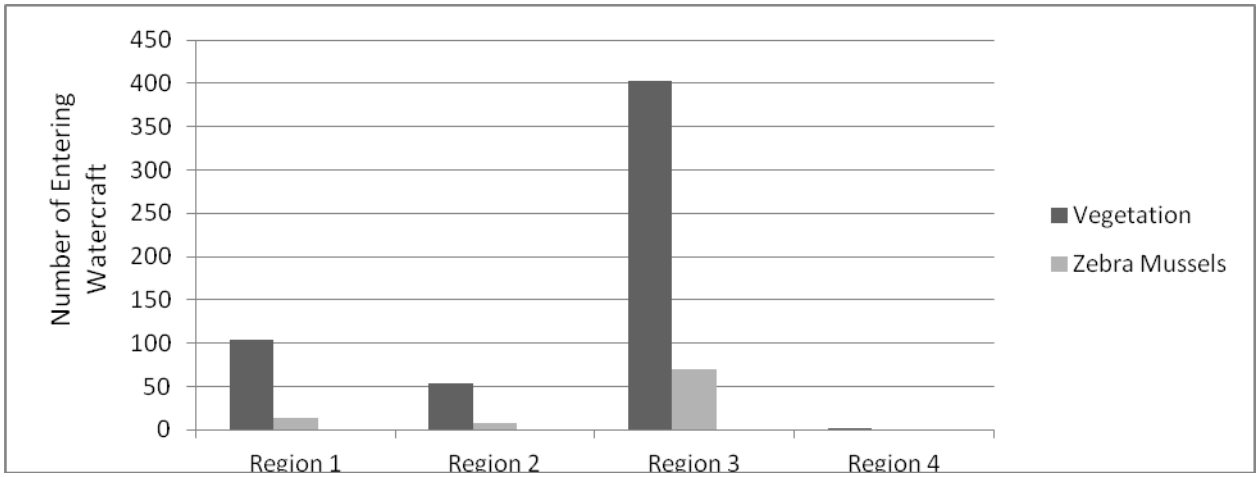


Figure 7. Number of watercraft entering a watercraft access with attached vegetation or zebra mussels per region.

Decontamination Units in 2012

In 2011, the DNR purchased three high-pressure, hot-water, portable decontamination units to be used to decontaminate watercraft at public water accesses as a part of our Watercraft Inspection Program. These three units were run by 17 staff from early September through October 25, prior to September; they had been run by Invasive Species Program staff after the government shutdown. In 2012, the Watercraft Inspection Program purchased an additional 20 units. A total of 23 decontamination units were used in the 2012 field season, staffed by an additional 46 Level 2 watercraft inspectors. In addition to the 46 Level 2 staff who started out the season, the DNR also hired an additional 30 Level 2 watercraft inspectors in late September.

The 23 decontamination units spent the equivalent of 2,456 days at water accesses with 385 of those days in Region 1; 587 in Region 2; 1,476 in Region 3; and 8 in Region 4. Each day consisted of ten hours which included equipment transport from a DNR work station. The decontamination units were focused on watercraft accesses on zebra mussel-infested water bodies that historically had high use.

Figure 8. Invasive Species Program staff decontaminating watercraft at a training session.

Summary of the 2012 watercraft inspection season

Early in 2011, the DNR made significant changes to the way that it allocated hours of watercraft inspection within the state, in response to the growing number of infested waters. These adjustments emphasized containment at zebra mussel-infested waters, with the goal of becoming more effective with available staff time. The tiered system developed for this effort was very successful and helped the Watercraft Inspection Program to increase the number of inspections from 66,000 in 2010 to 76,000 in 2011; this increase occurred even though DNR hours of inspection were reduced by 5,500 in 2011 from 2010.

The biggest challenge the Program faced in 2012 was the inability to meet original goals of hiring 100 Level 1 watercraft inspectors and 46 Level 2 watercraft inspectors. This lack of staff reduced the total number of hours of inspection and decontamination that the DNR was able to do around the state. The DNR responded to this issue by hiring an additional 30 staff through the emergency hiring process at the end of the season. The Watercraft Inspection Program underwent several changes in the 2012 season. The Program was regionalized, which meant the addition of four regional watercraft inspection supervisors, who will be supervised at the regional level. The Program was unable to hire the approximately 100 Level 1 watercraft inspector interns that had originally been outlined as a goal. The DNR did purchase an additional 20 decontamination units and used them at high-use, zebra mussel-infested waters.

Planning for the 2013 Watercraft Inspection Season

The Watercraft Inspection Program's goal for 2013 is to complete 60,000 hour of watercraft inspection with at least the equivalent of 2,400 days of Level 2 watercraft inspection at watercraft accesses around the state. The Watercraft Inspection Program will continue to operate regionally and grow in that new structure. As a part of the regional structure, each regional supervisor will receive some discretionary hours in addition to those designated by the tier system to assign based on regional issues and feedback.

Management of Invasive Aquatic Plants – Overview and Stakeholder Engagement

2012 Highlights

- Issued approximately 200 Invasive Aquatic Plant Management Permits
- Simplified the process of issuing grants to support control of invasive aquatic plants
- Issued nearly 150 grants, approximately three times the number issued in 2011.

Introduction

The DNR has been managing invasive aquatic plants (IAP) since the late 1980s. These efforts began with purple loosestrife and were soon expanded to include Eurasian watermilfoil. In the late 1990s, the DNR and its partners began to explore options for management of curly-leaf pondweed. Interest among citizens in management of IAP with support from DNR has been increasing over the years.

In 2012, the DNR made a number of improvements to management of existing infestations of invasive aquatic plants in Minnesota. These improvements were identified by the DNR and stakeholders during 2011. This effort consisted of two distinct phases. Phase 1 was designed to give citizens opportunities to express their concerns and suggest actions to the DNR related to management. Phase 2 involved two meetings with a select group of 15-20 stakeholders. These people analyzed the information in the report on Phase 1, shared additional insights and experiences they had about managing infestations, and made recommendations for improving management of invasive aquatic plants in Minnesota by the DNR and its partners. Several sets of meeting notes and other documents may be found at: http://www.dnr.state.mn.us/eco/invasives/aquatic_plants.html under the heading "Stakeholder Engagement." A number of improvements to be made were described in the notes from the second meeting of Phase 2. During 2012, the DNR made the following changes.

1. **Streamlined permitting by making organizational and operational changes,**
   a. Ecological and Water Resources staff began to issue Invasive Aquatic Plant Management Permits (M.S. 103G.615, Subd. 3a.) for projects that included:
      1. rapid response to new infestations of invasive aquatic plants,
      2. off-shore treatments of Eurasian watermilfoil, curly-leaf pondweed, and flowering rush,
      3. large bay-wide or lake-wide control of invasive aquatic plants,
      4. control of purple loosestrife.

In 2012, Ecological and Water Resources staff issued nearly 200 Invasive Aquatic Plant Management Permits (IAPMP) to allow control of curly-leaf pondweed or Eurasian watermilfoil, an increase in the permits issued from the previous year (Table 10).

Table 10. Number of permits issued to allow control of curly-leaf pondweed or Eurasian watermilfoil or both in 2011 and 2012 classified by region. In 2011, the permits issued were Aquatic Plant Management Permits and, in 2012, the permits issued were Invasive Aquatic Plant Management Permits. This is preliminary draft information that is subject to revision.

Year	Region 1 NW	Region 2 NE	Region 3 Central	Region 4 S	Sum
2011	13	30	83	24	149
2012	17	27	129	24	197

The majority of IAPMP were issued in Region 3, which includes central Minnesota.

Fish and Wildlife staff retained permitting authority for near-shore Aquatic Plant Management permits to provide access to open water or provide for recreational use of shoreline while protecting habitat.

b. Provided guidance for decisions about permitting by development of a simple decision tree. This was posted on the DNR website in mid-March. *http://files.dnr.state.mn.us/eco/invasives/guidance_for_permits_and_grants_mar_16.pdf*

c. Increased capacity to accurately delineate and treat infestations in a timely way by, in part, the addition of two invasive species specialists to the Program. One of the new positions is located in Sauk Rapids; the other is in Hutchinson.

2. Lake Vegetation Management Plans

a. Improved the efficiency of management of invasive aquatic plants by use of a standardized, short-form Lake Vegetation Management Plan (LVMP), which will be subject to revision to allow responses to changing conditions and new learning;
b. Ecological and Water Resources staff took the lead in development and timely completion of LVMPs for invasive aquatic plants.
c. Worked on development of transition plans for lakes that completed five years as pilot projects.

In the case of LVMPs developed or lakes where more than 15% of the littoral zone is permitted for treatment with herbicides, these plan also serve as the Pesticide Discharge Management Plan (PDMP). The PDMP is required under the Vegetative Pets and Algae Control General Permit (MNG87D000), which was issued on November 16, 2011, by the MPCA. The MPCA issued this permit to meet new requirements of the National Pollutant Discharge Elimination Program.

3. Improvements made to AIS grant programs

a. Simplified application process.
b. Expanded eligibility of projects to receive grants to include most control of Eurasian watermilfoil, curly-leaf pondweed, and flowering rush. As a result, the DNR issued nearly three times as many grants for control of invasive aquatic plants in 2012 as in 2011 (Table 11).

c. Increased funding for grants and other expenses related to management of invasive aquatic plants during 2012 to $1.1 million as compared to $730,000 in 2011.

Table 11. Approximate number of lakes receiving grants and amount of funding granted/reimbursed for management of invasive aquatic plants. This is preliminary draft information that is subject to revision.

	Number of lakes receiving grants from DNR	Budget	Amount of funding encumbered for grants from DNR	Amount of funding paid as reimbursements under grants from DNR
2011	54	$730,000	$ 660,000	$ 530,000
2012	147	$ 1,100,000	$ 990,000	$ 840,000*

* Reimbursements are still being received and processed as of December 13.

4. Research on AIS management

a. Continued to conduct and support research on AIS management. (see Management of Curly-leaf Pondweed, Management of Eurasian Watermilfoil,, and Management of Flowering Rush)
b. Continued to work with partners to assemble, summarize, and analyze data from current lake-wide projects.
c. Communicated results, including posting information on the DNR website.

5. Improving communications and public education around AIS management.

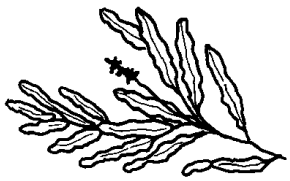
a. Posted guidance on management of invasive aquatic plants on the DNR website.

Future plans for management of invasive aquatic plants

- Continue to improve and streamline permitting for control of invasive aquatic plants.
- Continue to refine guidance for decisions about permitting by use of a decision tree.
- Continue to refine guidance for delineations and maintain or increase capacity for accurately delineating and treating infestations in a timely way.
- Plan to implement electronic permitting as it is developed in the future.
- Continue to refine use of a standardized, short-form LVMP.
- Continue to pursue long-term funding for AIS management.
- Continue to conduct and support research on AIS management.
  - Work with partners to assemble, summarize, and analyze data from current lake-wide projects.
  - Communicate results, including posting information on the DNR website.
- Continue to improve communications and public education around AIS management to include a manual on best management practices.
- Plan to organize a meeting(s) of people doing lake-wide control at which they can exchange ideas and hear from DNR staff, researchers, consultants, commercial applicators, and others.

Management of Curly-leaf Pondweed

2012 Highlights



- Issued 133 Invasive Aquatic Plant Management Permits (IAPMP) to allow control of curly-leaf pondweed or curly-leaf pondweed and Eurasian watermilfoil
- Provided 93 grants to support control of curly-leaf pondweed or curly-leaf pondweed and Eurasian watermilfoil
- 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.
  - Reductions in curly-leaf alone are not likely to result in major increases in clarity of lake water.
  - Three to five years of successive lake-wide treatment generally were not followed by a number of years when lake-wide monitoring or large treatment would not be necessary.

Introduction

Issue

Many users of lakes in central and southern Minnesota are familiar with curly-leaf pondweed, *Potamogeton crispus,* an invasive non-native, submersed plant. The plant is known to anglers and boaters because of the mats that can form at the water's surface in May and June. Shoreland owners know the mats and also the masses of curly-leaf that sometimes wash up on shore after the plant dies back in late June or early July. In some lakes, algal blooms and low-water clarity occurs in July and August. These conditions also concern managers who want to address water quality problems in lakes (James et al. 2002).

Minnesota lake users and managers have been living with curly-leaf pondweed since about 1910, when the plant was first noted in the state (Moyle and Hotchkiss 1945). This plant has a unique growth pattern in that reproduction occurs primarily by production of turions. Turions are hardened stem tips, which are formed by curly-leaf plants shortly before they die in early summer. The turions sink to the bottom of the lake where they lie dormant until early fall when they sprout. This is the start of curly-leaf plants that will over-winter under the ice and grow in spring to produce the following year's growth. It is important to note that curly-leaf pondweed also produces seed, which can germinate to produce new plants in lakes.

Goals

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

- To prevent the spread of curly-leaf pondweed within Minnesota.
- To reduce the negative effects of curly-leaf pondweed on 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 13).

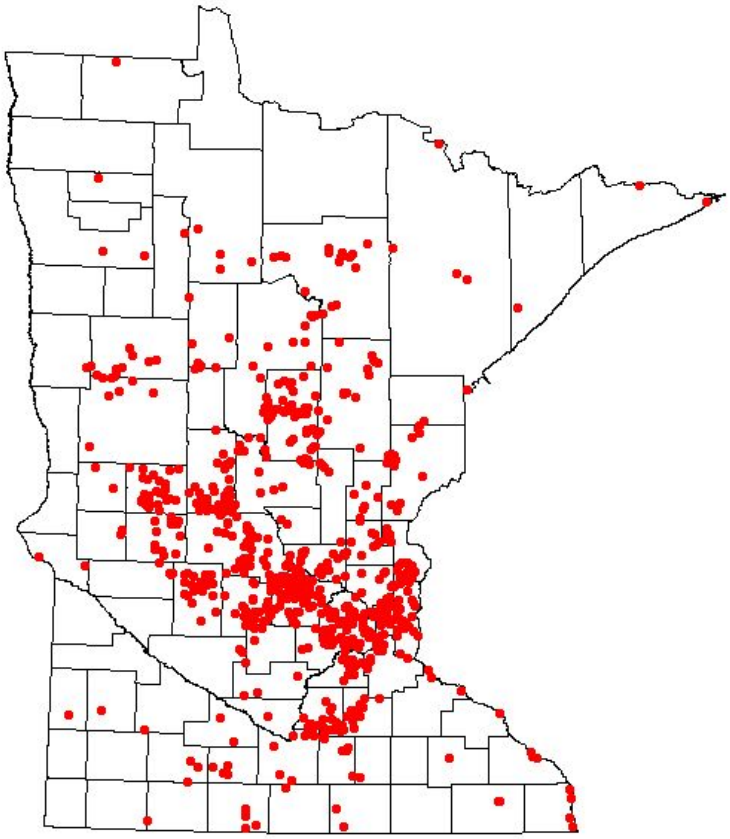


Figure 9. Curly-leaf pondweed locations in Minnesota as of November 2012 (compiled from reports from DNR Fisheries, Wildlife, and Ecological and Water Resources).

Prevention of spread

The Invasive Species Program continued to use watercraft inspections (see Watercraft Inspections), informational materials, and public speaking engagements to further our efforts to prevent the accidental spread of curly-leaf pondweed. 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 - 2012

Lake-wide treatments of curly-leaf pondweed for ecological benefits
Following the establishment of an Invasive Species Program at the DNR, interest in possible management of curly-leaf pondweed increased In the 1990s. In the late 1990s, researchers with the U.S. Army Corps of Engineers (Corps) learned that there is potential to control curly-leaf during early spring by treatment with endothall or diquat herbicides.

Not only did these treatments reduce growth of the plant, they also appeared to have the potential to disrupt reproduction. Production of turions can be prevented by early season treatment with herbicide.

Following the early work by the Corps on control of curly-leaf, the DNR initiated a number of lake-wide, pilot projects in Minnesota with five goals:

1. Reduce curly-leaf pondweed during the year of treatment.
   a. Immediate or principal benefit is reduction in interference with lake use
2. Reduce curly-leaf pondweed beyond the year of treatment–long-term control
   a. It was hypothesized that treatment that prevents production of turions would lead to long-term control
3. Increase native, submersed plants.
4. Increase water clarity.
5. Accomplish goals 1-4 with three to five years of successive lake-wide treatment, followed by a number of years when lake-wide treatment would not be necessary.

Increases in native submersed plants and water clarity would be ecologically beneficial. These efforts were called pilot projects because it was not known whether the goals of the projects could be met. To determine whether ecological benefits could be obtained by repeated lake-wide treatment, the DNR supported a limited number of well-planned and well-monitored projects. Some of these lakes were monitored by the University of Minnesota (University) under a contract with the DNR. In 2012, researchers at the University published results of its efforts (Johnson et al. 2012 and Jones et al. 2012). It is important to note that they reported results for eight (Jones et al. 2012) or nine (Johnson et al. 2012) treated lakes. Of these, six were eutrophic or hypereutrophic, i.e., Secchi depth less than 1.6 m for the lakes studied, and the other two or three were mesotrophic, i.e., Secchi depth greater than 2 m. As a consequence, the conclusions based on this research probably are more helpful in understanding effects of management in eutrophic lakes as compared to mesotrophic lakes. Additional analysis of observations from mesotrophic lakes would be useful. Based on these publications and review of results from additional lakes, it is evident that:

1. Lake-wide treatments with herbicides can reduce curly-leaf pondweed during the year of treatment.
2. Lake-wide treatments with herbicides may or may not reduce curly-leaf pondweed beyond the year of treatment.

   a. Although treatment can reduce or prevent production of turions, significant numbers of turions can remain in the lakes after as many as five years of lake-wide treatment.
3. Overall, most native aquatic plants were not harmed by lake-wide treatments of curly-leaf pondweed with endothall.
4. Overall, there did not appear to be a consistent trend of increasing water clarity following lake-wide treatments to control curly-leaf pondweed.
   a. The plant does not appear to be a significant driver of water quality in these lakes.
5. Three to five years of successive lake-wide treatment generally were not followed by a number of years when lake-wide monitoring or large treatment would not be necessary.

Regarding observation number 5 above, it is important to note that lake-wide projects have required the investment of significant amounts of time and effort. They began in early spring with a delineation of the areas in a lake with curly-leaf pondweed. Delineation was followed by treatment of some or all of the areas delineated in the lake. In many cases, the acres of curly-leaf pondweed delineated in spring usually decreased after three to five years of lake-wide treatment. This pattern is evident in the observations reported for Lower Mission Lake (Table 12). It is interesting to note that the number of acres of curly-leaf pondweed delineated in year six increased by comparison with the acres delineated in the previous year. For years six and seven, there were insufficient resources to cover the costs of continued treatment of all areas with curly-leaf pondweed in Lower Mission Lake. A different pattern was observed in Clear Lake, where the number of acres of curly-leaf pondweed delineated annually did not decrease over a period of six successive years of lake-wide treatment. Yet another pattern was reported for Crookneck Lake, which had water clarity that was the highest of the three lakes. In this lake, the acres of curly-leaf did not exceed 20% and averaged about 10% of the littoral zone.

Table 12. Amount of acres delineated and treated annually to control curly-leaf pondweed in three Minnesota lakes.

	Lower Mission Crow Wing County		**Clear Meeker County**		**Crookneck Morrison County**	
Water Clarity (Secchi depth in meters)	2 (Eutrophic)		0.6 (Hypereutrophic)		2.9 (Mesotrophic)	
Littoral acres/ Total acres	452/698		441/530		131/179	
Year of Treatment	Delineated	Treated	Delineated	Treated	Delineated	Treated
1	240	240	[unknown]	138	[unknown]	18
2	244	244	[unknown]	145	33	33
3	210	210	[unknown]	145	13	12
4	147	147	127	127	6	0
5	48	48	134	134	12	3
6	132	59	131	131	[unknown]	8
7	127	30			9	9

Invasive Aquatic Plant Management Permits and Grants for Curly-leaf Pondweed in 2012

The number of IAPMP issued to allow control of curly-leaf pondweed in 2012 was greatest in Region 3, the Central Region (Table 13). This region also received the most grants to allow control of curly-leaf. Approximately two-thirds of the IAPMP allowed treatment of less than 15% of the littoral zone, which is the cumulative limit on the amount of area in a lake to which herbicides may be applied without a variance.

Table 13. Number of Invasive Aquatic Plant Management Permits issued to allow control of curly-leaf pondweed in 2012 classified by region (Reg.), district (Dist.), and size of area allowed for treatment in relation to the 15% limit. This is preliminary draft information that is subject to revision.

		Numbers of Invasive Aquatic Plant Management Permits			Numbers of Grants from the DNR		
Reg.	Dist.	< 15% Littoral	> 15% Littoral	Sum	clp	clp & ewm	Sum
1	N	2	1	3	4	0	4
	S	5	3	8	3	0	3
2	-	14	5	19	18	0	18
3	N	34	8	42	24	4	28
	S	23	22	45	12	13	25
4	N	3	2	5	4	0	4
	S	10	1	11	9	2	11
Sum		**91**	**42**	**133**	**74**	**19**	**93**

Participation by Others in Management of Curly-leaf Pondweed - 2012

The Invasive Species Program received valuable assistance from staff in DNR Fisheries and the Aquatic Plant Management Program in Fisheries and the Division of Ecological and Water Resources.

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 U.S. Army Engineer Research and Development Center was critical to the success achieved in management of curly-leaf pondweed in Minnesota.

A number of local units of government continued to expand our understanding of the potential to manage curly-leaf pondweed by carrying out a variety of projects. Here we briefly describe several of these projects as representative examples.

Three Rivers Park District continued to monitor the results of lake-wide treatment of curly-leaf pondweed in combination with treatment with alum. The latter is intended to reduce the concentration of phosphorus in the water column, which in turn is hypothesized to reduce the growth of planktonic algae and so increase water clarity. Projects of this type are underway on Lake Rebecca and Hyland Lake.

The Minnehaha Creek Watershed District reported interesting results from Gleason Lake (Christianson et al. 2012). Over a period of five years of lake-wide treatment with endothall to control curly-leaf pondweed, water clarity appeared to increase. Over the same period, concentrations of both phosphorus and chlorophyll a decreased. This lake only supports four or five species of submersed plants. One plant, coontail, is dominant, occurring at 67% frequency in September of the fifth year of lake-wide treatment. The next most abundant submersed plant was Canada waterweed, which occurred at 5% frequency.

The Riley Purgatory Bluff Creek Watershed District supported a project by the University on Lake Susan, which involved removal of carp (Knopik and Newman 2012). This was followed by an increase in water clarity and submersed plants, particularly curly-leaf pondweed.

Research on Curly-leaf Pondweed in 2012 and Potential Approaches to Management in Minnesota

In 2012, researchers at the University published results of its monitoring of repeated lake-wide treatments to control curly-leaf pondweed (Johnson et al. 2012 and Jones et al. 2012). A summary of the results was presented above.

Also in 2012, Valley and Heiskary (2012) reported observations of short-term declines in curly-leaf pondweed that appeared to be related to high levels of snow accumulation on the ice of frozen lakes. These authors provided additional information on relationships between curly-leaf pondweed and water quality in a DNR Investigational Report (Heiskary and Valley 2012).

Skogerboe et al (2012) reported additional results from monitoring of two Minnesota lakes that were subjected to lake-wide treatment of both curly-leaf pondweed and Eurasian watermilfoil.

Future plans for management of curly-leaf pondweed

- Summarize and analyze data from lake-wide projects on high-clarity lakes, where results appear to be different from medium- to low-clarity lakes.
- Work with partners to assemble, summarize, and analyze data from recent lake-wide projects.
- Continue to 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 TV and radio advertising, watercraft inspections, literature, and public speaking engagements.
- Continue to support the management of curly-leaf pondweed in the state through technical assistance and grants.

References Cited

Christianson, Y.E., S. McComas, U. Singh, and K. Dooley. 2012. Managing curly-leaf pondweed with herbicides: Experiences with whole lake and partial lake treatments. Presentation by the Minnehaha Creek Watershed District, 18202 Minnetonka Blvd., Deephaven, MN 55391 given at the Minnesota Water Resources Conference will be held on October 16-17 at the Saint Paul River Centre.

Heiskary, S., and R.D. Valley. 2012. Curly-leaf pondweed trends and interrelationships with water quality. Minnesota Department of Natural Resources Investigational Report No. 558, Saint Paul.

James, W.F., J.W. Barko, H.L. Eakin, and P.W. Sorge. 2002. Phosphorus budget and management strategies for an urban Wisconsin lake. Lake and Reservoir Management 18:149-163.

Johnson, J.A., A.R. Jones, and R.M. Newman 2012. Evaluation of lakewide, early season herbicide treatments for controlling invasive curly-leaf pondweed (*Potamogeton crispus*) in Minnesota lakes. Lake and Reservoir Management 28:346-363.

Jones, A. R. J.A. Johnson, and R.M. Newman 2012. Effects of repeated early season, herbicide treatments of curly-leaf pondweed on native macrophyte assemblages in Minnesota lakes. Lake and Reservoir Management 28:364-374.

Knopik, J.M., and R.M. Newman. 2012. Aquatic plant community of lakes Ann, Lucy, Riley and Staring, Riley Purgatory Creek Watershed , Chanhassen, MN: 2011 Summary of Results. Annual report to the Riley Purgatory Bluff Creek Watershed District. Unpublished report submitted by the Fisheries, Wildlife and Conservation Biology Program, University of Minnesota, St. Paul, MN 55108.

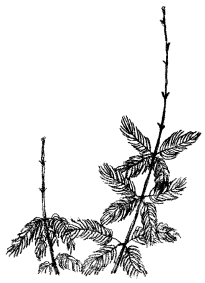
Moyle, J.B. and N. Hotchkiss. 1945. The aquatic and marsh vegetation of Minnesota and its value to waterfowl. Minnesota Department of Conservation. Technical Bulletin 3. 122 pp.

Skogerboe, J. G., K. D. Getsinger, and A. G. Poovey. 2012. Early season applications of endothall and 2,4-D for selective control of Eurasian watermilfoil and curly-leaf pondweed in Minnesota lakes: Year two evaluations of submersed plant communities. APCRP Technical Notes Collection. ERDC/TN APCRP-CC-13. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Valley, R.D., and S. Heiskary. 2012. Short-term declines in curly-leaf pondweed in Minnesota: potential influences of snowfall. Lake and Reservoir Management 28:338-345.

Management of Eurasian Watermilfoil

2012 Highlights



- Eurasian watermilfoil was discovered in 16 additional Minnesota water bodies during 2012. There are now 273 Minnesota lakes, ponds, rivers, and streams where the submersed aquatic invasive plant is known to be present.
- The DNR issued 64 Invasive Aquatic Plant Management Permits to allow control of Eurasian watermilfoil and 19 permits to allow control of Eurasian watermilfoil and curly-leaf pondweed
- The DNR provided 43 grants to support control of Eurasian watermilfoil and 19 grants to allow control of Eurasian watermilfoil and curly-leaf pondweed

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 2012.

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 2012

Milfoil was newly discovered in 16 lakes during 2012 (Figure 10). Milfoil is now known to occur in 273 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.

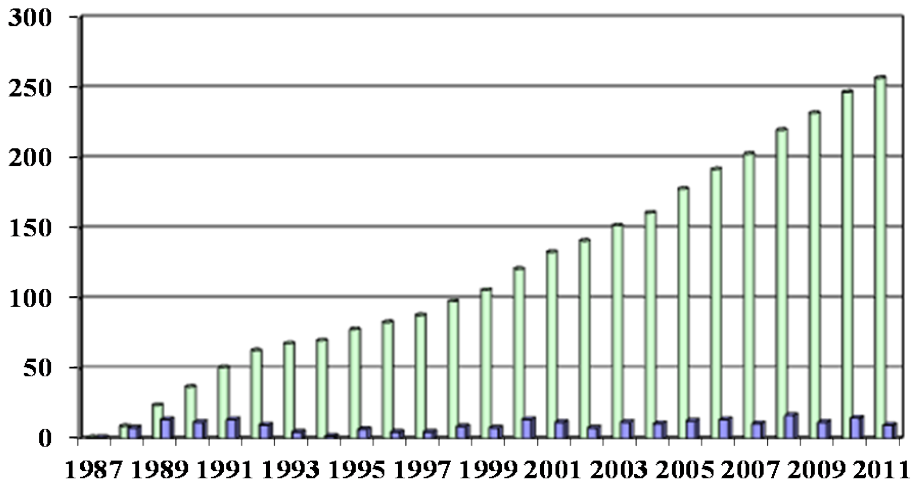


Figure 10. Discovery of water bodies in Minnesota with Eurasian watermilfoil; annual and cumulative numbers.

In 2012, two lakes with milfoil were discovered in northern Minnesota; one in Itasca County and a second in Saint Louis County (Figure 11). One lake with milfoil was discovered in Morrison County and another was found in Douglas County. In southern Minnesota, one lake with milfoil was discovered in Blue Earth County and another was found in Winona County. Otherwise, most newly discovered bodies of water with milfoil were located in or near the Twin Cities.

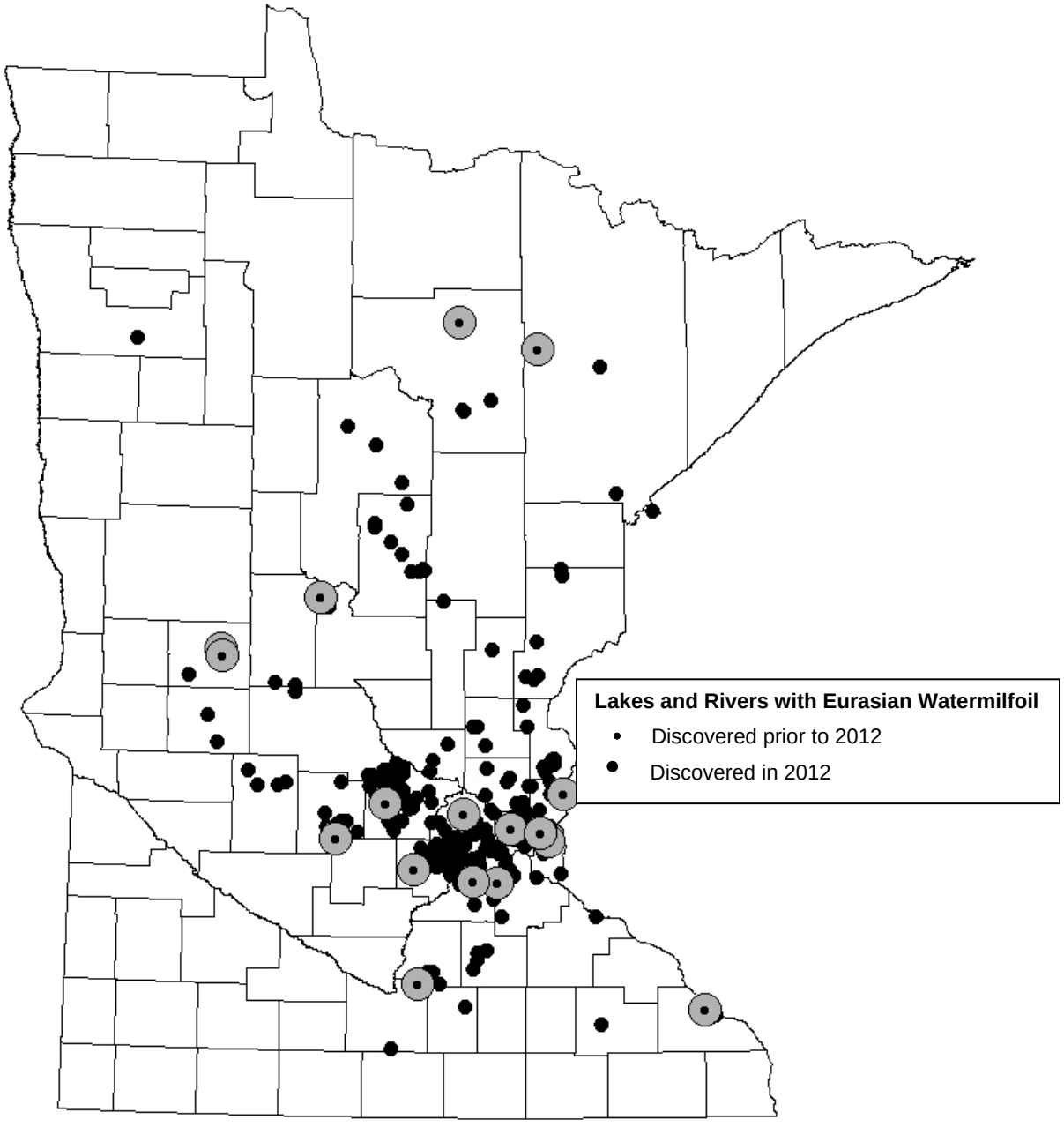


Figure 11. Distribution of water bodies with Eurasian watermilfoil in Minnesota as of November 2012.

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 2012, 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 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 - 2012

The majority of Invasive Aquatic Plant Management Permits issued to allow control of milfoil as well as grants issued to support such control went to lakes in Region 3, which is central Minnesota (Table 14). (see Watercraft Inspections for a map of DNR Regions).

Table 14. Numbers of Invasive Aquatic Plant Management Permits issued to allow control of Eurasian watermilfoil in 2012 and grants issued to support control of Eurasian watermilfoil or Eurasian watermilfoil and curly-leaf pondweed, classified by region (Reg.), district (Dist.) This is preliminary draft information that is subject to revision.

Reg.	Dist.	IAMP for milfoil	IAMP for milfoil and curly-leaf	Grants for ewm	Grants for ewm & clp
1	N	3	0	1	0
	S	1	0	1	0
2	-	8	0	6	0
3	N	22	4	10	4
	S	20	13	17	13
4	N	7	0	5	0
	S	3	2	3	2
Sum		**64**	**19**	**43**	**19**

Effectiveness of management of Eurasian watermilfoil in Minnesota lakes

Though the number of Minnesota lakes known to have milfoil increased in 2012, 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. The number of lakes where cooperators received funding from the DNR for control of milfoil during 2012 was essentially unchanged by comparison with the previous three years.

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 has many conversations with people over the telephone. In addition, staff of the Invasive Species Program exchanges 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 also has received valuable assistance from staff in DNR Fisheries and the Aquatic Plant Management Program in Fisheries, and the Division of Ecological and Water 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 2012, the U.S. Army Engineer Research and Development Center (ERDC) continued to monitor the distribution and abundance of both invasive and native plants on Lake Minnetonka where bay-wide treatments of milfoil have been done (Netherland et al. 2012).

During 2012, results from a number of studies of hybridization between Eurasian watermilfoil and northern watermilfoil became available. Zuellig and Thum (2012) reported that recurrent hybridization is the likely cause of genetic diversity among "hybrid watermilfoils." LaRue, et al. (2012) showed that hybrids grew more rapidly and were less susceptible to 2,4-D than was Eurasian watermilfoil. Berger et al. (In Press) as well as Thum et al. (In Press) are expected to report that hybrids were less susceptible to fluridone than was Eurasian watermilfoil.

Nault et al (2012) provide important descriptions of different patterns of exposures of submersed plants to 2,4-D following a variety of applications of the herbicide to control milfoil in Wisconsin lakes.

Skogerboe et al. (2012) reported additional results from a study of Minnesota lakes that were treated with herbicide to control both Eurasian watermilfoil and curly-leaf pondweed.

Parsons et al. (2011) described a decline in Eurasian watermilfoil in a Washington lake subjected to augmentative stocking with milfoil weevils. The weevils took five years to establish. Control of milfoil was attributed to a midge; also, a caddisfly may have contributed to the decline in milfoil. This research also was reported in *Lake Line* magazine (Parsons 2012).

In Minnesota, EnviroScience was contracted by the Minnehaha Creek Watershed District to initiate augmentative stocking with milfoil weevils in Christmas Lake, Hennepin County. EnviroScience also was contracted by the Chub Lake Association to undertake similar efforts on Chub Lake, Carlton County.

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.

References Cited

Berger, S., M.D. Netherland, and G.E. MacDonald. In Press. Evaluating fluridone sensitivity of multiple hybrid and Eurasian watermilfoil accessions under mesocosm conditions. Journal of Aquatic Plant Management. (Expected to appear in Volume 50).

LaRue, E.A., M.P. Zuellig, M.D. Netherland, M.A. Heilman, and R.A. Thum. 2012. Hybrid watermilfoil lineages are more invasive and less sensitive to a commonly used herbicide than their exotic parent (Eurasian watermilfoil). Evolutionary Applications. Published on line.

Nault, M., A. Mikulyuk, J. Hauxwell, J. Skogerboe, T. Asplund, M. Barton, K. Wagner, T. Hoyman, and E. Heath. 2012. Herbicide treatments in Wisconsin lakes. *LakeLine* spring 32:19-24.

Netherland, Michael D., John G., Skogerboe, and Angela G. Poovey. 2012. Summary of draft data from Aquatic Plant Surveys on Gray's Bay, Phelps Bay, and Carmen's Bay, Lake Minnetonka, Minnesota for 2007 through 2012. Unpublished report by the US Army Engineer Research and Development Center (ERDC) and the Center for Aquatic and Invasive Plants, 7922 NW 71st Street, Gainesville, FL 32653; and ERDC, Halls Ferry Rd., Vicksburg, MS 39180 [received on 11 December]

Parsons, J.K., G.E. Marx, and M. Divens. 2011. A study of Eurasian watermilfoil, macroinvertebrates and fish in a Washington lake. Journal of Aquatic Plant Management 49:71-82.

Parsons, J.K. 2012. What's bugging watermilfoil. *LakeLine* magazine, Spring issue 32:14-18.

Skogerboe, J. G., K. D. Getsinger, and A. G. Poovey. 2012. Early season applications of endothall and 2,4-D for selective control of Eurasian watermilfoil and curly-leaf pondweed in Minnesota lakes: Year two evaluations of submersed plant communities. APCRP Technical Notes Collection. ERDC/TN APCRP-CC-13. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Thum, R.A., M.A. Heilman, P.J. Hausler, L.E. Huberty, D.J. Wcisel, M.P. Zuelling, S.T. Berger, and M.D. Netherland. In Press. Field and laboratory documentation of reduced fluridone sensitivity of a hybrid watermilfoil biotype (*M. spicatum* x *M. sibiricum*). Journal of Aquatic Plant Management. (Expected to appear in Volume 50).

Zuellig, M.P., and R.A. Thum. 2012. Multiple introductions of invasive Eurasian watermilfoil and recurrent hybridization with northern watermilfoil in North America. Journal of Aquatic Plant Management 50:1-18.

Management of Flowering Rush

2012 Highlights

- A report on the research on the ecology and management of flowering rush in the Detroit Lakes area was received. This work was primarily funded by the Pelican River Watershed District (PRWD) with funds from the city of Detroit Lakes and the DNR.
- Information from this report was used by the PRWD to expand its flowering rush management in its district.
- The Invasive Species Program continued to provide technical assistance and field support to partners who managed flowering rush including the Detroit Lakes chain and Lake Minnetonka.

Introduction

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. Flowering rush also may grow as a non-flowering submersed plant with limp, ribbon-like leaves.

The plant spreads primarily vegetatively from thick rhizomes (Figure 12), 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.

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

Flowering rush was likely brought to North America in the late 1800s in ship ballast and also has 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.

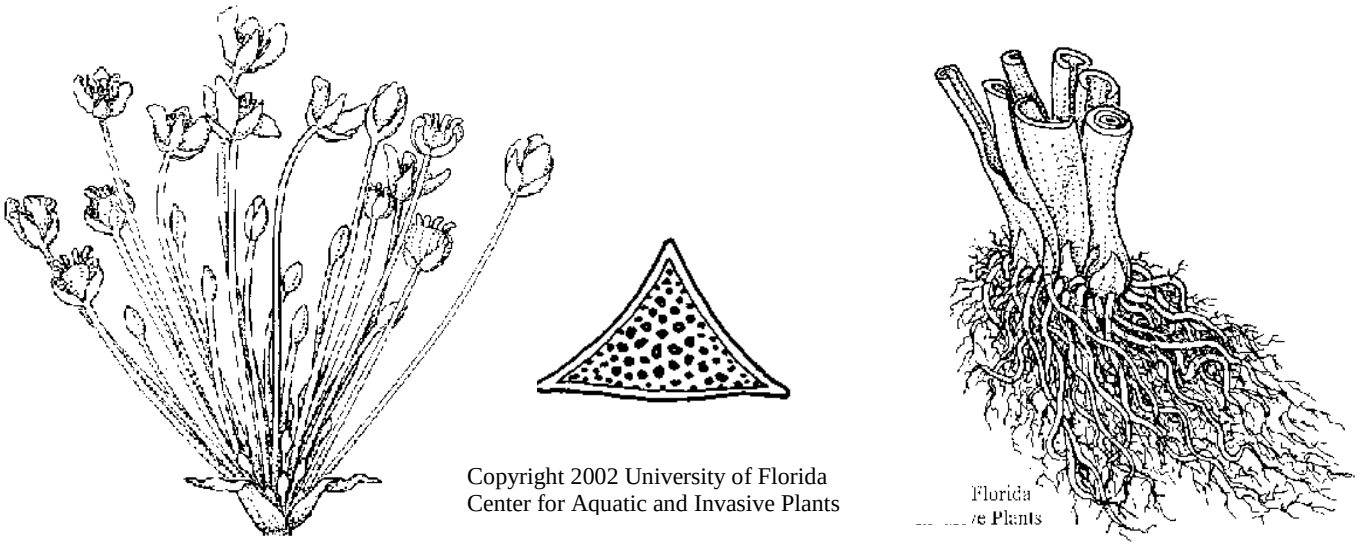


Figure 12. Flowering rush umbel, cross-section of a leaf, and rhizones.

Distribution

Flowering rush was first recorded in Anoka County in 1968 (Moyle 1968) and has since been located in 27 bodies of water in 10 counties. Despite its 30-plus year presence in the state, the distribution of flowering rush is widely scattered and uncommon (Figure 13).

In the Detroit Lakes area, there are large areas occupied by flowering rush, which continue to generate a high level of concern among residents. The level of concern about this plant is higher on Detroit Lake and other lakes in the Pelican River chain than elsewhere in Minnesota, even though flowering rush has been found in 27 bodies of water in total in the state.

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.

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 and 2009 Invasive Species Annual Reports (Invasive Species Program 2008, Invasive Species Program 2009).

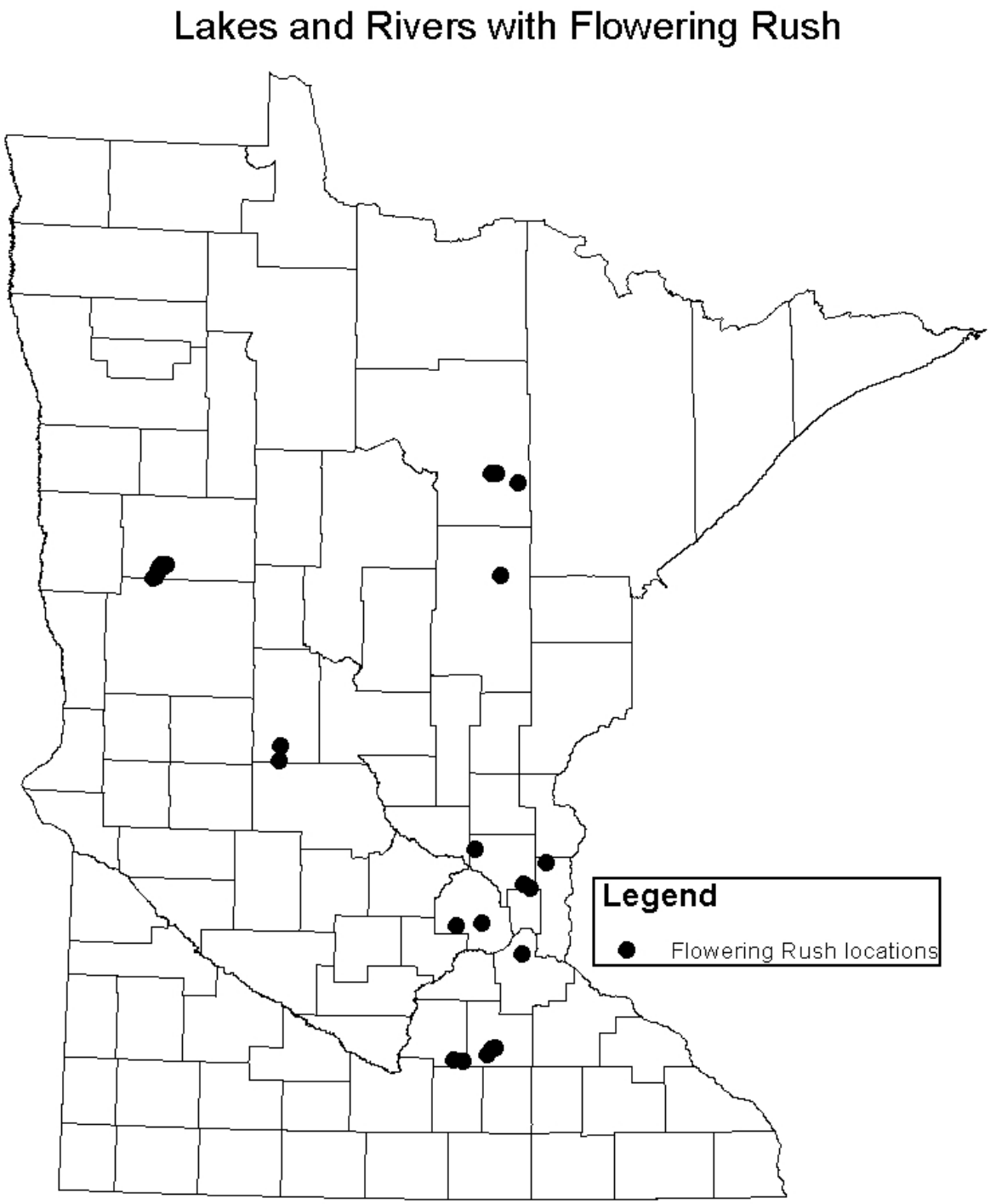


Figure 13. Flowering rush locations as of December 2012.

Management of Flowering Rush

More information about management options and approaches for flowering rush in the state can be found in the 2009 and 2010 Invasive Species Annual Reports (Invasive Species Program 2009, Invasive Species Program 2010).

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.

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.

Management of Flowering Rush - 2012

In 2012, researchers from the University of Mississippi, Concordia College in Moorhead, Minnesota, and the U.S. Army Engineer Research and Development Center continued a research project that evaluated the ecology and management of flowering rush in several lakes near Detroit Lakes (Madsen et al. 2012) .

The results outlined in the report guided the 2012 management efforts of flowering rush within Detroit, Curfman, Sallie, and Mellissa lakes. On the recommendations from the research, two diquat treatments were conducted across 161 acres over the four lakes. Treatments were targeted in water 4-feet deep and less and occurred in early June and mid-July. Several control areas where no diquat treatment occurred also were identified for comparison. If needed, 44 acres of flowering rush were permitted for treatment with imazapyr. The imazapry treatment was designed to treat flowering rush in the near shore areas (water less than 2-feet deep) where leaves are at least 1 foot above the water surface. The results of the diquat treatment were evaluated by collecting point intercept data of all vegetation within the treatment and control areas. Biomass estimates also were collected in the treatment and control areas to determine the effect of the diquat treatment on the flowering rush shoot and rhizome.

Although data is still being analyzed, field evaluations of the diquat treatments look promising. In many of the areas, it was decided that near shore imazapyr treatments would not be conducted due to the success of the diquat treatments. Results and potential management approaches from these diquat treatments will assist the PRWD, the city of Detroit Lakes, the DNR, and others interested in flowering rush management in the future.

Other work in the Detroit Lakes area for flowering rush management included the Invasive Species Program providing funds to support the control of flowering rush along the Detroit Lakes city beach. The DNR also continued to work with riparian property

owners for a lake-wide effort to allow flowering rush control through hand removal along the full frontage of an individual's property.

Downstream of the Detroit Lake chain is Buck Lake, another flowering rush-infested water at the downstream end of the PRWD, but in the Pelican Group of Lakes Improvement District (PGOLID). In Buck Lake, small clusters of flowering rush have been found in previous years, but none were found in 2012. PGOLID did find flowering rush upstream of Buck Lake and a permit was issued to remove the plants. PGOLID plans to continue to monitor for new infestations as flowering rush continues to not be discovered downstream of Buck Lake.

Future needs for management of flowering rush

- 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.
- Continue to monitor established populations of flowering rush to document abundance and spread.
- Continue to encourage research on the distribution, reproductive biology, and potential impacts of flowering rush in Minnesota.
- Continue to partner with the investigation of new methods of controlling flowering rush and to evaluate the results of ongoing flowering rush management within the state.

References Cited

Anderson, L.C., C.D. Zeis and S.F. Alam. 1974. Phytogeography and possible origins of *Butomus* in North America. Bulletin of the Torrey Botanical Club 101:292-296.

Gaiser, L.O. 1949. Further distribution of *Butomus umbellatus* in the Great Lakes Region. Rhodora 51:385-390.

Lui, K., F.L. Thompson & C.G. Eckert. 2005. Causes and consequences of extreme variation in reproductive strategy among invasive populations of a clonal aquatic plant, *Butomus umbellatus* (Butomaceae). Biological Invasions 7: 427-444.

Madsen, J.D., R.M. Wersal, M.D. Marko, and J.G. Skogerboe. 2012. Ecology and Management of Flowering Rush (*Butomus umbellatus*) in the Detroit Lakes, Minnesota. Geosystems Research Institute Report 5054. July, 27, 2012. http://www.gri.msstate.edu/publications/docs/2012/07/10292GRI_Report_5054_2012.pdf

Moyle, J. 1968. Flowering rush in Minnesota. The Latest Word 57 (5). Minnesota Department of Conservation, Division of Fish and Wildlife. 500 Lafayette Road, St. Paul, Minnesota.

Poovey, A.G., C.R. Mudge, R.A. Thum, C. James, and K.D. Getsinger. 2012. Evaluations of contact aquatic herbicides for controlling two populations of submersed flowering rush. Journal of Aquatic Plant Management 50:48-54.

PGOLID (Pelican Group of Lakes Improvement District) 2008. Pelican Group of Lakes Improvement District 2009 Eurasian Flowering Rush Contingency Control Plan.

Prepared by RMB Environmental Laboratories, Inc., 22796 County Hwy. 6, Detroit Lakes, MN 56501

Staniforth, R.J. and K.A. Frego. 1980. Flowering rush (*Butomus umbellatus*) in the Canadian Prairies. Canadian Field-Naturalist 94:333-336.

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 14). In 2012, four new purple loosestrife infestations were identified in Minnesota. There are now 2,412 purple loosestrife infestations recorded statewide (Table 15). 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 - 2012

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

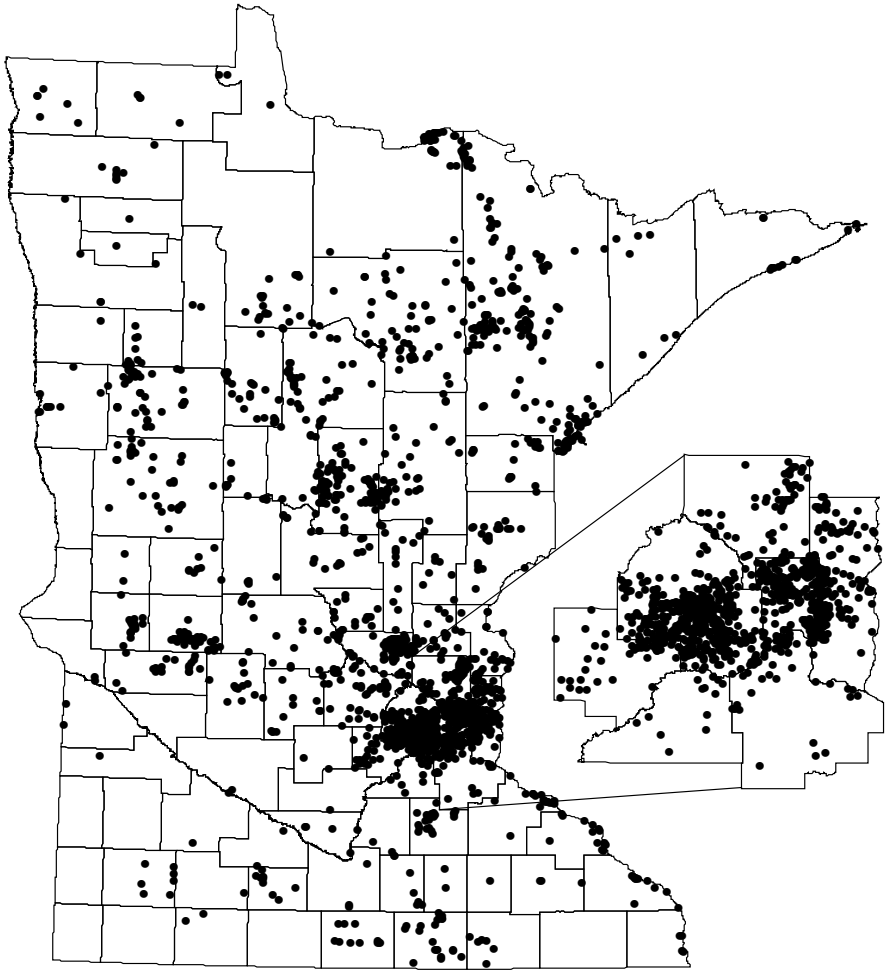


Figure 14. Purple loosestrife infestations in Minnesota as of December 2012.

Table 15. Purple loosestrife infestations in Minnesota recorded by the DNR in 2011 and 2012.

Site Type	Total sites 2011	New sites 2012	Total sites 2012
Lake	737	4	741
River	227	0	227
Wetland	769	0	769
Roadsides and ditches	510	0	510
Other[1]	165	0	165
Total	**2,408**	**4**	**2,412**

[1]Includes 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 2012, the number of sites, number of plants, and total cost of treating purple loosestrife with herbicide, have generally decreased (Table 16). 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 2012, only DNR staff was used to treat purple loosestrife stands statewide. DNR staff visited 29 purple loosestrife stands for herbicide control work (Table 16). A total of 29 sites were treated with herbicides. Most of the sites were very small: 93% (27 sites) had fewer than 100 plants. Seven purple loosestrife plants were hand-pulled from four locations. This work took a total of 22.7 worker hours, and only 0.75 gallons of *Rodeo* concentrate. The total cost for this effort was $600.00.

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 (three in 2012) 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 16. Historical herbicide applications performed by DNR and applicators contracted by DNR in Minnesota (1989-2012).

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
2010	74	61	13	0	403	.38	$11,400
2011	29	25	4	0	14.5	.09	$410.00
2012	29	27	2	0	22.7	.75	$600.00

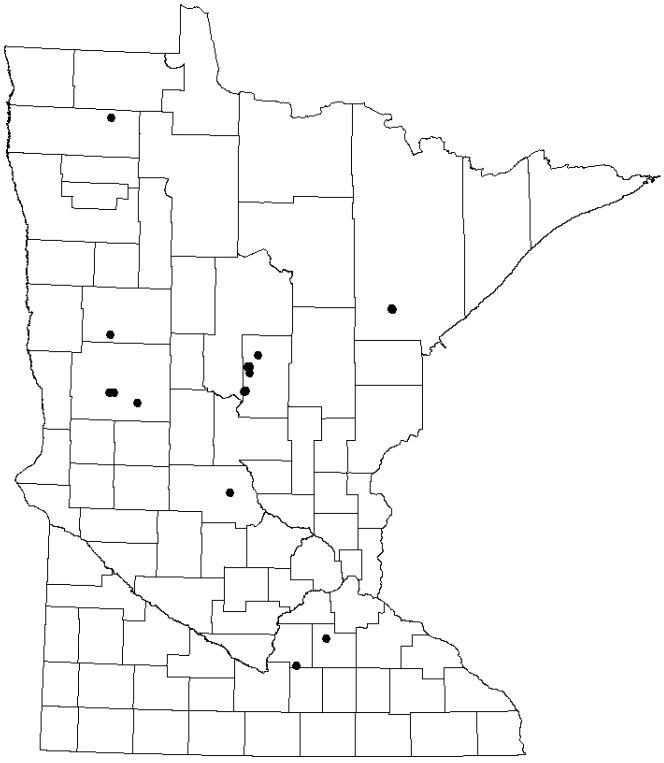


Figure 15. Locations where DNR staff used herbicides to control purple loosestrife in 2012.

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 calmariensis* 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, and 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 2012, this cooperative effort has had a significant effect on total number of insects released (Figure 16).

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 2012, an estimated 5,000 leaf-eating beetles were collected and released on five sites. To date, the leaf-eating beetles have been released on 883 sites statewide (see Figure 17, Table 17).

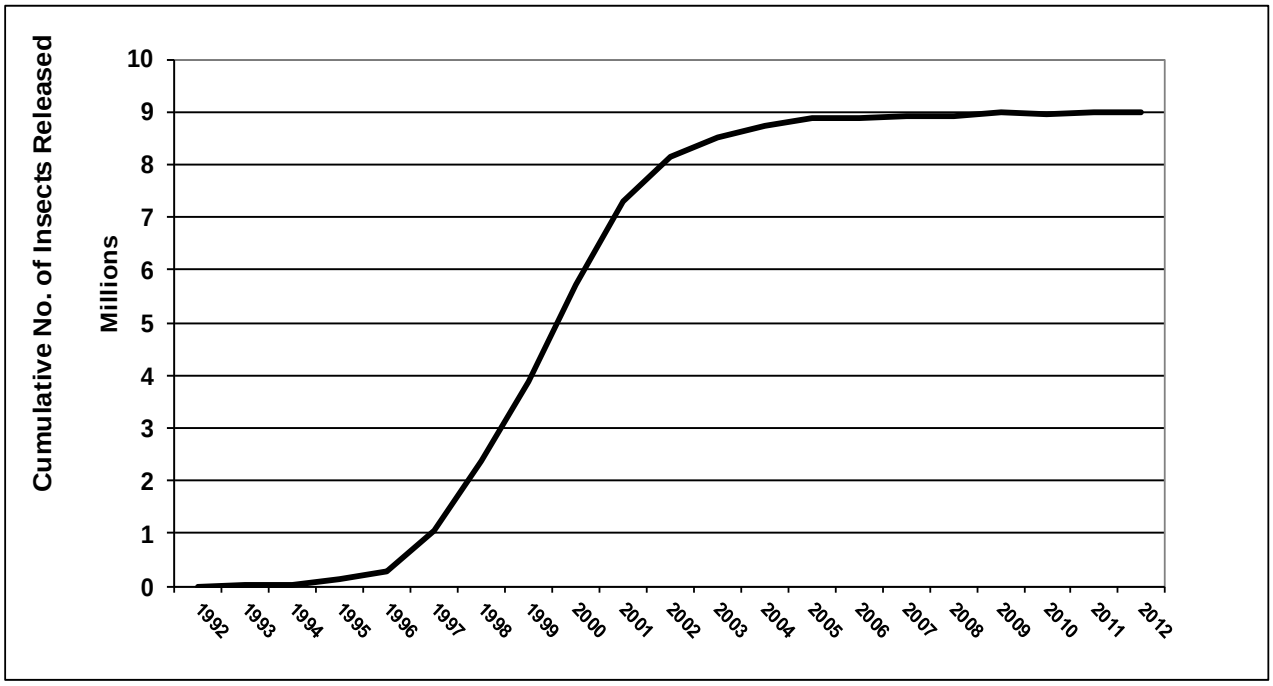


Figure 16. Cumulative number of insects released to control purple loosestrife by year.

Table 17. Summary of number of insects released in each region to control purple loosestrife (1992-2012).

Minnesota DNR Regions	Number of Release Sites	Number of Insects Released
1 – Northwest	144	1,370,616
2 – Northeast	235	1,648,400
3 – Central	439	5,260,677
4 – South	65	705,304
Totals	**883**	**8,984,997**

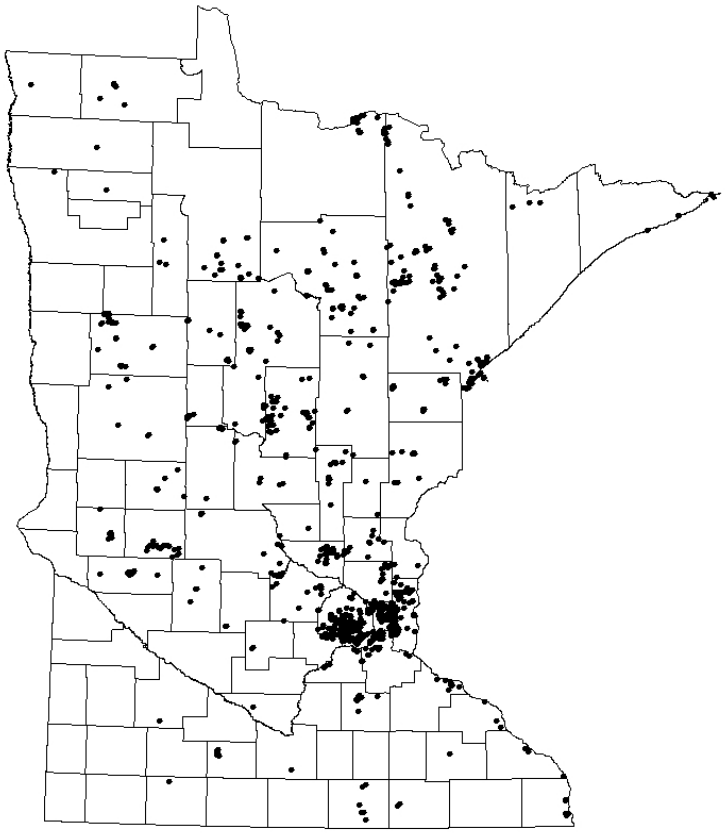
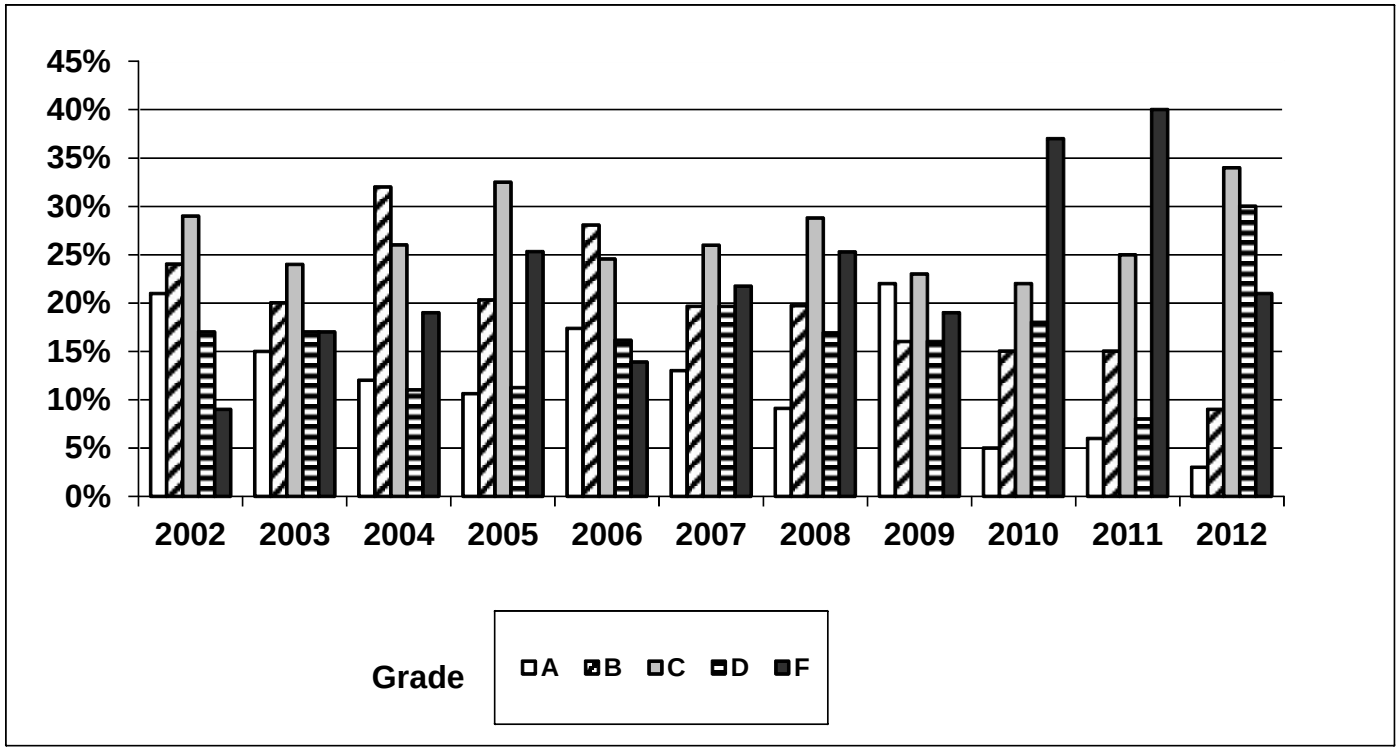


Figure 17. Locations of insects released to control purple loosestrife in Minnesota through 2012.

Biological control insects released between 1992 and 2012 have established reproducing populations at more than 60% of the sites visited. Insect populations increased significantly at many locations with pronounced damage to loosestrife plants.

In the summer of 2012, 61 insect release sites were assessed for insect establishment and level of control achieved. At 11% (7 sites) of the sites surveyed, insect populations were increasing and causing damage to the loosestrife infestations. At 1% (2 sites) of all visited sites, the loosestrife was severely defoliated (90-100%) (Figure 18).

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 2012 demonstrated that *Galerucella* introductions have caused moderate to severe defoliation of loosestrife populations on 41% (25 sites) of 61 sites assessed in 2012 (Figure 18).



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 18. 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 a 12-year period (1995-2007), a field study was conducted within ten purple loosestrife infestations to quantitatively assess the effects of *G. calmariensis 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.

References Cited

Blossey, B., L. Skinner and J. Taylor. 2001. Impact and management of purple loosestrife (*Lythrum salicaria*) in North America. Biodiversity and Conservation 10:787-1807.

Welling, C. H. and R. L. Becker. 1990. Seed bank dynamics of *Lythrum salicaria* L.: implications for control of this species in North America. Aquatic Bot. 38:303-309.

Other Invasive Aquatic Plant Species in Minnesota

Introduction

A number of invasive species of aquatic plants grows in the state. The previous chapters described species for which there were continuing efforts. Here we describe efforts to manage or monitor certain invasive aquatic plants that have not been the object of continuing management by the DNR and our partners.

Water hyacinth, water lettuce, and parrot's feather

Observations in Pool 5, Mississippi River, of water hyacinth, *Eicchornia crassipes*; water lettuce, *Pistia stratiodes*; and parrot's feather, *Myriophyllum aquaticum,* were reported to the DNR in August from the Wisconsin Department of Natural Resources (WIDNR). WIDNR received an e-mail about the observations from the U.S. Fish and Wildlife Service (USFWS) earlier on the same day.

It is important to note that WiDNR observed that hyacinth, lettuce, and parrot's feather were found in the same general areas they were observed in 2011. Also, water lettuce, water hyacinth, and giant salvinia, *Salvinia molesta,* were observed in Lake Winona in the late 1990s (Cochran et al 2006). The status of these non-native plants is summarized in Table 18.

Table 18. Status of observed and referenced non-native plants.

Established in Minnesota?	Likelihood of naturalization? (M.S. 84D.04, subd. 2 (2))	Rank of threat (MISAC 2009)	Common name	Scientific name	Classification of non-native species (M.S. 84D.04)
Possibly	Low	Severe	water hyacinth	*Eicchornia crassipes*	Unlisted
Possibly	Low	([not listed])	water lettuce	*Pistia stratiodes*	Unlisted
Unlikely	Low	([not listed])	parrot's feather	*Myriophyllum aquaticum*	Regulated
No	Low	Severe	Giant salvinia	*Salvinia molesta*	Prohibited

Rapid response efforts to control or remove these plants were lead by WiDNR and USFWS, with some assistance from DNR. These three agencies plan to continue to work together in 2013 to assess the status of the plants in Pool 5, and take appropriate action.

This incident was used by DNR as a case study in the Minnesota Rapid Response Plan for Aquatic Invasive Species (DNR 2012).

In addition, an observation of water hyacinth in Lac qui Parle, southwest of Appleton, was reported to the DNR during October and subsequently confirmed. Water hyacinth plants observed during searches of the area in and around the original sighting were removed.

In recent years, water hyacinth also has been observed in other northern states, including Michigan (Ankney No Date).

Hydrilla

Hydrilla, *Hydrilla verticillata*, is a non-native submersed aquatic plant which can be very invasive. Although it has been a problem in the south, there is concern that it could become established in Minnesota. During the summer of 2007, hydrilla was discovered in an artificial pond in northeast Wisconsin. Fortunately, a rapid response, which included filling the pond, appears to have eliminated the plant. Nevertheless, the threat of invasion remains; one mode of introduction might be through the commercial trade of aquatic plants (Maki and Galatowitsch 2004). In 2012, the DNR coordinator of Management of Aquatic Invasive Species attended a meeting on the potential spread of hydrilla to northern states at the invitation of the U.S. Army Engineer Research and Development Center. The meeting was held in Syracuse, New York, during September and the discussions will be summarized in a white paper to be produced early in 2013.

Reed canary grass, common reed, purple loosestrife, and hybrid cattail

Reed canary grass, common reed, purple loosestrife, and hybrid cattail are all species of concern to Minnesota. One, purple loosestrife, has been the object of continuing management efforts which are described in another chapter in this report. All were addressed in a recent article by Galatowitsch (2012), an update of a previous review (Galatowitsch et al. (1999). In the recent paper, Galatowitsch described potential effects of invasion by these plants on efforts to restore wetland plants, noting that hybridization in cattail may have increased the invasiveness of this plant.

A petition to classify non-native haplotype of common reed, *Phragmites australis*, as a type of noxious weed is under consideration by the Minnesota Noxious Weed Advisory Committee.

Yellow iris

Yellow iris, *Iris pseudacorus*, is classified as a *regulated invasive species* in Minnesota and is commonly sold in the state. Public education has focused on preventing people from planting it in natural water bodies. In 2012, a pilot project involving management of this plant was undertaken on inlets and outlets of lakes Six and Seven in Otter Tail County by DNR Invasive Species Program staff. Both of these lakes have an extensive population of yellow iris and the goals of this project were to reduce the likelihood that yellow iris moves downstream to other waters, and to reduce its impact on the functionality of the inlets and outlets. In the fall, approximately 300 plants were treated with *Rodeo*, an herbicide approved for aquatic use. If the treatment results are positive, future work may be completed on the lakes by local partners to reduce the abundance of yellow iris.

References Cited

Ankney, M. No Date. Occurrence and persistence of water hyacinth) *Eicchornia crassipes*) in Michigan 2011-2012. Report by the Michigan Department of Natural Resources, Wildlife Division.

Cochran, P.A., S. Pociask, H. Warthesen, and N. Proulx. 2006. Noteworthy collection: Minnesota. *Pistia stratiodes* L. (Araceae) . Waterlettuce. The Michigan Botanist 45:210-213.

Galatowitsch. S.M. 2012. Why some wetland plants are invasive and how they affect restoration. National Wetlands Newsletter. July-August:16-19.

Galatowitsch, S.M., N.O. Anderson, and P.D. Ascher. 1999. Invasiveness in wetland plants in temperate North America. Wetlands 19:733-755.

Maki, K., and S. Galatowitsch. 2004. Movement of invasive aquatic plants into Minnesota (USA) through horticultural trade. Biological Conservation 118:389-396.

MISAC (Minnesota Invasive Species Advisory Council). 2009. A Minnesota state management plan for invasive species. Dated 20 October. Available at: http://files.dnr.state.mn.us/natural_resources/invasives/state_invasive_species_plan.pdf

MnDNR (Minnesota Department of Natural Resources). 2012. Minnesota Rapid Response Plan for Aquatic Invasive Species. December 14 Draft.

Terrestrial Invasive Plant Management

Overview

Terrestrial invasive plant species are non-native plants that naturalize and threaten natural resources and their use. Invasive plant species outcompete native plants that provide critical habitat needed to support wildlife species. For example, common buckthorn (*Rhamnus cathartica*) and glossy buckthorn (*Frangula alnus*) 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), and 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, outreach and communication, and research.

This work is being funded by state sources including the General Fund and the Environment and Natural Resources Trust Fund through the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Management

Funding Program

The Invasive Species Program initiated a funding program for the management of terrestrial invasive plant species on state-managed lands in 2006 (Table 19). Due to cuts from the state general fund, funds for fiscal years (FY12 and 13) were reduced from their highs in fiscal years 2009 and 2010. Funds of $178,340 were awarded to land managers for August 1, 2011 - June 30, 2012. Funds of $160,000 were awarded to land managers for July 1, 2012 - June 30, 2013. 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, Scientific and Natural Areas, Native Prairie Bank conservation easements, and terrestrial portions of Aquatic Management Areas. Through this program, more than 200,000 acres of DNR-managed lands have been inventoried and managed for terrestrial invasive species.

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, 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 terrestrial invasives funds 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 (reduce the spread and impact of invasive species); and 3) planning and implementation of invasive plant management efforts.

Table 19. History of terrestrial invasive plants funding program:

Fiscal Year	$ awarded	Acres (inventory + manage)	# of projects
2006-2007	$365,000	27,375	31
2008	$435,660	26,523	32
2009	$610,807	40,000 (estimate)	47
2010	$606,777	27,955 (+40,000 from aerial survey)	42
2011	$438,000	18,258	33
2012	$178,340	24,989 (+13,500 from aerial survey)	26
2013	$160,000	Currently underway	22

Outcome Report: 2012 Funding Cycle

Four divisions and two regions addressed 26 terrestrial invasives projects in FY12 (Table 20). The projects implemented treatment or inventory for more than 25 different invasive plant species (Table 21). Many of the projects targeted the control or inventory of woody invasive species such as buckthorn, non-native bush honeysuckles, and Siberian elm. Other projects targeted species that typically grow in open areas such as common tansy, leafy spurge, spotted knapweed, and Canada thistle. Normally, staff would have the full fiscal year (July 1, 2011 to June 30, 2012) to complete the projects. Due to the government shutdown in July 2011 and the lack of a known budget until after the shutdown, there was a decreased window for work (late August 2011-June 30, 2012). July and August are times of the year when much invasive plant inventory and management work is done as many plants can be identified for inventory and when many treatment methods are effective. Projects that were not completed in FY12 were given the option to have their funds rolled forward to the final year of biennium, FY13.

Table 20. Types of funded terrestrial invasive plant inventory and management projects for FY12.

Division/Section	# of Projects	Project Type (# of projects)	Subtotal
Ecological and Water Resources	3	-Inventory and management on Scientific and Natural Areas and native prairie bank easements (1) -Monitoring invasive species spread in Manitou Forest project (1) -Oak savanna restoration (1)	$45,154
Fish and Wildlife/ Fisheries	2	-Management on an Aquatic Management Area (1) -Inventory and management on an Aquatic Management Area and GPS unit (1)	$7,198
Fish and Wildlife/ Wildlife	4	-Inventory of invasive species on Wildlife Management Areas, GPS equipment (2) -Management on Wildlife Management Areas (1) -Inventory and management on Wildlife Management Areas (1)	$23,408
Forestry	7	-Inventory of invasive species on State Forests (2) -Management of invasive species on State Forests (4) -Launch of “PlayCleanGo” Terrestrial Invasive Species Education Project (1)	$33,186
Parks and Trails	8	-Inventory of invasive species on State Parks (2) -Management of invasive species on State Parks (3) -Inventory and management of invasive species on State Parks (3)	$39,565
Region 2	1	-Region 2 DNR offices and WMA invasives management	$2,875
Region 3	1	-Region 3 Headquarters invasives management	$10,000
TOTAL	**26**		**$161,386**

Table 21. Results of funded terrestrial invasive plant inventory/management projects for FY12.

Division/ Section	Acres Inventoried	Targeted Species: Inventory	Acres Managed	Targeted Species: Management	Equipment Purchased
Ecological and Water Resources	310	bird's foot trefoil, bull thistle, Canada thistle, common buckthorn, cow vetch, crown vetch, glossy buckthorn, non-native honeysuckle, leafy spurge, reed canary grass, spotted knapweed, tansy, wild parsnip	385	bird's foot trefoil, bull thistle, Canada thistle, common buckthorn, cow vetch, crown vetch, glossy buckthorn, non-native honeysuckle, leafy spurge, reed canary grass, spotted knapweed, tansy, wild parsnip	-boot brush kiosks
Fish and Wildlife/ Fisheries	1,455	buckthorn, Canada thistle, garlic mustard, leafy spurge, sow thistle, spotted knapweed, wild parsnip	1,457	buckthorn, Canada thistle, garlic mustard, leafy spurge, non-native honeysuckle, reed canary grass, sow thistle, spotted knapweed, wild parsnip	-1 Trimble Juno GPS handheld unit
Fish and Wildlife/ Wildlife	20,709	bird's foot trefoil, buckthorn, Canada thistle, cow vetch, crown vetch, leafy spurge, non-native honeysuckle, Queen Ann's lace, Siberian elm, Siberian peashrub, spotted knapweed, sweetclover, tansy, Russian olive, wild parsnip	291	spotted knapweed, tansy	-1 Trimble Juno GPS handheld unit
Forestry	19,500 (13,500 of this aerial survey)	buckthorn	160	black locust, buckthorn, non-native honeysuckle, spotted knapweed, tansy, wild parsnip	-chainsaw
Parks and Trails	2,674	Amur maple, bird's foot trefoil, Canada thistle, common buckthorn, crown vetch, garlic mustard, glossy buckthorn, leafy spurge, non-native honeysuckles, phragmites, purple loosestrife, Queen Ann's lace, reed canary grass, St. John's wort, Siberian elm, Siberian peashrub, spotted knapweed, tansy, thistles, wild parsnip	1,391	buckthorn, Canada thistle, garlic mustard, non-native honeysuckle, reed canary grass, Siberian elm, spotted knapweed, tansy	-
Region 2	0	-	154	bird's foot trefoil, buckthorn, spotted knapweed, tansy, thistle	-
Region 3	0	-	3	buckthorn	-
TOTAL	**44,648**		**3,841**		

Current Terrestrial Invasives Funding Proposals ending June 2013

In response to the FY13 request for proposals for terrestrial invasive plant management, we received proposals for 46 projects totaling $490,798. It was possible to fund 22 of the proposals for a total of $160,000 (Table 22). The funded proposals included 11 proposals for management of invasive plants, three proposals for invasive plant inventories, and eight proposals to do both inventories and management. Two proposals also included purchase of educational boot brush kiosks to be placed at trailheads.

Many of the management proposals targeted the control of woody invasive species (such as buckthorn), control of invasive plants of prairies, such as spotted knapweed, and control of the woodland invader garlic mustard. Many Parks and Trails appear to now have fairly robust inventories of invasive species and can now focus more on the management aspect. Other programs, such as Aquatic Management Areas and Public Water Accesses, are in the earlier stages of completing invasive species inventories on the terrestrial portions of those lands. This is the first year that the Lands and Minerals division has participated.

Table 22. Funded terrestrial invasive plant inventory/management projects for FY13.

Division/Section	# of Projects Funded FY13	Project Type (Number of projects)	Subtotal
Ecological and Water Resources	1	-Inventory and management (1)	$30,000
Fish and Wildlife/ Fisheries	2	-Inventory (1) -Management (1)	$14,000
Fish and Wildlife/ Wildlife	4	-Inventory and management (3) -Management (1)	$21,000
Forestry	5	-Inventory and management (3) -Management (2)	$35,000
Lands and Minerals	1	-Inventory and management (1)	$9,340
Parks and Trails	7	-Inventory (1) -Management (5) -Management and equipment (1)	$35,000
Region 3	1	-Management (1)	$8,000
Region 4	1	-Inventory and equipment (1)	$7,660
TOTAL	**22**		**$160,000**

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 its work activities. Division Guidelines were finalized and implemented in 2008. In 2012, the Division of Ecological and Water Resources led the DNR-wide effort to revise and update Operational Order 113.

Inventory

Using standardized protocols developed by the DNR, 127,000 locations of invasive plant species on state-managed lands have been mapped using GPS/GIS technologies (Figure 23). From the Parks and Trails division this includes data from 60 state parks, 15 state trails (more than174 miles of trail), and more than 470 public water accesses. The Fish and Wildlife division has collected data from more than 470 wildlife management areas and 18 aquatic management areas. The Forestry division has invasive plant locations mapped from 61 state forests. The Ecological and Water Resources division has data from more than 50 scientific and natural areas and more than 25 native prairie bank sites. Data collected in the field is sent directly (via the Web) to a central database within DNR where the terrestrial invasive plant data is stored and managed. This data is available to DNR staff through quick themes in ArcMap. Managers are now using this information to target and monitor the results of control efforts on these populations.

Early Detection

Oriental bittersweet (*Celastrus orbiculatus*) is an invasive plant that is found in Minnesota, but has populations that are not widely distributed. A new population was found on DNR land in Washington County in 2012. DNR coordinated with MDA and MNDOT to work on forming a plan for the site.

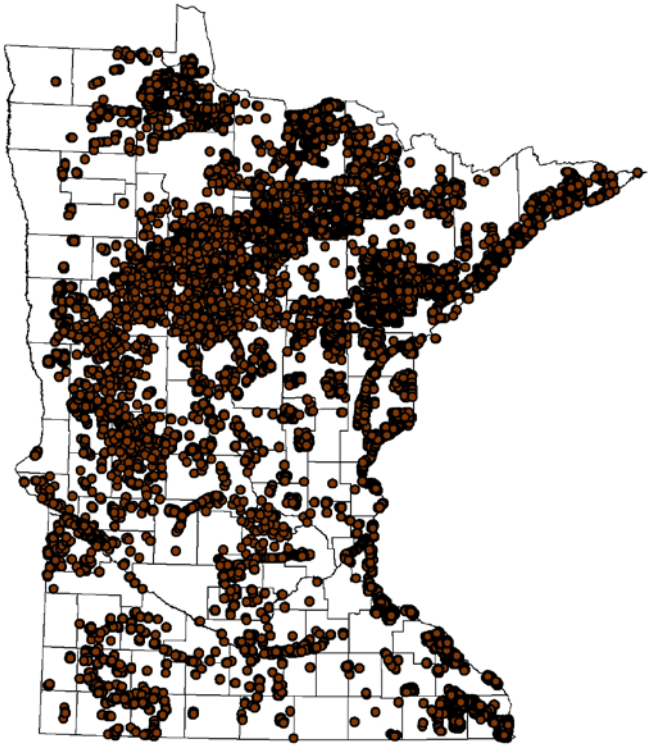


Figure 19. Terrestrial invasive plant inventories (all species), 2012.

Outreach and Communication

The link between outdoor recreation and pathways of spread for terrestrial invasive species is not well understood by the recreational public. While many water recreationists know how to "Stop Aquatic Hitchhikers", there was no equivalent consistent message or brand for people who recreate on land. In 2011, an effort to brand an outreach campaign was initiated with direction from an interagency task force. DNR Forestry led the project with DNR Ecological and Water Resources as part of the task force. The goal of the campaign is: *"To give recreationists a clear call to action - to be informed, attentive, and accountable for stopping the spread of invasive species."*

Branding objectives were to be fun and to encourage recreation; be user friendly, and accessible; be flexible to accommodate a variety of audiences and media outlets; be compatible with the "Stop Aquatic Hitchhikers!" brand and other partner brands; and to build on an education plan designed to change public behavior. With an emphasis on prevention, the new brand name and tagline is **PlayCleanGo:** *Stop invasive species in your tracks*. Sample media, signage, banners, and headlines have been developed using the brand signature. This systems approach to brand messaging is designed to reach a variety of audiences including campers, motorized and non-motorized trail users, hunters, and even state employees. PlayCleanGo messages are being incorporated into outreach materials including boot brush kiosk signs, public events, messages to DNR staff, and online and traditional media (Figure 20). The website www.playcleango.org was launched and other organizations have begun to partner on this campaign.

At the 2012 Minnesota State Fair, the former theater in the DNR building was used for invasive species displays. Impacts of terrestrial invasive species, such as earthworms, wild parsnip, buckthorn, Oriental bittersweet, emerald ash borer, and gypsy moth were shared with fair goers. Additionally, messages on how to prevent the spread of terrestrial invasive species were given using PlayCleanGo. On "Invasive Species Day" at the DNR grounds, two stage presentations were given on prevention and management of terrestrial invasive species.

Figure 20. PlayCleanGo logo, example two-color ad, example full-color poster

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

In 2001, the DNR initiated a research project on biological control of European buckthorn, conducted by CABI Europe-Switzerland (CABI). This research is funded by the DNR and the Environment and Natural Resources Trust Fund as recommended by the LCCMR. Common buckthorn (*Rhamnus cathartica*) and glossy buckthorn (*Frangula alnus*) are both shrubs and small trees of Eurasian origin which have become invasive in North America.

Biocontrol insects for these species must be host-specific to common or glossy buckthorn. Initial surveys and research found that there were no host-specific potential biocontrol agents for glossy buckthorn. Over 30 specialized insects were identified as potential candidates for biocontrol of common buckthorn. Most of these species were discarded because they lacked host-specificity. Two psyllids were promising in terms of

host-specificity, but did not cause significant damage to buckthorn and the insects were infected with the plant disease '*Candidatus* Phytoplasma rhamni' (buckthorn witches' broom). Due to the limited research on this disease and since it is not known to be in the United States, there is low potential that the psyllids would be approved for release in the U.S. A final potential biocontrol insect, a seed-feeding midge, proved too difficult to work with in a research setting. It was not possible to obtain adult fruiting trees of native North American *Rhamnus* species for host-specificity testing in Switzerland.

After 11 years of searching for a biological control insect that is host-specific and damaging to buckthorn, we conclude that we do not have any promising agents at this time. The results of this research will be published in a scientific journal so that the information gained can be shared with others.

Garlic Mustard Biological Control Research

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 the 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.

Host-specificity testing of native plant species was completed for *C. scrobicollis* and a petition was submitted in April 2008, to USDA-APHIS Technical Advisory Group (TAG) to allow state agencies to field release *C. scrobicollis* in the United States. After review of the petition, TAG recommended in 2009 that additional plant species undergo host-specificity testing. This work was completed in 2011. The results of this supplemental research were submitted to TAG in September 2011. After TAG reviews the proposal, it will submit a recommendation to APHIS. As of November 2012, DNR has received no feedback from TAG on the release petition.

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. Garlic mustard monitoring plots were established in 12 sites in central and southeastern Minnesota. The established plots then had their garlic mustard abundance recorded in June and October of 2005-2011.

In 2010, a research article titled "Population biology of garlic mustard (*Alliaria petiolata*) in Minnesota hardwood forests" was published documenting the results of the first four years of garlic mustard monitoring (Van Riper et al. 2010). In 2012, monitoring continued with data collected at all 12 monitoring sites in June and October. Data collected included garlic mustard population density, percent cover, insect damage, and heights and numbers of siliques of the second year plants. Funding for this effort was

from the Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources.

References Cited

Heidorn, R. 1991. Vegetation management guideline: exotic buckthorns—common buckthorn (*Rhamnus cathartica* L.), glossy buckthorn (*Rhamnus frangula* L.), Dahurian buckthorn (*Rhamnus davurica* Pall.) *Natural Areas Journal* 11:216-217.

Randall, J.M. and J. Marnelli. 1996. *Invasive plants: Weeds of the global garden*. Brooklyn Botanic Gardens, Inc. Brooklyn, N.Y. 111 pages.

Schmidt, K.A. and C.J. Whelan. 1999. Effects of exotic *Lonicera* and *Rhamnus* on songbird nest predation. *Conservation Biology* 13: 1502-1506.

Van Riper, L. C., R. L. Becker, L. C. Skinner. 2010. Population biology of garlic mustard (*Alliaria petiolata*) in Minnesota hardwood forests. *Invasive Plant Science and Management* 3:48-59.

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 and Missouri River basins toward Minnesota. There is also heightened concern 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 and Illinois rivers 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.

Grass carp have been caught by Minnesota commercial fisherman in the Mississippi River since the 1990s, and numbers have been increasing. The first bighead carp in Minnesota was caught by a commercial fisherman from the St. Croix River in 1996. Individual bighead carp were collected from the Mississippi River at Lake Pepin in 2003 and 2007 (Table 23).

In November 2008, Wisconsin licensed commercial fishermen caught several 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, three bighead carp, and two grass carp. The catch of a 6- to 7-pound, 24-inch silver carp in the Minnesota-Wisconsin border waters represented 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.

In 2009 and 2011, individual silver carp were caught from the Mississippi River near La Crosse, Wisconsin. Also in 2011, a single bighead carp was caught in the St. Croix River, near the mouth at Prescott, and the first grass carp outside of the Mississippi River was caught from Lake Zumbro. In April 2012, an adult bighead carp was caught in the St. Croix River, and a grass, bighead, and silver carp were caught by commercial fishermen in Mississippi River Pool 6 near Winona in March 2012.

Table 23. History of bighead and silver carp captures in Minnesota, Twin Cities to Lock and Dam #9 (near Iowa border).

Location	Species	Date	Number caught	Type of gear
St. Croix River	Bighead adult	10/17/1996	1	commercial
Lake Pepin - near Camp Lacupolis	Bighead adult	10/23/2003	1	commercial
Lake Pepin - near Frontenac	Bighead adult	10/3/2007	1	commercial
Mississippi River Pool 8 - gravel pit - WI	Bighead adult	11/1/2008	3	commercial
Mississippi River Pool 8 - Running Slough	Silver adult	11/1/2008	1	commercial
Mississippi River Pool 5a - Polander Lake	Bighead adult	1/1/2009	1	commercial
Mississippi River Pool 9 - Ferryville (WI/IA)	Bighead adult	1/30/2009	1	commercial
Mississippi River Pool 8 - WI side	Silver adult	3/10/2009	1	commercial
Mississippi River Pool 9 - Winneshiek Slough (WI/IA)	Silver adult	2/14/2011	1	commercial
St. Croix River - near Prescott	Bighead adult	4/18/2011	1	commercial
Mississippi River Pool 6 – MN side near Winona	Silver adult, bighead adult	3/2012	1 of each	commercial
St. Croix River – near Prescott	Bighead adult	4/2012	1	commercial

While individual collections are increasing, there is no evidence of natural reproduction of Asian carp in Minnesota. The closest known reproducing populations are in Iowa waters of the Mississippi River near Pool 17.

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 could 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 DNR's goal is to prevent or slow the introduction of Asian carp into state waters, continue to support research efforts to develop new control techniques, and improve habitat so native species are more resilient to Asian carp. 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.

Progress in Management of Asian Carp - 2012

In January, 2011, an informal Asian Carp Task Force was established. The Task Force grew in membership as the year progressed, with representatives from state and federal agencies, universities, local governments, non-governmental organizations, and other interested participants. DNR co-chairs the Task Force along with the National Park Service. In November 2011, the Task Force released an action plan to address Asian carp issues in Minnesota. The action plan included monitoring/detection, prevention, mitigation/control, and communication/outreach. During 2012, work was underway to implement many elements of the action plan, as described below. The plan can be viewed at the following link: http://files.dnr.state.mn.us/natural_resources/invasives/aquaticanimals/asiancarp/asiancarpactionplan.pdf

Environmental DNA, or eDNA, testing was completed for the first time in Minnesota waters in 2011. This technology was developed out of Notre Dame University to determine if DNA from Asian carp is present in water samples. Water samples were collected in July 2011, from the St. Croix River below the St. Croix Falls Dam, and in the Mississippi River below Lock and Dam #1. Samples from the St. Croix River tested positive for silver carp, while all samples from the Mississippi River were negative.

Additional water samples were then collected in September 2011, from the St. Croix River (above and below the dam at St. Croix Falls, Figure 21), the Mississippi River (below Lock and Dam #2 at Hastings, below Lock and Dam #1 at Minneapolis (Figure 22), above and below the Coon Rapids Dam at Coon Rapids (Figure 23), and above and below the Upper St. Anthony Falls Lock and Dam at Minneapolis), and from the lower Minnesota River. Some samples from all of these locations except above the St. Croix Falls dam tested positive for silver carp. There have been no positive eDNA tests for bighead carp.

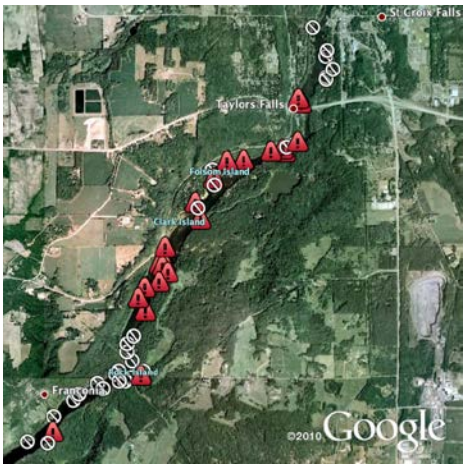


Figure 21

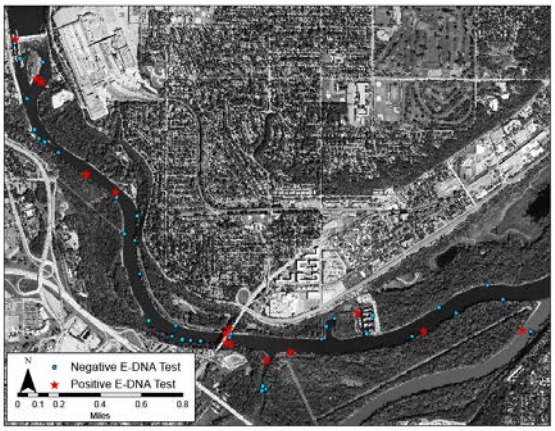


Figure 22

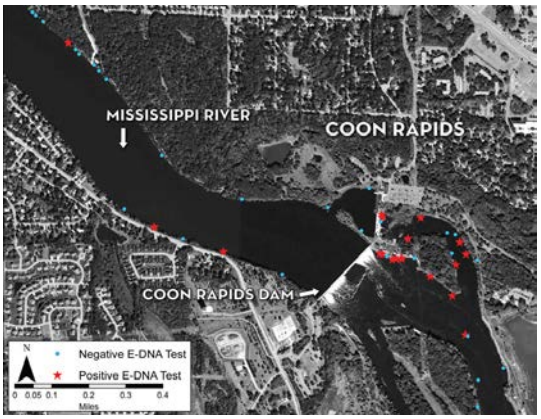


Figure 23

eDNA testing results. Samples positive for Asian carp are red triangles (Fig. 21) or red stars (Figs. 22 and 23):

- Figure 21 - below the St. Croix Falls Dam
- Figure 22 - below Lock and Dam #1 in Minneapolis
- Figure 23 - above and below the Coon Rapids Dam

Positive eDNA results alone do not confirm the presence of live silver carp To test for false positives, additional water samples were collected in spring 2012 from a lake in the Twin Cities metropolitan area where Asian carp were very unlikely to be present. Twenty samples analyzed by the U.S. Army Corps of Engineers tested negative, while one sample out of 20 analyzed by the DNR contractor tested positive for silver carp. This one sample is most likely a false positive. False positives could occur for several reasons including: DNA is present from a source other than a live fish (carcass dumped in water); other species could have genetic markers similar to Asian carp; or there is contamination in the water sample collection, filtering, or analysis process. The cause of the single false positive would be very difficult to determine.

To improve confidence in eDNA results, the University of Minnesota (University), National Park Service, U.S. Geological Survey (USGS), and DNR are working together to complete additional eDNA testing. Funding from the Legislative Citizens-Commission on Minnesota Resources is being provided through the University to the USGS to conduct analysis following federal protocols. Approximately 500 samples were collected in September 2012 from a variety of locations including negative controls (i.e., well water), positive controls (i.e., tanks containing live Asian carp), and from many of the same locations where positive samples were reported on the Mississippi and St. Croix rivers in 2011. Results will improve confidence in eDNA testing and help determine future sampling strategies.

During 2011, Minnesota Gov. Mark Dayton hosted a series of three Asian Carp Summits which included the congressional delegation, state and federal partners, and non-governmental organizations. Gov. Dayton presented an action plan that included many of the actions recommended by the Asian Carp Task Force.
The DNR and other partners are currently in the process of implementing the Action Plan. Current efforts are focused on:

- Better understanding of eDNA results and establishing a long-term monitoring program;
- Commercial fishing to search for and document live Asian carp;
- Installing an electrical or sound/bubble deterrent barrier at Lock and Dam #1 to prevent upstream fish movement;

- Installing barriers at five locations in southwest Minnesota that are threatened by Asian carp moving up the Missouri River;
- Cost sharing an electric barrier in NW Iowa to prevent Asian carp from getting into Minnesota;
- Completing a feasibility study to determine if a deterrent barrier is warranted at the mouth of the St. Croix River, Minnesota River at Mankato, Lock and Dam #2, and Mississippi River Pool 6;
- Evaluating a deterrent barrier at Lock and Dam #19 to prevent black carp and other invasive species from moving further upstream in the Mississippi River;
- Expanding research on long-term control technologies;
- Improving habitat for native species in order that they can better compete with Asian carp.

The Minnesota legislature provided $7.5 million from the Outdoor Heritage Fund during 2012 to complete the Asian carp barrier work described above, as well as $3.8 million to establish a new Aquatic Invasive Species Research Center at the University of Minnesota to accelerate research on long-term controls for Asian carp.

While not a consensus in the Action Plan, efforts also are underway to consider closing the lock at Upper St. Anthony Falls if Asian carp are detected downstream. This effort is controversial and is being considered by a variety of partners. A study was completed by the Metropolitan Council that evaluated the economic impacts to businesses of lock closure, and a study was completed by the DNR on the economic value of the sport fishery upstream of Minneapolis. In addition, the DNR and other partners continue to participate on the Asian Carp Regional Coordinating Committee (ACRCC) which focuses national attention on preventing Asian carp from entering the Great Lakes. Research results along with new technologies and approaches developed through the ACRCC will have application to Minnesota.

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, September 8, 2005). The birds can consume eight 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 which 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 DNR's goal for mute swan management is to avoid the establishment of naturalized populations of mute swans in Minnesota.

Distribution

As in previous years, unconfined mute swans were reported in Minnesota in 2012. Monitoring mute swans in the wild is a strategy necessary to help DNR respond to birds that may establish naturalized populations. During 2012, the DNR recorded reports of wild or escaped mute swans at locations in the state. A total of 23 birds were reported in the wild in 14 counties (Table 24).

Progress in Management of Mute Swans - 2012

Three Rivers Park District officers removed a mute swan from Lake Rebecca Park in Hennepin County.

Table 24. Unconfined mute swans sighted in Minnesota counties during 2012.

County (Location)	Number of Mute Swans Reported
Anoka	1 - March
Dakota	1 - June
Goodhue	2 to 5 - January, February, March, October (5)
Grant (Pelican Lake)	2 - June
Hennepin (Lake Rebecca Park)	1 - April
McLeod	1 - July
Mille Lacs (Mille Lacs Kathio State Park)	1 - September
Scott (Veteran's Park Shakopee)	1 - December
Sherburne (Lake Orrock)	1 - October
Sibley (Gaylord)	1 - July
Wabasha (Minneiska)	1 - February
Waseca	1 - April
Washington	5 - September
Wright (Pelican Lake)	1 - September
Total for all counties	**23**

Future / ongoing 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 solid surfaces 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, docks, lifts, other recreational equipment 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 in any water taken from infested lakes 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 - 2012

New Infestations:

Pelican Lake in Crow Wing County was listed as infested following the finding of two zebra mussels on the lake bed by DNR scuba divers on July 9. Brainerd DNR Fisheries and Invasive Species staff met with the Pelican Lake Association board on July 27, and developed a work plan for monitoring the extent of the zebra mussel population in Pelican Lake. Transect dives by DNR scuba divers on August 15 and 16, resulted in finding four additional zebra mussels. Other Ecological and Water Resources staff also conducted dive searches for zebra mussels on August 29, and found two more zebra mussels. Zebra mussel veliger samples also were collected on that survey and found 14 veligers at two sampling locations.

Gilbert Lake (also called Lake Ore-Be-Gone) in St. Louis County was listed as infested after recreational divers discovered zebra mussels near the public access. Subsequent diving by DNR staff found larger mussels attached to rocks, but no smaller young of the year were discovered. It is not known how large or how widespread the zebra mussel population is in the lake.

Zebra mussels continued to expand their range in the Northwest Region in 2012 (Figure 24). Due to the possibility of boats moving upstream into Buck Lake in Becker County from zebra mussel-infested waters (Pelican and Little Pelican lakes, Otter Tail County), Buck Lake was designated as infested with zebra mussels in summer 2012. Other locations include attached zebra mussels found in Lake Minnewaska in Pope County, in the Otter Tail River below Orwell Reservoir in Otter Tail County, and in Lake Miltona in Douglas County. In addition, zebra mussel veligers were collected from Paul, Kerbs, and Rusch lakes in Otter Tail County.

The fact that zebra mussels were found in the Otter Tail River below Orwell Reservoir is not surprising. This location is downstream of several lakes (Pelican, Lizzie, and Prairie) that have established zebra mussel populations. Orwell Reservoir, Dayton Hollow Reservoir, and Breckenridge Lake are located on this stretch of the Otter Tail River and were, therefore, designated as infested with zebra mussels.

In late July, a lakeshore owner was removing debris from Lake Minnewaska that had been blown into the water by a strong storm in August 2011. Upon inspection of a boat seat that had been removed from the lake bottom, the lakeshore owner noticed an adult zebra mussel attached. Once the find was confirmed, Invasive Species Program staff conducted a shoreline search in the immediate vicinity of the reported find and also at other areas of the lake. Approximately 3 miles to the west of the initial find, staff found another adult zebra mussel attached to a rock. These findings resulted in the designation of Lake Minnewaska, the waters between Lake Minnewaska and Lake Emily, and Lake Emily as infested waters. Although zebra mussels were not confirmed in Lake Emily, water from Lake Minnewaska flows into the lake and this designation will serve as a way to stay ahead of an infestation. In response to the designation, local partners were informed about the find, signs were installed at the public accesses, and a press release was issued. Increased watercraft inspections and enforcement also occurred.

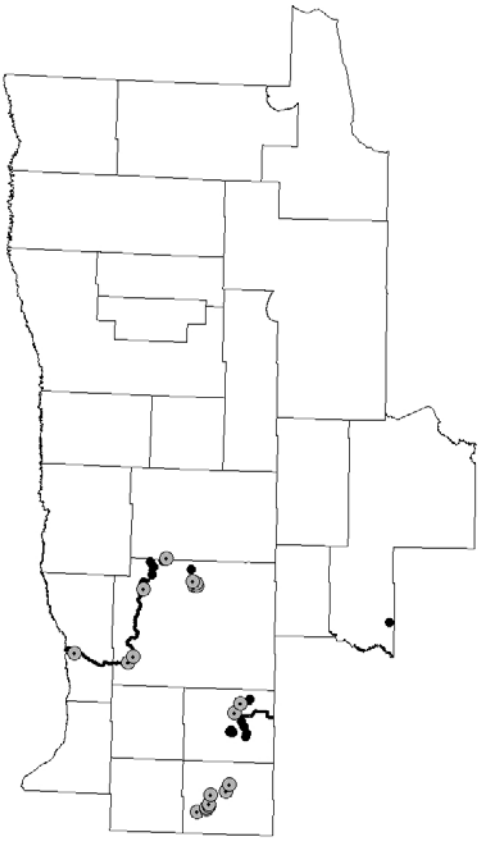


Figure 24. Zebra mussel infestations in the Northwest Region of Minnesota. Gray circles indicate new lake infestations in 2012. Black dots indicate infested lakes prior to 2012 and bold black lines indicate infested river areas.

In association with a proposed water outlet project, the Little McDonald, Kerbs, and Paul Lake Improvement District (LMKP-LID) contracted with RMB Environmental Laboratories, Inc. (RMB Labs) in Detroit Lakes to collect an August water sample from Little McDonald, Paul, Rusch, and Kerbs lakes. The proposed water outlet project would address high water issues in the surrounding area by connecting these lakes to several other lakes before the water enters the Otter Tail River system. One of the conditions of outletting the water was that if any aquatic invasive species were found, the outlet (which has not been constructed yet) would be closed. This prompted the LMKP-LID to voluntarily test the lakes for zebra mussel veligers as a precaution, prior to construction. Water samples from Paul, Kerbs, and Rusch lakes were found to contain zebra mussel veligers. As part of its protocol, RMB Labs contacted the DNR with the veliger findings. The samples were sent to the New York State Museum, which verified the presence of zebra mussel veligers. No adult zebra mussels were found after Invasive Species Program staff inspected hundreds of docks and boat lifts in these waters. Although adult zebra mussels have not been verified, a precautionary approach was taken by designating all four lakes as infested waters.

In October, a lakeshore owner on Lake Miltona was removing lake equipment when the owner noticed several small zebra mussels attached to the base of one of the docks. Invasive Species Program staff searched additional equipment on the property and found zebra mussels attached to other equipment as well as zebra mussels attached to rocks in the lake where the equipment was located. Approximately two weeks later, a zebra mussel was found almost 2 miles northwest of the initial find, attached to a dock at a DNR public access. As a result of this find, Lake Miltona was designated as infested with zebra mussels. Lake Ida, less than one and a half miles downstream of Lake Miltona, was also designated as infested with zebra mussels due to the high likelihood of zebra mussel veligers to travel downstream into the lake. Similar to Lake Minnewaska, other responses to this infestation included informing local partners about the find, installing signs at public accesses, issuing a press release, and increasing watercraft inspections and enforcement.

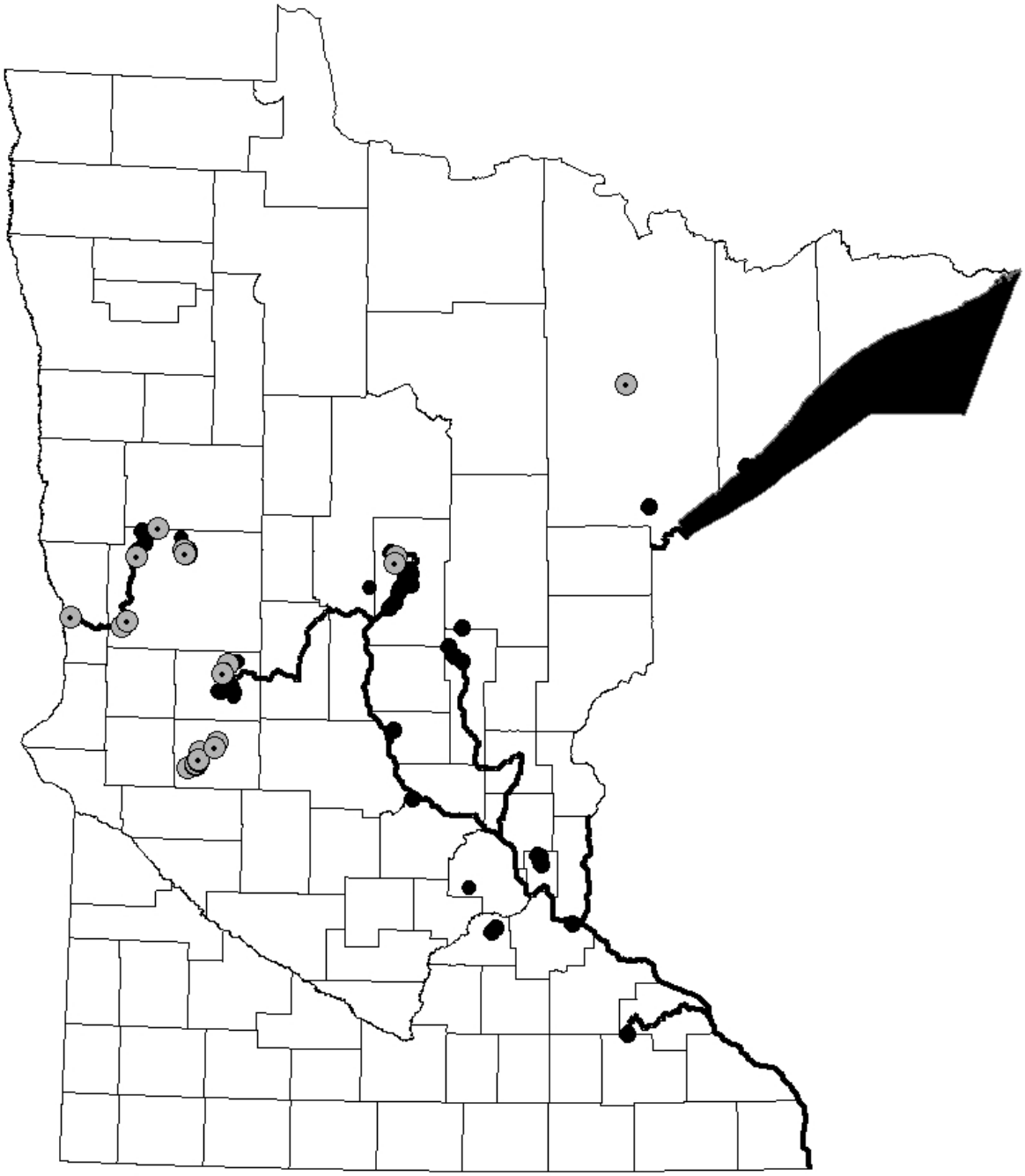


Figure 25. Zebra mussel infestations in Minnesota. Gray circles indicate new lake infestations in 2012. Black dots indicate infested lakes prior to 2012 and bold black lines indicate infested river areas and Lake Superior.

Existing populations and efforts:
Water column samples were collected throughout Mille Lacs Lake by Fisheries staff during the summer, and zooplankton and veliger densities were analyzed. Both veliger and spiny waterflea densities continued to expand, with veligers present earlier in the season and for a longer period of time, possibly due to early warm waters. DNR scuba divers counted zebra mussels along 15 established transects in August 2012. These

600-foot transects have been surveyed yearly since 2005 when zebra mussels were first reported in the lake. The average zebra mussel transect density was 1,270 per square foot, but the highest single quadrat count was on Three Mile Reef where the density of zebra mussels was 7,669 per square foot. Densities continue to increase, and divers noted that zebra mussels were beginning to create a layer on softer sediments by attaching to scattered solid objects and other zebra mussels.

Carlos Lake had a substantial increase in veliger densities in water samples, and plant surveys found many tiny zebra mussels attached to vegetation. The population in Carlos appears to be rapidly building. Lake Minnetonka zebra mussel distribution expanded nearly lakewide from data collected from settling samplers. Water samples collected were analyzed for veliger and zooplankton densities and showed an increase in veligers, suggesting increasing reproduction in the lake.

Gull Lake Reservoir was listed as infested in the fall of 2010. DNR scuba divers searched and counted zebra mussels along six 250-foot transects on July 12, 2012. The average transect zebra mussel density was 153 per square foot. Zebra mussel veliger samples were collected with a plankton tow at four sites by Invasive Species Program staff on August 2. The microscopic young zebra mussels varied from 2.4 veligers per liter to 28.4 veligers per liter. Brainerd DNR Area Fisheries and Invasive Species Program staff met with the Gull Lake Association board in the fall to report on the 2012 zebra mussel monitoring results. Zebra mussel populations appear to be increasing throughout the lake.

Reports from boaters, marina operators, and researchers documented a massive die-off of zebra mussels in the Mississippi River, particularly in Lake Pepin. A proposed trial using *Zequanox* to test efficacy on newly settled zebra mussels was cancelled when researchers found no mussels on the substrates placed in the river last fall. Subsequent searches for over a mile failed to find enough mussels to run the trial. Many boaters report no zebra mussels or very few on their watercraft in the Lake Pepin area. This die-off is similar to those seen in the past in the Mississippi River as well as Lake Zumbro. Such die-offs seem to coincide with times of extremely low water coupled with high summer temperatures. This combination may be stressful or lethal to zebra mussels and contribute to these mass population crashes. It is important to note that despite massive population declines, the zebra mussel populations rebound in subsequent years–thus, this has not in the past been the “end” of zebra mussel infestations, and it is very likely that the populations will rebound in future seasons.

In the fall of 2011, the Invasive Species Program investigated two separate cases where boat lifts used in zebra mussel-infested lakes had been moved to non-infested waters (Lake Irene in Douglas County and Rose Lake in Otter Tail County). In both lakes, only juvenile zebra mussels were found in a small, localized area. This offered the DNR the unique opportunity to attempt to eradicate zebra mussels by treating both areas with copper sulfate, a common chemical used to treat snails that cause swimmer’s itch. To evaluate the success of these treatments, Invasive Species Program staff collected water samples to look for larval zebra mussels (veligers) and conducted scuba and lake equipment searches to look for juvenile and adult zebra mussels throughout the 2012 open water season. Veligers were not found in any of the

water samples, nor were large zebra mussels found during the scuba searches conducted in the summer. However, during the fall, adult zebra mussels were found in both lakes. In Rose Lake, three zebra mussels attached to three separate boat docks were found in the same area where the treatment occurred. In Lake Irene, one adult zebra mussel attached to a native mussel was found approximately one mile away from the treatment area. Because monitoring efforts did not produce any veligers or juvenile zebra mussels, it is unknown whether zebra mussels have reproduced in either lake. Nonetheless, the recent find of adult mussels means that despite early detection and a rapid response, efforts to kill the zebra mussels in these lakes were not successful. Invasive Species Program staff will continue to monitor these lakes next year to evaluate the zebra mussel populations.

Dramatic increases in zebra mussel reproduction and settlement were seen in other lakes in the Northwest Region. Lake Darling (Douglas County) and Prairie Lake (Otter Tail County) were found to have their highest production of zebra mussels since the discovery of their infestations in 2009.

Zebra mussel research: Recent work and progress in the potential for bacterial control of zebra mussels has raised the possibility of use of such a method in Minnesota lakes. Marrone Bio-Innovations has been testing and refining the use of a strain of *Pseudomonas flourescens*, a common soil bacteria (trade named *Zequanox),* for zebra mussel control. This bacterial strain was shown to kill zebra mussels when high enough doses were consumed. DNR staff worked with the U.S. Geological Survey (USGS) to provide potential inland infested water sites for inclusion in the research. Researchers with the USGS placed settling substrates in two locations: Lake Pepin and Carlos Lake (Douglas County). *Zequanox* is not registered for open water use, so no applications were made within the lake. Instead, a research trailer was used to expose the test substrates, and the test water was treated and disposed of on land. USGS researchers conducted trials on Lake Carlos in late summer 2012; however, no trials were done in Lake Pepin, due to a massive die-off of zebra mussels in the Mississippi River. Progress reports on the trials have not yet been completed by the USGS. Future research directions for this material include more non-target toxicity data, as well as micro- and mesocosm trials in natural lake conditions. Questions remain on the potential use, as initial trials have shown high-dose rates and long-exposure times are necessary to obtain zebra mussel mortality.

Volunteer Zebra Mussel Monitoring Program: The Volunteer Zebra Mussel Monitoring Program continued, mailing report forms to all lakeshore residents who participated last year. Program information and reporting forms were placed on the DNR website, allowing users to report electronically. More than 125 people annually have participated in the program, checking lakes across the state for zebra mussels. These efforts provide a much more extensive survey of Minnesota waters for this invasive than could be conducted by the Invasive Species Program alone.

Other Invasive Animal Species in Minnesota

Mystery Snails (Chinese, banded)

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. Mass die-offs of *V. georgianus* have been seen in a number of Minnesota lakes where this species 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 - New reports are confirmed with specimens and added to distributional lists. The increase in waters reported with these taxa may be an indication of heightened awareness of the species or increased surveys rather than an indication of recent spread.

Management - There are currently no environmentally acceptable control methods specific for mystery snails. The Aquatic Plant Management Program permits control of native snails for control of swimmer's itch situations through the use of registered copper products (such as copper sulfate). However, control is only permitted on smaller areas, and is effective only for a limited time, as snails can move back into the treated area after copper dissipates. Copper sulfate is toxic to snails and mussels, some algae, various zooplankton taxa, crustaceans, some aquatic insect taxa, and can cause fish mortality. With the broad toxicity of the control material and no possibility of eliminating snails from a lake, no lake-wide control is conducted.

Spiny Waterflea

The spiny waterflea (*Bythotrephes longimanus*) is an invasive cladoceran zooplankter native to Europe. It was brought to the Great Lakes in ballast water in the late 1980s. This zooplankter 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. However, 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. The spiny waterflea produces resting eggs, 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. Ephippia (resting eggs) can remain viable after passage through fish.

Bythotrephes sp. - 2012: One new infestation was reported in 2012, in Trout Lake in Cook County. Trout Lake is part of the SLICE program – Sustaining Lakes in a Changing Environment. As part of this research effort, annual data is available on various ecological aspects such as zooplankton and fish communities for Trout Lake. Continued monitoring in this program may aid in a better picture of impacts that this invasive may cause in such lakes. With the interconnections between many infested lakes in northern Minnesota, more infestations are likely to be discovered in future seasons. 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 ephippia, or inadvertently by recreational anglers or boaters.

Existing work: DNR biologists are helping draft final publications from Voyageurs National Park by analyzing zooplankton data 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 Fisheries staff are being analyzed by DNR biologists to provide data on zooplankton communities as well as spiny waterflea abundance. Area Fisheries managers in the northern part of the state have sent zooplankton tows from uninfested lakes used for aerial stocking operations to check if these lakes have become infested, with negative results to date. Water samples collected for a study on zebra mussel reproduction from multiple sites in Mille Lacs Lake have documented a significant increase in the spiny waterflea population in the lake. It is unknown what population levels may be found long-term in this lake, which is distinctly different morphologically from many other infested waters.

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 is 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 10,000 scaup and coots since 2007on Lake Winnibigoshish, its connected water, and neighboring Bowstring Lake. Since 2002, they have had similar impacts along the Mississippi River at Lake Onalaska near La Crosse, Wisconsin, where 60,000-70,000 waterfowl have died. 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.

Work in 2012 - In July, a faucet snail was found in a container of leeches purchased at a bait store in Otter Tail County. Work by DNR biologists, enforcement officers, and White Earth Tribal employees tracked the source of the faucet snail to several leech ponds in Becker County within White Earth Tribal boundaries. Based on these finds, the White Earth Tribal Council closed the ponds to leech harvest until training could be held for its members. The training was held in August to educate tribal members of the threat of faucet snails and other AIS to their natural resources and bait industry. In addition to the training, a letter to all commercial bait harvesters and retailers about the faucet snail find was sent out statewide as a reminder to be watchful while packaging bait. This letter also was accompanied by a poster of other AIS that the recipients could post in their store or workplace.

By the end of the 2012 open water season, 41 potential leech ponds across four counties in northwest Minnesota had been searched for the presence of faucet snails. Only eight were confirmed to have faucet snails. Work in 2013 will aim to work with White Earth Tribal employees to continue to assess leech ponds for the presence of faucet snails.

Management - There are no environmentally friendly management tools available 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.

Appendix A - 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	Ann Pierce	651-259-5119	ann.pierce@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	Laura Van Riper	651-259-5090	laura.vanriper@state.mn.us
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 waterfleas, 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	Cory Palmer	507-359-6040	cory.palmer@state.mn.us
Public and Media Relations - statewide coordination of public education and outreach programs; media relations	Marjorie Casey	651-259-5132	marjorie.casey@state.mn.us
Training Coordinator - develop and administer invasive species training programs	April Rust	651-259-5706	april.rust@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)	Joe Eisterhold	218-699-7293	joe.eisterhold@state.mn.us
West-Central MN (Fergus Falls)	Nathan Olson	218-739-7576 x259	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)	Keegan Lund	651-259-5828	keegan.lund@state.mn.us
Central MN	Courtney Millaway	320-223-7847	courtney.millaway@state.mn.us
Southern MN (New Ulm)	Vacant		joe.eisterhold@state.mn.us
Southern MN (Hutchinson)	Nick Brown	320-234-2550 x238	nicholas.brown@state.mn.us
Northern MN (Park Rapids) Supervisor	Bruce Anspach	218-699-7295	bruce.anspach@state.mn.us
Watercraft Inspection Program Supervisors and Assistants – Supervise local watercraft inspection and outreach for awareness events at water accesses.			
West-Central MN (Fergus Falls) Assistant	Anna Ness	218-739-7576 x247	anna.ness@state.mn.us

Appendix A. Continued

Central MN (Brainerd) Supervisor	Keri Hull	218-833-8737	keri.hull@state.mn.us
Central MN (Brainerd) Assistant	Justin Swart	218-833-8730	justin.swart@state.mn.us
Central MN (St. Cloud) Supervisor	Evan Freeman	320-223-7845	evan.freeman@state.mn.us
Central MN (Shakopee) Assistant	Jessica Melin	952-496-4141	jessica.melin@state.mn.us
Central and Southeast MN (St. Paul) Supervisor	Adam Doll	651-259-5835	adam.doll@state.mn.us
Central and Southeast MN (St. Paul) Assistant	Maureen Ziskovsky	651-259-5146	maureen.ziskovsky@state.mn.us
General Information		651-259-5100	

Appendix B - 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	Ryan Blaedow	651-259-5821
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
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

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 Pest Detection and Response Unit addresses species such as emerald ash borer, potato cyst nematode, and Asian long-horned beetle. The Pest Mitigation and Biocontrol Unit coordinates all aspects of survey, treatment, and regulatory work pertaining to gypsy moth. The Seed Inspection and Noxious 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.

Plant Protection Division Contacts

Pest Detection and Response Unit	Teresa McDill	651-201-6448
Pest Mitigation and Biocontrol Unit	Lucia Hunt	651-201-6329
Pest Mitigation and Biocontrol Unit-Biocontrol	Monika Chandler	651-201-6537

Seed Inspection and Noxious Weed Unit Contacts

Noxious Weed Law and General Management	Anthony Cortilet	651-201-6538

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 - Pest Mitigation and Biocontrol 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 Pest Detection and Response Unit, Plant Protection Division, 651-201-6448 and Laura Van Riper, DNR Invasive Species Program, Ecological and Water Resources Division, 651-259-5090.