

Invasive Species of Aquatic Plants and Wild Animals in Minnesota

**Annual
Report
2011**

*for the year
ending December 31*



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Preface

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

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Invasive Species of Aquatic Plants and Wild Animals in Minnesota: Annual Report for 2011

Summary

Invasive species are 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 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: 2011

Aquatic Plants

Eurasian watermilfoil was discovered in 10 additional water bodies during 2011. The total number of milfoil infested water bodies is 257.

Purple loosestrife was found in two new sites in 2011, bringing the total number of known infestations to 2,408.

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 2011.

Wild Animals

Zebra mussels were reported from eight new waters during 2011: Brophy, Cowdry, Taylor, North Union, Stoney, and Irene lakes in Douglas County and Rose Lake and the Pelican River in Otter Tail County. Pelican River and Brophy, Cowdry, Taylor, North Union, and Stoney lakes are connected to waters with established zebra mussel populations.

Three species of **Asian carp** were caught in Minnesota in 2011. One bighead carp was caught in the St. Croix River; one grass carp was caught in Lake Zumbro; and one silver carp was caught in the Mississippi River near La Crosse, Wisconsin.

No new **New Zealand mudsnail** infested waters were discovered in 2011.

No new **spiny waterflea** infested waters were discovered in 2011. However, 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.



No new **faucet snail** infestations were discovered in 2011. Faucet snails are known to be in 21 water bodies in the state.

Mute swans were found in four counties in 2011. A total of seven birds were reported in the wild.

Hot Topics

Asian carp

With the recent captures of Asian carp in the St Croix and Mississippi rivers and growing concern of impacts by Asian carp to Minnesota's valuable waters, Gov. Mark Dayton signed a bonding bill, approved by the Minnesota Legislature, funding a \$16 million upgrade of the Coon Rapids Dam on the Mississippi River. The dam improvements are designed to provide a permanent barrier to the upstream migration of Asian carp to the upper reaches of the Mississippi River. Construction should begin in 2012.

For the first time in Minnesota, environmental DNA, or eDNA testing was carried out to detect Asian carp in Minnesota waters in 2011. This technology was developed to determine if DNA from Asian carp is present in water samples. In 2011, water samples were collected from the St. Croix River below the St. Croix Falls Dam, multiple locations of the Mississippi River, and in the lower Minnesota River. Water samples from the St. Croix River tested positive for silver carp, as well as samples collected from several locations in the Mississippi River including below Lock and Dam #1, below Lock and Dam #2 at Hastings, and above and below the Coon Rapids Dam. There have been no positive eDNA tests for bighead carp. Positive eDNA results do not confirm the presence of live silver carp as there may be other pathways for DNA to enter the water. These other potential sources are unlikely, however, they are being investigated. At this time, the risk is too high to assume live fish are not present based on the eDNA evidence.

In January, 2011, an informal Asian Carp Task Force was established. The Task Force has representatives from state and federal agencies, universities, local governments, non-government organizations, and other interested participants. The Asian Carp Task Force developed and released an "Asian Carp Action Plan" for Minnesota in November. The DNR and other partners are currently in the process of implementing the Action Plan where support and funding is available. Currently 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 the Lock and Dam #1 lock chamber to prevent upstream fish movement; completing a feasibility study to determine if a deterrent barrier is warranted at the mouth of the St. Croix River; completing a feasibility study on a permanent fish barrier at Upper St. Anthony Falls and Lock and Dam #1 including emergency lock closure; expanding research on long-term control technologies, and improving habitat for native species in order that they can better compete with Asian carp. For more information: www.dnr.state.mn.us/asian-carp .

New Legislation in 2011

Legislation aimed at strengthening Minnesota's ability to prevent the spread of aquatic invasive species was signed into law May 27, 2011, by Gov. Mark Dayton. Among the results will be more authority to inspect watercraft and stronger regulations to prohibit the transportation of invasive species.

The new law, which received bipartisan support in the Legislature, is the product of a year-long effort 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 new authorized inspectors who along with conservations officers have the authority to visually and tactilely inspect water-related equipment. Those inspections can include the removal, drainage, decontamination, or treatment of water-related equipment to prevent the transportation of aquatic invasive species.

The new law puts some muscle behind the requirements. Authorized inspectors can prohibit the launching or operation of water-related equipment if a person refuses to allow an inspection, or doesn't remove water or aquatic invasive species. A civil citation and a one-year watercraft license suspension can be the result.

The new laws now cover more than just watercraft. Motor vehicles, docks, lifts, rafts, trailers, livewells, bait containers, and other water-hauling equipment capable of transporting aquatic invasive species are covered by the new regulations.

All such water-related equipment, including portable bait containers, must be drained before leaving any water body. Anglers who want to keep leftover bait alive are required to replace existing water in the bait containers.

To help ensure that watercraft owners are familiar with the new regulations, a required aquatic invasive species rules decal is available at boat and bait dealers, DNR license sellers, deputy registrar offices, at DNR offices, and by DNR conservation officers.

Businesses that install or remove water-related equipment or structures will also be held to higher standards. They must complete invasive species training and pass an examination in order to qualify for a required permit, which will be valid for three years. People who work for the service providers must also complete DNR training.

Watercraft Inspections

As a result of 2011 legislation, the DNR hired and trained new authorized inspectors to ensure compliance with invasive species laws. The DNR 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 will also be trained to use decontamination equipment at the access.

In 2011, the DNR purchased three high-pressure, hot-water portable decontamination units to be used to decontaminate watercraft at public water accesses as part of our watercraft inspection program. Using the new DNR Watercraft Inspection and Decontamination Handbook, staff were trained and authorized to inspect and decontaminate watercraft. The decontamination units were deployed August through October around Detroit Lakes, Alexandria, Brainerd, and the Twin Cities at high-use accesses on zebra mussel infested waters.

Significant changes were made to how inspectors were deployed in 2011 to maximize effectiveness and efficiency by focusing more inspection time on boaters leaving high-use accesses on zebra mussel infested waters. This targeted effort was very successful and helped increase the number of inspections from 66,000 in 2010 to 76,000 in 2011, even though hours of inspection were reduced by 5,500 in 2011 due to the 20-day state government shutdown in July.

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

In 2011, there were two cases where boat lifts with zebra mussels were moved from zebra mussel infested waters to non-infested waters without proper cleaning or drying. During the summer, a private individual moved a boat lift from a zebra mussel infested water to Rose Lake (Otter Tail County) without proper cleaning. In September, the boat lift was removed from the lake and zebra mussels were found attached. A search was conducted by DNR staff and SCUBA divers and zebra mussels were only found near the area where the boat lift was located. Based on this information, it appeared the zebra mussel infestation was localized to a small area of Rose Lake and it was decided that the DNR would attempt to eradicate the zebra mussels before the population expanded.

In Lake Irene (Douglas County), a private individual had a boat lift moved from zebra mussel infested water to Lake Irene early in the summer. In October, when the boat lift was removed from the water, the private individual observed zebra mussels attached to the boat lift. Again a search by DNR staff and SCUBA divers found a number of zebra mussels on rocks in the area where the boat lift was located. Once again, it appeared the zebra mussel population was localized to a small area and an eradication attempt was planned.

For both Rose Lake and Lake Irene, the eradication effort consisted of physically removing all zebra mussels found, then chemically treating 10 acres of the lake around where the dock was removed using a copper-based product called Cutrine®-Ultra. This product is commonly used to treat algae growth and swimmer's itch. Cutrine®-Ultra was chosen because it is toxic to zebra mussels, EPA approved for aquatic use, and readily available. To keep the concentration at a high enough level, three treatments were conducted (one treatment every seven days). Weather was favorable for all treatments and landowner cooperation was excellent. Future monitoring for zebra mussels in these two lakes will determine the success of the eradication effort.

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 (www.mndnr.gov/invasives) to present more information and make that information easier to find. Invasive species was the theme at the DNR's Minnesota State Fair exhibit with invasive species awareness promoted through stage events, new displays and banners, and presentations.

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 simplification of application, expansion 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.

The DNR is in the process of implementing these changes.

The DNR continued to provide grants for aquatic invasive species control. In 2011, 26 pilot projects for lake-wide control of curly-leaf pondweed were funded for a total of \$370,000. Cooperators on 24 lakes received funding from the DNR for control of Eurasian watermilfoil for a total of \$168,000.

Enforcement

Conservation officers spent 13,629 hours on invasive species enforcement and held 287 specific aquatic invasive species (AIS) work details which included 5,463 contacts statewide. In 2011, 487 written citations were issued (up from 159 citations in 2010) for invasive species violations statewide. Conservation officers worked closely with the new authorized inspectors, implementing the new inspection authorities. Eight law enforcement training classes for local law enforcement were provided across the state.

Revenue and Expenditures

Funding for the Invasive Species Program includes a \$5 surcharge on watercraft registered in Minnesota and a \$2 surcharge on non-resident fishing licenses (which makes up the Invasive Species Account), appropriations from the general fund account, Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources, and local contributions. These funding sources generated \$4,643,000 for all invasive species prevention and management activities for the 2011 fiscal year.

Aquatic invasive species spending (\$3,893,000) for fiscal year 2011 is shown in Figure 1. The Management/Control and Inspections/Enforcement categories account for 71% 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.

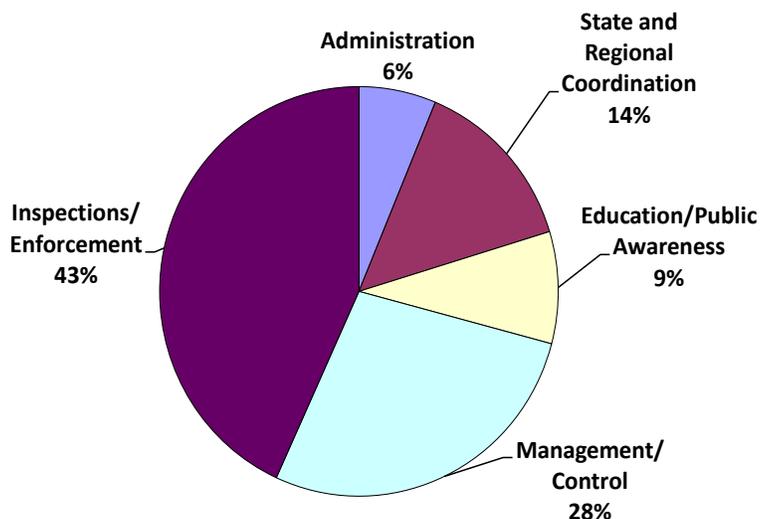


Figure 1. Aquatic Invasive Species Program spending (Invasive Species Account and General Fund only) in FY11 by major categories.

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, water chestnut, and Asian carp. To do so, the Program identifies potentially invasive species in other areas of North America and the world, predicts pathways of spread, and develops and implements solutions that reduce the potential for introduction and spread. 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 100 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 over 20 full-time positions is focused on invasive species work.

The Program has begun to address terrestrial plant species on DNR-managed lands. Within the DNR, our goal is to enhance the ability of field staff to effectively manage terrestrial invasive plants on DNR-managed lands. Key strategies include: 1) coordinate inventories of public lands for invasive species; 2) gather, maintain, and share knowledge of integrated pest management (chemical, mechanical, and biological control) for invasive terrestrial plants; 3) fund management efforts on state-managed lands; and 4) develop or improve management practices through research (i.e., biological control).

With invasive species issues continuing to grow and a heightened level of concern, the Invasive Species Program continues to build capacity for the future, react quickly to new threats, and provide more support to those trying to manage invasive species. The DNR is expanding activities focused on both aquatic and terrestrial species. Specific target areas includes increasing or expanding:

- 1) enforcement efforts by DNR conservation officers;
- 2) watercraft inspection program;
- 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 provide support for the Invasive Species Program's public awareness activities (see Education and Public Awareness).

DNR Fisheries assist with the management of various invasive plants including purple loosestrife, Eurasian watermilfoil, curly-leaf pondweed, and flowering rush. In addition to these staff, other individuals from the Division of Fish and Wildlife and the Division of Ecological 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: preventing new introductions into the state; early detection and rapid response to new introductions; containment of populations, and management of established populations to reduce their harm.

The Plan reflects several years of work by many organizations from the local, state, and federal government levels and a number of non-governmental organizations. The Plan will also provide opportunities for improved coordination and partnerships between federal, state and local governments, tribes, conservation organizations and others working to minimize the impacts caused by invasive species in the state. 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 FY11. The Program is also supported with funds from general fund appropriations. In addition, the 2007 Legislature created an “Invasive Species Account” in which all watercraft surcharge and non-resident fishing license proceeds are held.

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

Table 1. State and local funding (in thousands of dollars) received by the Invasive Species Program, fiscal years 2007-2011.

Fiscal Year	Surcharge ²	Invasive Species Acct	General Fund	Legislative-Citizen Commission on Minnesota Resources ¹	Local Contributions	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	--	4,643

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, and FY10/11 bienniums.

Federal Funds

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

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

	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	2010-2012	792	USFWS
	2011	2012-2013	1040	USFWS

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

Timeframe

This report covers activities in calendar year 2011, which includes the last half of the Minnesota fiscal year 2011 (FY11), January 1-June 30, 2011, and the first half of fiscal year 2012 (FY12), July 1-December 31, 2011. To provide a comprehensive review of expenditures and to meet the report’s January 15, 2012 due date, we report on expenditures that were incurred in FY11 (July 1, 2010-June 30, 2011).

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. Examples from 2011 include: a Mississippi River Basin Panel on Aquatic Nuisance Species (ANS) meeting, participation on conference calls associated with the Council of Great Lakes Governors' ANS Initiative, and a regional workshop focused on Promoting Regional ANS Cooperation and Coordination. "Training, supervising, related work" represents a variety of work activities that staff participate in to improve their skills, direct co-workers, or help on other projects. Finally, *Equipment and Services* includes fleet costs not assigned to a specific activity and the cost to purchase and repair boats, trailers, computers, and similar items.

Education/Public Awareness

Expenditures in this category include staff time, in-state travel expenses, fleet charges, mailings, supplies, printing and advertising costs, and radio and TV time to increase public awareness of invasive aquatic species. The costs of developing and producing pamphlets, public service announcements, videos, and similar material are included, as are the costs of developing and maintaining invasive species information on the DNR's 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 2011 (FY11) Expenditures

Expenditures on aquatic invasive species activities during FY11 (July 1, 2010-June 30, 2011) totaled \$4,322,000. 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, \$825,000 was spent on terrestrial invasive species management and research activities. That work was funded exclusively from the general fund and by grants from other organizations. Accomplishments for terrestrial invasive species management activities are found in the following chapters.

The \$2,044,000 of "Invasive Species Account" expenditures during FY11 (Table 3) were less than the \$2,142,000 appropriated by the Legislature (Table 1). The unspent FY11 funds remain in the Invasive Species Account. General Fund expenditures were 2,492,000 slightly above the 2,401,000, due to roll forward of unspent funds from FY10.

Figure 2 provides a broad outline of how \$3,893,000 in funding was spent from the "Invasive Species Account" and the general fund for aquatic invasive species. Within Figure 2, the Management/Control category (\$1,074,000) and Inspections/Enforcement category (\$1,676,000) represent the two largest segments of the budget; these two categories accounted for 71% of aquatic invasive species expenditures in FY11. The focus on those two categories, plus Education/Public Awareness which represents an additional 9% of FY11 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.

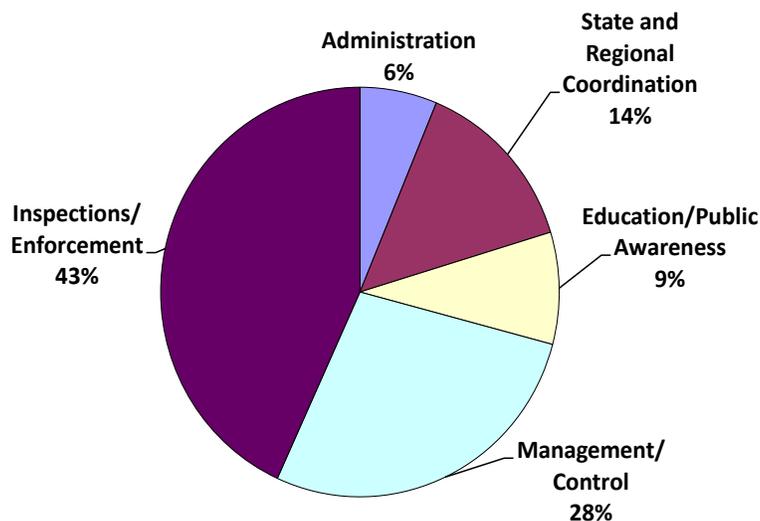


Figure 2. Aquatic Invasive Species Program spending (Invasive Species Account and General Fund only) in FY11 by major categories.

Fiscal Year 2012 (FY12) Future Expenditures

Since this report is due in the middle of FY12, projected expenditures for that fiscal year are not reported. A comprehensive review of FY12 expenditures will be provided in the 2012 Annual Report.

Table 3. Invasive species related expenditures in fiscal year 2011 (FY11) (in thousands of dollars).

Categories of Expenditures	Invasive Species Account	General Fund	Other Funding Sources
	FY11	FY11	FY11
Administration Division Support Costs Clerical Administrative Support Subtotal	103	140	0
State and Regional Coordination State coordination Support regional/federal activities Training, supervising, related work Equipment and services Other Subtotal	400	144	³ 32
Education/Public Awareness Radio spots, TV, website development Other Subtotal	112	231	³ 52
Management/Control <u>Aquatic</u> Eurasian watermilfoil Purple loosestrife Zebra mussel Curly-leaf pondweed Flowering rush <u>Terrestrial invasive species</u> Subtotal	461 --	613 607	³ 3 -
Inspections/Enforcement Watercraft inspections Enforcement - access checks Subtotal	955 --	69 652	^{1,3} 104 ^{1,3} 153
Research Aquatic species Terrestrial Invasive Plants Subtotal	13	36	³ 85 ^{1,2,3} 182
Total	2,044	2,492	611

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

Prevention and Containment

Introduction

Issue

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

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

Goals

The 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 - 2011

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

- DNR Enforcement activities continued to significantly increase (13,629 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 third year through the DNR's Prevention Grant Program. A total of \$32,411 was paid to 14 groups who accomplished new or continued public awareness projects, an additional \$48,553 was provided to local entities for 6,625 hours of watercraft inspections by DNR inspectors, and \$33,000 for six local government entities to hire their own watercraft inspectors.
- DNR watercraft inspectors logged over 44,500 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 2011, 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 already known to occur in the state. The discovery of zebra mussels in Rose and Irene lakes, as a result of placing contaminated boat lifts in those waters, triggered unique rapid responses by the Invasive Species Program. Responses at these waters included:

- 1) Assessing the extent of the zebra mussel distribution by DNR staff,
- 2) Notifying local lake associations,
- 3) Issuing news releases about the new infestations,
- 4) Posting Invasive Species Alert signs at the water accesses,
- 5) Starting watercraft inspections at public water accesses on those infested waters,
- 6) Designating the waters as infested waters,
- 7) Increasing enforcement in the new infestation areas, and
- 8) Considering and assessing prevention options to curb the spread to upstream waters.

More information on the responses is provided in the zebra mussel management chapter.

Priority Containment Lakes

Several lakes in the state were the focus of elevated containment efforts in 2011 due to their infestation status and the high level of boating at those waters: Mille Lacs, Minnetonka, and the lower Mississippi River. They were a priority for watercraft inspections and enforcement. Radio and newspaper ads were placed in the Lake Mille Lacs and Brainerd area. A *Stop Aquatic Hitchhikers!* ad was placed in the *Mille Lacs Area Travel Guide* for 2010-2011.

Prevention Grants

In 2011, the DNR continued providing grants to local groups and governments to help prevent the spread of aquatic invasive species, especially zebra mussels and spiny waterfleas into Minnesota waters. Grants were provided to help local entities (lake associations, coalitions of lake associations (COLAs), local citizen groups, and local units of government (e.g., conservation districts, lake improvement districts, watershed districts, and counties) implement locally focused prevention efforts and to dovetail those efforts with other ongoing statewide aquatic invasive species prevention efforts. One example of a statewide prevention effort is the "Stop Aquatic Hitchhikers!" campaign, which is being implemented by the DNR, Minnesota Sea Grant, Wildlife Forever, and the U.S. Fish and Wildlife Service. A total of \$32,411 was paid to 14 groups to initiate new or continue public awareness projects, an additional \$48,553 worth of watercraft inspection time was provided to 24 entities at the local level for 6,265 hours of watercraft inspections, and \$33,000 for six local government entities to hire their own watercraft inspectors during 2011 (Table 4).

The five types of grants or partnership projects eligible in 2011 are described below:

Watercraft Inspections - DNR Watercraft Inspectors

In this grant type, the local organization provides funding for salaries (at \$12/hour) and the DNR hires watercraft inspectors to work at local water accesses. The DNR provides/grants an equal amount of inspection hours (up to the maximum grant amount) to those funded by the local entity. The 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 \$12/hour, then DNR provides an additional 166 hours at local accesses. DNR will also recruit, hire, and schedule the inspectors, and provide supervision, insurance, and social security costs.

Watercraft Inspections - Non-DNR Watercraft Inspectors

Local government units (LGU) can hire watercraft inspectors for work at local waters. DNR will train the inspectors and provide grant funds for 50% of the inspection costs. The LGU must recruit, hire, and schedule the inspectors, and provide supervision, insurance, social security and potential unemployment costs. There were five participants in this type of grant during 2011.

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.



Figure 3. Large-size Stop Aquatic Hitchhikers! signs that are provided by DNR for water accesses.



Figure 4. Burma Shave style signs produced and posted by the Fifty Lakes Property Owners Association in 2011 with local and DNR prevention grants funds.

Table 4. Summary of DNR Prevention Grants completed in 2011.

Local Entity	Grant (Value of Inspections)	Grant Types	Specific Grant Activities
Bay Lake Association	\$2,224	DNR Watercraft Inspections	287 grant hours completed
Big Cormorant Lake Association	\$4,053	DNR Watercraft Inspections	523 grant hours completed
Carlton County and Chub Lake Association	\$496	DNR Watercraft Inspections	64 grant hours completed
Child, Girl, and Woman Lake Property Owners Association	\$670	DNR Watercraft Inspections	87 grant hours completed
Chisago/South Lindstrom Lakes	\$2,217	DNR Watercraft Inspections	286 grant hours completed
City of Big Lake	\$1,550	DNR Watercraft Inspections	200 grant hours completed
Comfort Lake Forest Lake Watershed District	\$3,875	DNR Watercraft Inspections	500 grant hours completed
Cowdry, Taylor, Stony and Union Lakes Association	\$279	DNR Watercraft Inspections	36 grant hours completed
Green Lake Property Owners Association	\$4,634	DNR Watercraft Inspections	598 grant hours completed
Gull Lake Association	\$659	DNR Watercraft Inspections	85 grant hours completed
Hubbard County COLA	\$2,900	DNR Watercraft Inspections	374 grant hours completed
Lake Hubert Association	\$202	DNR Watercraft Inspections	26 grant hours completed
Lake Ida Association	\$450	DNR Watercraft Inspections	58 hours completed
Lake Minnewashta Conservation District	\$4,588	DNR Watercraft Inspections	592 grant hours completed
Long Lake Association	\$2,139	DNR Watercraft Inspections	276 grant hours completed
Minneapolis Park and Recreation Board	\$628	DNR Watercraft Inspections	81 grant hours completed
Otter Tail Lake Property Owners Association	\$1,728	DNR Watercraft Inspections	223 grant hours completed
Pelican Group of Lakes Improvement District	\$2,240	DNR Watercraft Inspections	289 grant hours completed
Pelican Lake Property Owners Association	\$1,690	DNR Watercraft Inspections	218 grant hours completed
Roosevelt and Lawrence Area Lakes Association	\$744	DNR Watercraft Inspections	96 grant hours completed
Sportsmen's Club of Lake Vermillion	\$3,875	DNR Watercraft Inspections	500 grant hours completed
Sugar Lake Association	\$2,589	DNR Watercraft Inspections	334 grant hours completed
Waterville Lakes Association	\$3,286	DNR Watercraft Inspections	424 grant hours completed
Whitefish Area Property Owners Association	\$837	DNR Watercraft Inspections	108 grant hours completed
Total (24)	\$48,553.00		6,265 grant hours

Table 4. Continued

Local Entity	Grant (Value of Inspections)	Grant Types	Specific Grant Activities
Association of Cass County Lakes	\$2,684	Public Awareness Grant	AIS info packets
Clitherall Lake Association	\$1,114	Public Awareness Grant	AIS handouts, PSAs, flyer, newsletter
Cross Lake Association of Pine County	\$783	Public Awareness Grant	Distributed AIS literature
Crow Wing Lake and Rivers Alliance	\$5,238	Public Awareness Grant	AIS handouts, stickers, reference cards
Crow Wing Soil and Water Conservation District	\$1,790	Public Awareness Grant	AIS poster contest at Brainerd Community Ed
Douglas County Lakes Association	\$4,125	Public Awareness Grant	AIS billboard, AIS tent cards, radio PSAs, buttons
Hubbard County COLA	\$3,210	Public Awareness Grant	AIS billboard, AIS info packets, AIS card
Kimble Lake Association	\$1,462	Public Awareness Grant	Burma Shave style signs with contest
Sand Lake Property Owners Association	\$508	Public Awareness Grant	SAH rulers, AIS info handouts
River Keepers	\$2,050	Public Awareness Grant	Red River map with AIS information
Becker County COLA	\$3,300	Public Awareness Grant	Brochures, holders at water accesses, over the counter holders
Sportsman's Club of Lake Vermilion	\$1,914	Public Awareness Grant	Placemats, AIS ads, banners
Fifty Lakes Property Owners Association	\$1,089	Public Awareness Grant	Burma Shave style signs and contest
Pelican River Watershed District	\$3,144	Public Awareness Grant	AIS videos
Total (14)	\$32,411.00		

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 who applied for the grant (e.g., COLA level, multi-lake or multi-organization projects).

These criteria were used in 2011 to rank and award the grants because there was a much higher demand for grants than funds available. All 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 2011, there were several requests to transport infested water and to divert infested waters. The following entities obtained infested waters permits in 2011 from the DNR Invasive Species Program:

- Cannon River Watershed Partnership for water quality sampling;
- Aitkin County SWCD / Mille Lacs Lake Watershed Management Group for water quality sampling;
- Three Rivers Park District for water quality sampling;
- International Falls Bass Championship for an off-site weighin; and
- Minnesota Department of Natural Resources, Fisheries Section for transport of filtered water from Devil Track Lake for stocking.

Prohibited Invasive Species Permits

State law prohibits the possession, transport, sale, purchase, and import of prohibited invasive species except by permit. In 2011, several permits were issued to entities that did research, education, or control related to prohibited invasive species in the state. Permits, with conditions to avoid spread, were issued to the following entities for the prohibited species listed:

- Minnehaha Creek Watershed District - Eurasian watermilfoil;
- MnDOT-District 3 - zebra mussels, Eurasian watermilfoil, curly-leaf pondweed;
- Prior Lake Association - zebra mussels;
- Great Lakes Aquarium - Sea lamprey, round goby, ruffe, white perch;
- Lake Region Aquatic Weed Harvesting - zebra mussels;
- NRRI - purple loosestrife;
- Minnehaha Creek Watershed District - zebra mussels;
- Chisago Lindstrom Lake Association - Eurasian watermilfoil;
- DNR Parks and Trails staff - zebra mussels;
- Woods End Educational Products - curly-leaf pondweed, Eurasian watermilfoil, and zebra mussels;
- R.R. Handyman / Aquatic Weed Harvesting - zebra mussels; and
- Linder Media Productions - zebra mussels.

In addition, many permits to transport boats and equipment from zebra mussel infested waters for cleaning and winter storage were issued as a general permit to marinas and other lake service providers.

Permits to Harvest Bait from Infested Waters

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

Education and Public Awareness

2011 Highlights

- DNR partnered with the Minnehaha Creek Watershed District, Minneapolis Park and Recreation Board, and City of Minneapolis to develop the “Save Our Summers” campaign to raise awareness about aquatic invasive species among recreational boaters in the Twin Cities metro area
- DNR’s Prevention Grant Program awarded 74 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. One of the grant outcomes in December was the completion of 11 new 30-second video public service announcements (PSAs) about stopping the spread of AIS by boaters, anglers, and waterfowl hunters.
- DNR’s Minnesota State Fair exhibit promoted invasive species awareness through stage events, new displays and banners, and presentations
- Through a multi-entity effort, billboards were posted with the “Stop Hitchhiking Zebra Mussels” message at 40 locations along key state travel routes to and from lake areas.
- DNR’s website was reorganized to make information about invasive species easier to find.

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 - 2011

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 Fishing Opener and Memorial Day. The stations were selected for their listener profiles which correspond with those of boat owners. In addition, paid ads and public service announcements were aired on Minnesota News Network, reaching nearly 60

commercial radio stations throughout greater Minnesota in May and June. Ads also were placed in the Duluth market, Brainerd Lakes area, and Twin Cities. A special program covering fishing, including invasive species issues, 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. Advertising was temporarily suspended for the month of July due to the state government shutdown,

Television

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

A second version of the spot aired in other markets where zebra mussels and Eurasian watermilfoil are a primary concern. This version was shown throughout the spring and early summer on "Minnesota Bound," a popular half-hour program that appeals to both outdoor enthusiasts and general audiences. The ad also aired on other stations in the Twin Cities and in the La Crosse area during both morning and evening newscasts to reach viewers in the greater metropolitan area as well as southeastern Minnesota/southwestern Wisconsin.

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

Newspapers and informational materials

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 including Brainerd, Duluth, Rochester, Twin Cities, and Winona in spring and early summer. The ads also ran in several specialty newspapers and magazines reaching boaters, campers, anglers, outdoor enthusiasts, and tourists.

Print ads also appeared in the Mille Lacs and Aitkin newspapers to keep attention on the increasing zebra mussel population at Lake Mille Lacs, a popular summer vacation destination. In addition, ads were placed in newspapers covering northern Minnesota including Baudette and International Falls to help raise awareness about the continuing spread of spiny waterfleas along the U.S.-Canadian border waters.

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

The 2011 *Minnesota Fishing Regulations* included a section on invasive aquatic species. Descriptions and illustrations of several invasive species were included in the booklet along with a summary of invasive species laws and other pertinent information. The back cover of this year's regulations book featured an invasive species message, listing 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 Aquatic Hitchhikers!" message at 40 locations along key state travel routes to and from lake areas. The billboards were placed beginning in May and continued through September (Figure 5).

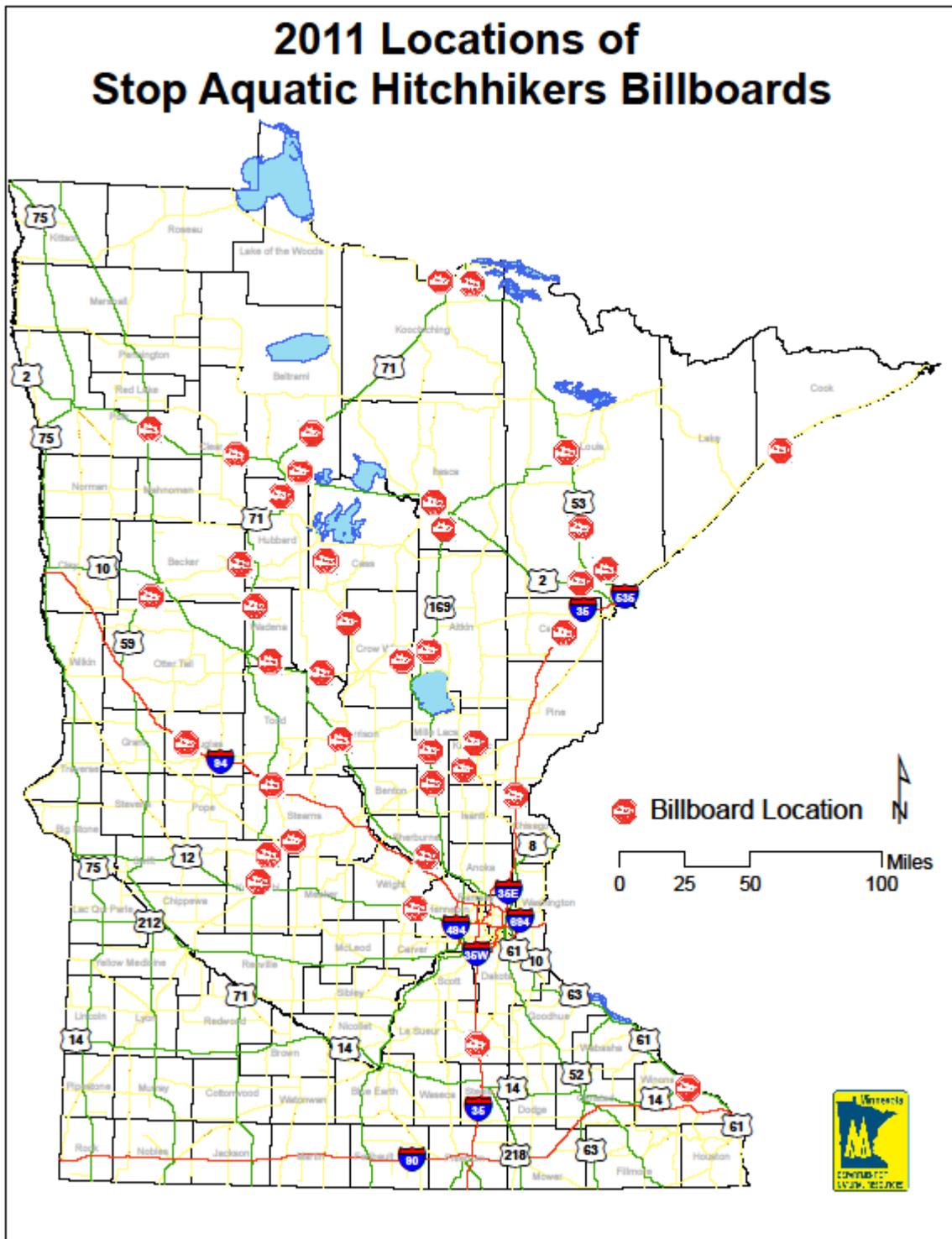


Figure 5. Locations of Stop Aquatic Hitchhikers! billboards.

News releases

News releases alerting the public about invasive species in the state were distributed throughout the year to all major Minnesota media outlets. In addition, several interviews with Minnesota media resulted in expanded television, radio, and print coverage this year, helping to raise awareness about these issues. Major daily and weekly newspapers ran articles generated from the news releases and several of these articles were syndicated to other newspapers around the country.

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 this year to provide the most current information available on invasive species issues (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 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. New informational banners were created and several presentations were given at the outdoor stage. 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 5).

Table 5. Major statewide events staffed by DNR Invasive Species Program and Water Resources Enforcement Officers.

Event	Date	Location
Red River Basin Annual Conference	Jan. 18-20	Fargo
Minneapolis Boat Show	Jan. 20-24	Minneapolis
Sportsmen's Boat, Camping and Vacation Show	Feb. 12-14	St. Cloud
Boat, Sport and Travel Show	Feb. 17-21	Duluth
Winterfest	Feb. 19	Detroit Lakes
Cabela's Outdoor Expo	Mar. 6	Owatonna
Northwest Sportshow	Mar. 30-Apr. 3	Minneapolis
Minnesota Muskie Expo	Apr. 8-10	St. Paul
Lake Home and Cabin Show	Apr. 9-11	Minneapolis
Tracy Area Sportsman's Show	Apr. 17	Tracy
Minnesota Waters Lakes and Rivers Conference	Apr. 28-29	St. Cloud
Minnesota Governor's Fishing Opener	May 13-15	Grand Rapids
Aitkin County Rivers and Lakes Fair	June 18	Aitkin
Minnesota Trapper's Association Convention	July 29-31	Redwood Falls
Crow Wing County Fair	Aug. 2-6	Brainerd
Farmfest	Aug. 3-5	New Ulm
Game Fair	Aug. 6-8, 13-15	Ramsey
Steele County Fair	Aug. 16-21	Owatonna
Minnesota State Fair	Aug. 26-Sept. 6	St. Paul
Todd County Enviro Fest	Sept. 23	Browerville
Minnesota Resort and Campground Association Fall Conference	Oct. 25-27	Ottertail

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 2011 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 44,500 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 13,629 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 2011 Prevention 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 in the state 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 Seaplane Pilots Association

DNR staff worked with the Minnesota Seaplane Pilots Association to develop and post new signs (right) for seaplane bases in the state in 2011.

Minnesota Invasive Species Advisory Council

The Minnesota Invasive Species Advisory Council (MISAC) produced a 2012 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.



Wildlife Forever

Wildlife Forever continued to be a key partner to raise awareness in Minnesota and other states during 2011. 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 58 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 (NOAA). Several highlights of Minnesota Sea Grant's AIS outreach and research activities in 2011 are listed below:

Leadership and Service

Sea Grant staff serve on state, regional, and national task forces and committees including the: Minnesota Invasive Species Advisory Council, DNR's AIS Prevention Stakeholder Team, DNR's Invasive Species Education Planning Committee, 2012 Upper Midwest Invasive Species Conference Executive Planning Committee, Great Lakes Panel on ANS (at-large member) and Information/Education Committee (chair), Lake Superior AIS Prevention Team, Binational Program's Lake Superior Lakewide Management Program Work Group, and Great Lakes Ballast Water Collaborative (GLBWC).

Outreach

Sea Grant and its partners reached over 34,400 people through direct programming at 82 events, meetings, workshops, and conferences. More than 38 talks were given to groups, communities, businesses, industries, agencies, and task forces across Minnesota and beyond.

Of those people reached, Sea Grant and its partners promoted the *Stop Aquatic Hitchhikers!* campaign at 34 events including the Duluth Boat, Sports, Travel, and RV Show, 79th Annual Northwest Sportshow (Minneapolis), 54th Annual Conference on Great Lakes Research (Duluth), Mills Fleet Farm *Kid's Fishing Day* (eleven locations), Lake Superior Days (Duluth), Minnesota State Fair, Ely's Blueberry Festival, and Grand Marais' Fisherman's Picnic.

Sea Grant co-leads *Habitattitude*, a national campaign to educate aquarists and water gardeners about the importance of not releasing unwanted aquarium pets and plants into the environment. Staff promoted the campaign during 36 events including River Quest, 54th Annual Conference on Great Lakes Research (poster), Lake Superior Watershed Festival, and through the Great Lakes Aquarium's new Invasive Species Exhibit.

Sea Grant provided leadership and expertise at more than a dozen events related to ballast water and maritime commerce. Staff were actively engaged in many activities related to ballast water AIS outreach, education, and policy development across the Great Lakes, including the GLBWC. A major priority of the GLBWC is development of a transfer risk mitigation project. The purpose of the project is to improve understanding of the risk for transfer of AIS, revise ballast water management practices for domestic vessels, and recommend short-term risk mitigation measures that can be taken.

Staff worked collaboratively with the University of Minnesota Extension's Shoreland Education Team to promote workshops for lake associations on shoreland buffers, plantings, and plant identification. Several stories on invasive species were featured in the *From Shore to Shore* newsletter.

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 and empower communities along the North Shore of Lake Superior to join the fight against the spread of AIS. Staff gave over a dozen talks at lake association meetings, workshops, conferences, and in classrooms that support community efforts to promote awareness. Through this effort, Sea Grant co-hosted with community partners nearly two dozen booths at sport shows, county fairs, and special events. Media pickups in newsletters, radio, and television helped to reach a potential audience of over 11,000 people with prevention messages.

The Great Lakes Sea Grant Network (GLSGN) project, led by Minnesota, 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 a total of 136 talks at meetings and other events; supported mass media communications efforts by Wildlife Forever and other partners; coordinated production of 12 new *Stop Aquatic Hitchhikers!* educational resources, co-hosted 90 displays at boat, sports, and travel shows and other events; posted education messages via social media such as Tweets, podcasts, RSS feeds, and radio interviews; and issued eight news releases that generated 61 story placements in newspapers, radio, television, and e-news. The youth education component, *Nab the Aquatic Invader* featuring *SAH!*, taught 21,663 students and teachers through teacher education workshops, stewardship projects, and AIS service learning courses. Together, AIS awareness through the *SAH!* campaign generated 5.1 million exposures.

Building upon this successful effort, EPA awarded Minnesota Sea Grant, on behalf of the GLSGN, a new two-year GLRI grant to strengthen and broaden regional AIS outreach efforts. Working with partners in the pet and plant industries, the GLSGN will use a variety of marketing and education techniques to broaden the *Habitattitude* campaign partnership. Work will also help federal, state, and tribal agencies, businesses, academia, and non-governmental organizations prevent the spread of both terrestrial and aquatic invasive species through HACCP training workshops and new materials (see <http://www.seagrants.umn.edu/ais/haccp>). These entities could spread invasive species through the movement of field equipment or other research or management activities if appropriate actions are not taken.

Based on a grant from the National Oceanic and Atmospheric Administration-National Sea Grant Program, GLSGN, led by Wisconsin, began a two-year, multi-state outreach effort in partnership with fishing tournament organizers and professional anglers. For

the Minnesota component, Sea Grant supported four events: Cabela's *Masters Walleye Circuit* (Lake City, June), Sportsman's Club of Lake Vermilion *Take a Kid Fishing Day*, which was co-hosted by professional anglers (Tower, July), the North American Bass Circuit (Lake Minnetonka, August), and the 2011 Cabela's Masters Walleye Circuit World Championship (Prairie du Chien, WI, October).

Youth Education

Sea Grant reached nearly 1,400 students about AIS in the Duluth area and beyond. Events and schools included: Great Lakes Aquarium's *Partners in Education*; *River Quest*; Mills Fleet Farm *Kids' Fishing Day* (11 locations in Minnesota); Pike Lake School *Forestry Days*, *Upward Bound*, Woodland Hills Academy, and Oshki Ogimaag Charter School (Grand Marais).

Research

Sea Grant co-sponsored and lead research-focused efforts aimed at helping gain a better understanding for control and impacts of AIS. Two highlights are featured below:

- Sea Grant was a co-sponsor of the 54th Annual Conference on Great Lakes Research held in Duluth in May-June 2011.
- Minnesota Sea Grant funded a small research project to examine if the sea lamprey's autoimmune system could be used to prevent lamprey maturation, which, if successful, might be used for population control.

Future needs for public awareness in Minnesota

- Increase spending on paid public awareness radio/TV spots and newspaper ads to reinforce high awareness of invasive species by watercraft users.
- Continue to make public awareness of zebra mussels in Minnesota near 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 goal of preventing the spread into and throughout Minnesota. Enforcement activities, whether educational opportunities or issuing citations and warnings, are geared towards compliance. 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. Aquatic Invasive Species (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 officers 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 - 2011

Expanded Enforcement

This was the third full year that included eight officers who were dedicating a significant portion of their work efforts towards invasive species enforcement. This change was implemented as part of an increased focus on enforcement of invasive species laws and the need to have coordinated efforts. Conservation officer hourly goals were also increased to manage the increased work load.

The efforts to increase enforcement of invasive species laws for the 2011 open water season began long before the ice went out. Enforcement and Ecological and Water Resources management and field staff met again to create strategies and to prepare an enforcement plan on a statewide as well as regional and district levels. At the joint staff meetings, and informally in their regions, 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 their 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.

In the time period from January 1, 2011, through the present, Minnesota conservation officers have worked 13,629 hours of invasive species enforcement and held 287 specific aquatic invasive species (AIS) work details which included 5,463 contacts.

In 2011, 487 written citations were issued for invasive species violations statewide (Table 6).

Local Law Enforcement Training - Local, county and state law enforcement agencies were invited to participate in AIS enforcement training. Eight law enforcement training classes were provided across the state with minimal participation. Addition trainings will be offered prior to the open water season in 2012. All enforcement 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.

Regional Enforcement Highlights

Region 1

WREOs attended public meetings throughout 2011 in regard to aquatic invasive species. The meetings included representatives from the Pelican River Watershed District, DNR officials, legislative community information sessions, and lake associations.

WREOs along with staff from Ecological and Water Resources also facilitated and provided training sessions for conservation officers and peace officers as well as lake service providers and bait harvesters.

Conservation officers/WREOs provided coverage for numerous work crews at public water access sites of infested and non-infested lakes. Other enforcement related activity

included: working with conservation officers on the enforcement and sale of frozen herring sold by bait dealers with a source from viral hemorrhagic septicemia- (VHS) infested waters; investigating the arrival of a house boat transported with questionable decontamination actions; and working with Ecological and Water Resources staff with decontamination units at water access sites.

Upon being advised of the introduction of zebra mussels in Rose and Irene lakes, WREOs, conservation officers, and DNR Invasive Species Program staff met to formulate and implement a plan of action. Charges in both cases have been filed.

WREOs along with conservation officers assisted watercraft inspectors in educating the public in the prevention of invasive species as they traveled from lake to lake during the summer months. Officers also educated the public in reference to the use of hunting equipment such as boats and trailers, boots, waders, dogs, and other equipment that can transport invasive species while waterfowl hunting.

Region 2

AIS enforcement this year has been focused, not only on prevention, but also on public access work involving working with Ecological and Water Resources and watercraft inspectors as the state ramped up inspections on lakes with zebra mussels as well as milfoil issues. Inspections of boaters and anglers entering and leaving AIS-infested waters were conducted. Watercraft with issues were put through decontamination with the use of the new, high-pressure wash stations. Enforcement action was taken for transporting AIS and aquatic vegetation from infested waters and on public roadways. The Division of Enforcement ramped up efforts on the “remove the drain plug law” as well as draining water from bait buckets and cleaning water-related equipment when leaving public waters.

Work is ongoing with DNR Fisheries, Ecological and Water Resources, and Enforcement divisions on new rules and emergency rules governing the use of smelt and ciscos in Minnesota for bait. An ongoing investigation is being conducted on importing processed bait that has come from known VHS waters into Minnesota. An out-of-state business has been contacted, and ongoing cooperation with all parties is bringing the case to a close. Fisheries will be monitoring this with Enforcement and USFWS as it develops.

Education and outreach program work continues with area schools, special interest groups, and the public on AIS issues, concerns, and prevention. Work with Minnesota Sea Grant on AIS education was conducted around the state at sport shows, county fairs, state fairs, and outdoor gardening events.

A trip to Colorado by Ecological and Water Resources, Enforcement, and Parks and Trails staff was undertaken. Two days were spent working with Colorado DNR employees to educate Minnesota DNR on its AIS inspection and enforcement programs.

WREOs and area conservation officers attended community events associated with AIS enforcement and education. Angling tournaments at Lake Winnie, Rainy, and tributaries were monitored by Enforcement. Increased respective enforcement efforts included commercial bait harvest monitoring, aquatic plant management permit compliance checks, and continued cooperative work with Leech Lake tribal staff on gill netting and bait harvest in infested waters.

District work details increased at infested Lake Winnibigoshish and tributaries, Rainy Lake and tributaries, Lake Kabetogama, and Namakan Lake. Increased enforcement and education efforts at Bowstring Lake accesses attempted to prevent faucet snail spread from Lake Winnibigoshish and tributaries, protecting remaining scaup populations. Likewise, waterfowl hunting equipment checks were increased. WREOs and conservation officers worked decontamination unit details at Mille Lacs. District conservation officer AIS law enforcement training was conducted. Other agency law enforcement training was offered as well.

Region 3

2011 had been extremely busy with AIS issues in Region 3. Conservation officers and WREOs have worked closely with other DNR divisions to prevent the spread by assisting with wash stations and providing guidance to field staff. Region 3 has some of the most heavily used recreational waters within the state. Lake Minnetonka, Prior Lake, the Mississippi River, and the St. Croix River are all infested with zebra mussels. Not only did officers concentrate efforts to educate the public, but as a region we took steps to prevent the spread by dedicating enforcement boats to specific bodies of water that were infested.

Officers were creative in their efforts to make contact with the public by checking on commercial harvesters, concentrating efforts around large fishing tournaments, and making several media appearance regarding the new AIS laws. Divisional meetings always contained important information about AIS issues and new ideas were solicited from the officers.

Several work crews were organized at infested bodies of water and provided education and some enforcement action to the public. Officers carried the AIS concerns into the waterfowl season by making contact with duck hunters and raising their level of awareness. As 2011 comes to a close, new ideas and thoughts are being evaluated so we can continue to have a strong and calculated response to AIS issues in Region 3.

Region 4

The invasive species 2011 spring season started out with a scare in Waseca County where a pontoon was found to have zebra mussels inside the aerator motors. After investigation, the pontoon was found to have come from a boat lift on Mille Lacs Lake and was being serviced in the Waseca area.

Conservation officers helped educate the public by staffing booths during fishing, hunting, and other sport shows during the winter and spring months. A large part of the education efforts included presentations, training, and education for individuals at sporting shows, lake associations, lake service providers, and bait

dealers. Training was held for other law enforcement agencies on law changes and implementation of these laws.

Conservation officers continued efforts to keep the spread of AIS to a minimum in the southern region through assisting with the new portable decontamination units. They worked with the watercraft inspectors at public water accesses and hosted numerous work crews throughout the open water and fall hunting seasons.

Goals for 2012

The Division of Enforcement continues to focus its efforts towards enforcement and education which have been proven as critical roles in reducing the spread of invasive species. This type of natural resource enforcement is new, so updates and training will be mandated by the division. We will continue to monitor and evaluate our actions to provide the most effective measures available. We will work with 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 is now included in our core responsibilities.

For 2012, 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. This includes participation in lake service provider and bait dealer training and training local law enforcement.

Local Law Enforcement Training - Local, county, and state law enforcement agencies will be invited to participate in aquatic invasive species training which will be offered prior to the open water season in 2012.

Other tasks include developing protocols and obtaining the equipment to safely and effectively administer AIS checkpoints and to provide training for law enforcement agencies. All enforcement 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 in Enforcement Education

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

Officers will continue to work with other Department staff to develop a schedule to train local law enforcement personnel. 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 6. Invasive species violations in 2011 (January 1 - November 30, 2011)

Violation Type	Written Citations	Written Warnings
Transportation of Aquatic Invasive Species	102	57
Fail to Drain Water/Pull Plug	385	294
Miscellaneous		4
Total	487	355

Table 7. Data for specific invasive species enforcement work crews in 2011 (this is a subset of all invasive species enforcement actions and efforts in 2011).

Aquatic Invasive Species Work Crew Data					
	# Contacts	# Citations	# Written Warnings	# Verbal Warnings	Violation Rate
Total	5,463	121	427	431	18%

The violation rate is primarily related to the new drain plug law and boaters not pulling their plugs.

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. Major changes to the numbers are not anticipated.

Regulations and Proposed Changes

Introduction

Issue

Minnesota's regulations related to invasive species of aquatic plants and wild animals, currently 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 (harmful exotic) species.

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

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

In 2007, the Minnesota Pollution Control Agency (MPCA) joined with the DNR to address the ballast water issue spurred by a Federal District Court ruling in late 2006 that vacated federal exemptions of vessel discharges from National Pollutant Discharge Elimination System 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 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 - 2011

State Statute Changes

The Legislature passed extensive legislation that made several modifications and added numerous new authorities and requirements to state statutes related to AIS in 2011. Minnesota Statutes 2008, section 84D.10, was amended as described below (modifications are shown in strike and underline and additions to statutes are shown without strike or underline):

New Definitions

Several new definitions were added to the statutes. They are shown below or in the subsequent sections.

"Decontaminate" means to wash, drain, dry, or thermally or otherwise treat water-related equipment in order to remove or destroy aquatic invasive species using the "Recommended Uniform Minimum Protocols and Standards for Watercraft Interception Programs for Dreissenid Mussels in the Western United States" (September 2009) prepared for the Western Regional Panel on Aquatic Nuisance Species, or other protocols developed by the commissioner. **[Effective 5-28-2011]**

"Inspector" means: (1) an individual trained and authorized by the commissioner to inspect water-related equipment under section 84D.105, subdivision 2, paragraph (a); or (2) a conservation officer or a licensed peace officer. **[Effective 5-28-2011]**

"Water-related equipment" 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 for those vessels permitted under the Pollution Control Agency vessel discharge program, bilge areas, and water-hauling equipment that is capable of containing or transporting aquatic invasive species, aquatic macrophytes, or water. **[Effective 5-28-2011]**

"Wild animal" ~~means a living creature, not human, wild by nature, endowed with sensation and power of voluntary motion~~ has the meaning given under section 97A.015, subdivision 55. **[Effective 5-28-2011]**

Inspections of Watercraft and Other Water-related Equipment

- Compliance with inspection requirements for watercraft and water-related equipment is now an express condition of operating or transporting water-related equipment.

84D.105 INSPECTION OF WATER-RELATED EQUIPMENT.

Subdivision 1. Compliance inspections.

Compliance with aquatic invasive species inspection requirements is an express condition of operating or transporting water-related equipment. An inspector may prohibit an individual from placing or operating water-related equipment in waters of the state if the individual refuses to allow an inspection of the individual's water-related equipment or refuses to remove and dispose of aquatic invasive species, aquatic macrophytes, and water. **[Effective 5-28-2011]**

- Authorized inspectors can visually and tactilely inspect water-related equipment. Conservation officers or licensed peace officers may set up check stations at or near water access sites.

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.

(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. **[Effective 5-28-2011]**

- Inspections include the removal, drainage, decontamination, or treatment to prevent the transportation and spread of AIS, aquatic macrophytes (plants), and water.

"Inspect" means to examine water-related equipment to determine whether aquatic invasive species, aquatic macrophytes, or water is present and includes removal, drainage, decontamination, or treatment to prevent the transportation and spread of aquatic invasive species, aquatic macrophytes, and water. **[Effective 5-28-2011]**

- Authorized inspectors may prohibit the launching or operation of water-related equipment if a person refuses to allow an inspection or does not remove and dispose of AIS, aquatic macrophytes and water.

Boating

- Transportation of aquatic macrophytes on all roads is now prohibited unless specifically exempted. Previous law only prohibited transportation on public roads.

M.S. 84D.09 AQUATIC MACROPHYTES.

Subdivision 1. Transportation prohibited.

A person may not transport aquatic macrophytes ~~on any state forest road as defined by section 89.001, subdivision 14, any road or highway as defined in section 160.02, subdivision 26, or any other public road,~~ except as provided in this section. **[Effective 5-28-2011]**

Subd. 2. Exceptions.

- ...
- (7) when transporting commercial aquatic plant harvesting or control equipment to a suitable location for purposes of cleaning any remaining aquatic macrophytes;
 - (8) that are wild rice harvested under section 84.091; ~~or~~
 - (9) in the form of fragments of emergent aquatic macrophytes incidentally transported in or on watercraft or decoys used for waterfowl hunting during the waterfowl season; ~~or~~
 - (10) when removing water-related equipment from waters of the state for purposes of cleaning off aquatic macrophytes before leaving a water access site. **[Effective 5-28-2011]**

- The statute changes allow for a criminal citation option for violations involving the transportation of aquatic macrophytes, water, and non-compliance with drain plug removal.

84D.13 ENFORCEMENT; PENALTIES.

Subd. 3. Criminal penalties.

(a) A person who violates a provision of ~~section sections~~ sections 84D.03 or 84D.06, 84D.07, 84D.08, or 84D.10 to 84D.11, or a rule adopted under section 84D.12, is guilty of a misdemeanor.

- Draining requirements were expanded to include all water-related equipment and at all waters (rather than infested waters as was in rule). An exception was added to the drain plug law that allows emergency response vehicles and equipment to be transported on a road with the drain plug or other similar device replaced after all water has been drained from the equipment upon leaving the water body.

Subd. 4. Persons leaving public waters; report transporting water-related equipment.

(a) ~~A person~~ When leaving waters of the state a person must drain boating-related water-related equipment holding water and live wells and bilges by removing the drain plug before transporting the watercraft and associated water-related equipment on public roads 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 watercraft on a public road 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 and marine sanitary systems and portable bait containers are excluded exempt from this requirement subdivision.

- Watercraft owners or operators must now 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. After August 1, 2014, failure to display the required rules decal may result in a citation for a petty misdemeanor.

86B.508 AQUATIC INVASIVE SPECIES RULES DECAL.

(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 7-1-2011]

86B.811 CRIMINAL PENALTIES.

Subd. 1a. Petty misdemeanor.

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. [Effective 7-1-2011]

SESSION LAW (Not in statute) - TEMPORARY WARNING REQUIREMENTS; AQUATIC INVASIVE SPECIES RULES DECAL.

A violation of Minnesota Statutes, section 86B.508, prior to August 1, 2014, shall not result in a penalty, but is punishable only by a warning.

Riparian Owners

- Definitions were added or modified in statute to allow docks, boat lifts, and other water-related equipment, which is removed from infested waters and placed on the riparian property on a seasonal basis or for short-term maintenance purposes, to legally be returned to the same waters without removing non-native species from the equipment.

"Transport" means to cause or attempt to cause a species to be carried or moved into or within the state, and includes accepting or receiving the species for transportation or shipment.

Transport does not include:

- (1) the ~~transport~~ movement of infested water or a nonnative species within a water of the state or to a connected water of the state where the species being transported is already present; or
- (2) the movement of a nonnative species attached to water-related equipment or other water-related structures from a water of the state to the shore of riparian property on that water or the return of water-related equipment or structures from the shore into the same water of the state.

[Effective 5-28-2011]

"Introduce" means to place, release, or allow the escape of a nonnative species into a free-living state. Introduce does not include:

- (1) the immediate return of a nonnative species to waters of the state from which the nonnative species was removed; or
- (2) the seasonal return of nonnative species attached to water-related equipment, such as a dock or boat lift, that has been stored on riparian property and directly returned to the same waters of the state from which the water-related equipment was removed. **[Effective 5-28-2011]**

Lake "Service Providers"

- Service providers are defined as individuals or businesses hired to install or remove water-related equipment or structures from waters of the state.

"Service provider" means an individual who installs or removes water-related equipment or structures from waters of the state for hire. "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 5-28-2011]**

- Service providers must now obtain a permit from DNR before providing any services and must have a valid permit in possession while providing services. Service providers must complete invasive species training and pass an examination in order to qualify for a permit. Permits are valid for three years. The employees working for service providers are required to complete DNR aquatic invasive species training. That training will be provided online.

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. **[Effective 7-1-2011]**

Subd. 2. Permit requirements.

(a) Service providers must complete invasive species training provided by the commissioner and pass an examination to qualify for a permit. Service provider permits are valid for three calendar years.

- (b) A \$50 application and testing fee is required for service provider permit applications.
- (c) Persons working for a permittee must satisfactorily complete aquatic invasive species-related training provided by the commissioner. **[Effective 7-1-2011]**

Bait Harvesting

- Annual AIS training is now required from DNR for the employees of a permittee who work in designated infested waters. This training will be provided by DNR online.

84D.11 PERMITS. Subd. 2a. Harvest of bait from infested waters.

The permit shall include conditions necessary to avoid spreading aquatic invasive species.

- (b) Before receiving a permit, or working for a permittee, a person annually must satisfactorily complete aquatic invasive species-related training provided by the commissioner. **[Effective 7-1-2011]**

- Bait harvest is not allowed in waters designated as infested because they have certifiable diseases of fish. Permits to harvest may not be issued for those waters either.

Subd. 3. Bait harvest from infested waters.

(a) ~~The Taking of 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, the taking of wild animals may be permitted for: ...

84D.11 PERMITS. Subd. 2a. Harvest of bait from infested waters.

(a) The commissioner may issue a permit to allow the harvest of bait:

- (1) from 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 in section 17.4982, subdivision 6; and
- (2) from infested waters as allowed under section 97C.341, paragraph(c).

- Equipment authorized for minnow harvest in a designated infested water may not be transported to, or used in, any other waters unless specifically authorized by a permit.

84D.03 INFESTED WATERS; RESTRICTED ACTIVITIES.

Subd. 3. Bait harvest from infested waters.

(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 5-28-2011]**

Commercial Fishing

- The tagging requirements for commercial fishing equipment were modified to be similar to the requirements on bait harvesting equipment. Gear in infested waters, except Lake Superior must be tagged with infested waters tags provided by DNR.

Subd. 4. Commercial fishing and turtle, frog, and crayfish harvesting restrictions in infested and noninfested waters.

(a) All nets, traps, buoys, anchors, stakes, and lines used for commercial fishing or turtle, frog, or crayfish harvesting in an infested water that is designated because it contains invasive fish, invertebrates, or certifiable diseases, as defined in section 17.4982, may not be used in any other waters. If a commercial licensee operates in ~~both~~ an infested water designated because it contains invasive fish, invertebrates, or certifiable diseases, as defined in section 17.4982, ~~and other waters~~, all nets, traps, buoys, anchors, stakes, and lines used for commercial fishing or turtle, frog, or crayfish harvesting in waters ~~not~~ designated as infested with invasive fish,

invertebrates, or certifiable diseases, as defined in section 17.4982, must be tagged with tags provided by the commissioner, as specified in the commercial licensee's license or permit, and may not be used in infested waters designated because the waters contain invasive fish, invertebrates, or certifiable diseases, as defined in section 17.4982. This tagging requirement does not apply to commercial fishing equipment used in Lake Superior. [Effective 5-28-2011]

Local Governments

- The statutes were changed so the civil penalties collected from violators now goes to the governmental entity that issued the citation.

Subd. 7. Satisfaction of civil penalties.

A civil penalty is due and a watercraft license suspension is effective 30 days after issuance of the civil citation. A civil penalty collected under this section ~~is payable to~~ must be paid to either: (1) the commissioner if the citation was issued by a conservation officer and must be credited to the invasive species account; or (2) the treasury of the unit of government employing the officer who issued the civil citation. [Effective 5-28-2011]

Technical Changes

- Some technical edits were made to reflect changes in new terms used in M.S. 84D and other state regulations regarding aquatic plant management.

84D.10 WATERCRAFT 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 aquatic plant harvesting or control equipment that has aquatic macrophytes, zebra mussels, or prohibited invasive species attached except as provided in this section. [Effective 5-28-2011]

84D.10 WATERCRAFT REQUIREMENTS AND PROHIBITIONS.

Subd. 3. Removal and confinement.

(a) A conservation officer or other licensed peace officer may order:

- (1) the removal of aquatic macrophytes or prohibited invasive species from ~~a trailer or watercraft~~ water-related equipment before it is placed into waters of the state;*
- (2) confinement of the ~~watercraft~~ water-related equipment at a mooring, dock, or other location until the ~~watercraft~~ water-related equipment is removed from the water; and*
- (3) removal of ~~a watercraft~~ water-related equipment from waters of the state to remove prohibited invasive species if the water has not been designated by the commissioner as being infested with that species; and*
- (4) a prohibition on placing water-related equipment into waters of the state when the water-related equipment has aquatic macrophytes or prohibited invasive species attached in violation of subdivision 1 or when water has not been drained or the drain plug has not been removed in violation of subdivision 4.*

(b) An inspector who is not a licensed peace officer may issue orders under paragraph (a), clauses (1), (3), and (4). [Effective 5-28-2011]

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 2011.

DNR Commissioner's Orders

Two Commissioner's Orders were issued in 2011 to designate additional infested waters. The orders were published in the *State Register* on April 21, and October 3,

2011. Another will be issued in early 2012 to cover new infestations discovered in late 2011.

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 establishment of state and federal ballast water regulations protective of Minnesota and the nation's waters.
- Seek legislative changes on AIS prevention in 2012 that build on 2011 legislation.

Watercraft Inspections and Awareness Events

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 8). As of 2011, the statutory requirement was repealed and additional inspection authorities were granted to the Commissioner of Natural Resources.

Goals

The goal of the Watercraft Inspection Program helps to achieve 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;
- 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 - 2011

Complete watercraft inspections

In 2011, approximately 98 watercraft inspectors worked during the open water season inspecting boats and providing information to the public on watercraft inspections and invasive species. Inspections began in late April and continued through mid-October. Within this 25-week period, watercraft inspectors logged over 44,500 inspection hours (Table 8). A total of 75,800 watercraft/trailers were inspected throughout the state (Figure 8).

During the open water season, inspections were conducted at 66 fishing tournaments. Although our primary audience is recreational boaters, watercraft inspections also continued through October in order to reach waterfowl hunters. Inspectors distributed more than 6,200 Invasive Alert Tags on vehicles with trailers at access points on infested waters. Inspectors also worked to clear aquatic plant fragments from the public water accesses at which they were stationed.

Table 8. 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, and 2011. (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

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

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

This approach is effective in targeting 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 6). 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 reverse this trend, we created a tiered system to further refine our 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 from 2010 (Table 8), 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 6).

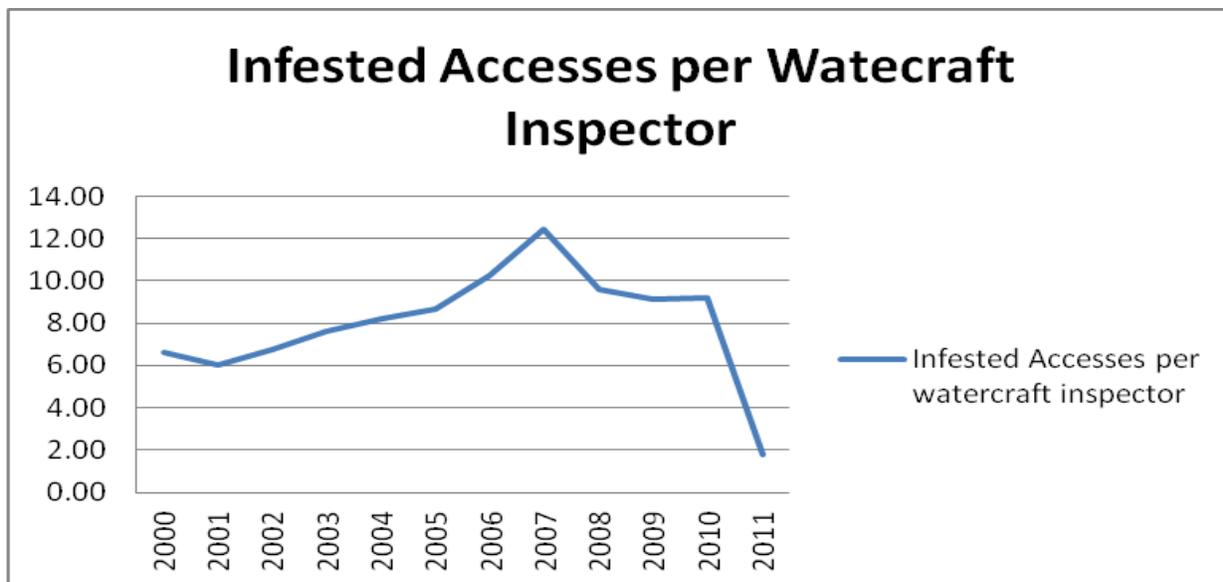


Figure 6. Watercraft accesses on infested waters per watercraft inspector.

In addition to the hours of watercraft inspection that are directed by the goals of the Invasive Species Program, we also offered about 15,000 hours of watercraft inspection through grants to local groups. Typically, citizen groups want additional hours of inspection on lakes where they live or recreate. Watercraft inspection grants provide a one-to-one match for hours paid for 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 their water body that could be carrying aquatic invasive species. (Figure 7).

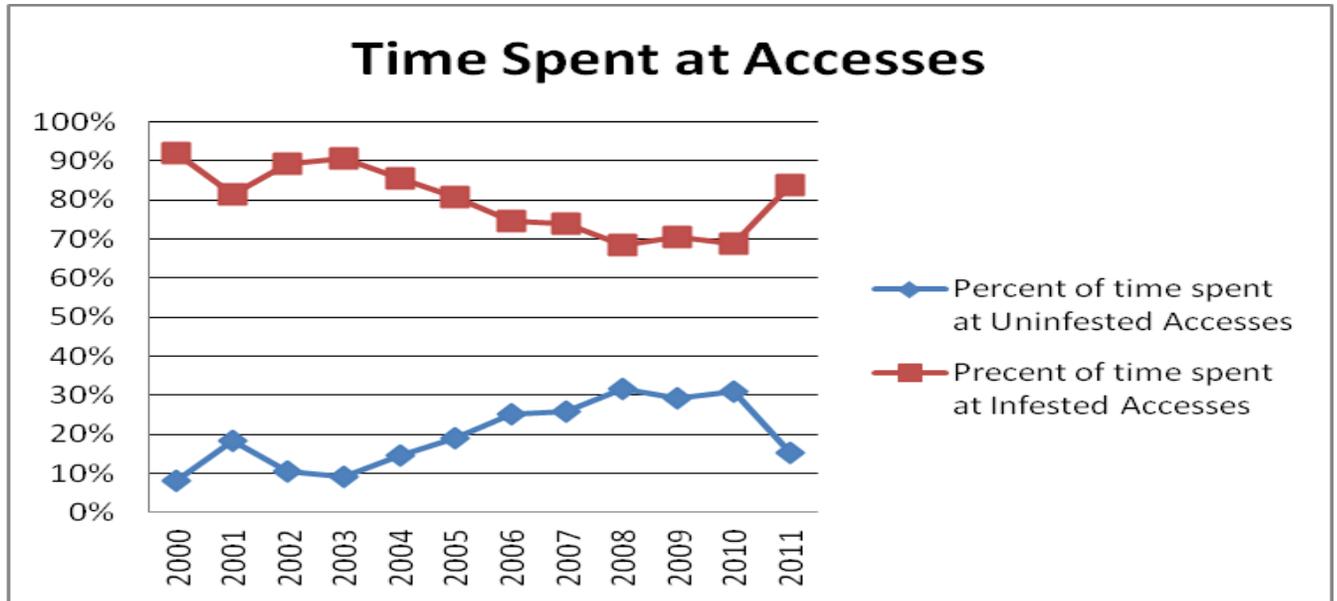


Figure 7. Percent of watercraft inspection hours spent at infested and non-infested water bodies.

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. During 2010, 11,800 hours were spent at non-infested accesses resulting in 14,000 inspections. During 2011, 45% of the previous year’s time (5,000 hours) was spent at non-infested accesses, resulting in 12,000 inspections which is comparable to the 2010 number of inspections on non-infested waters.

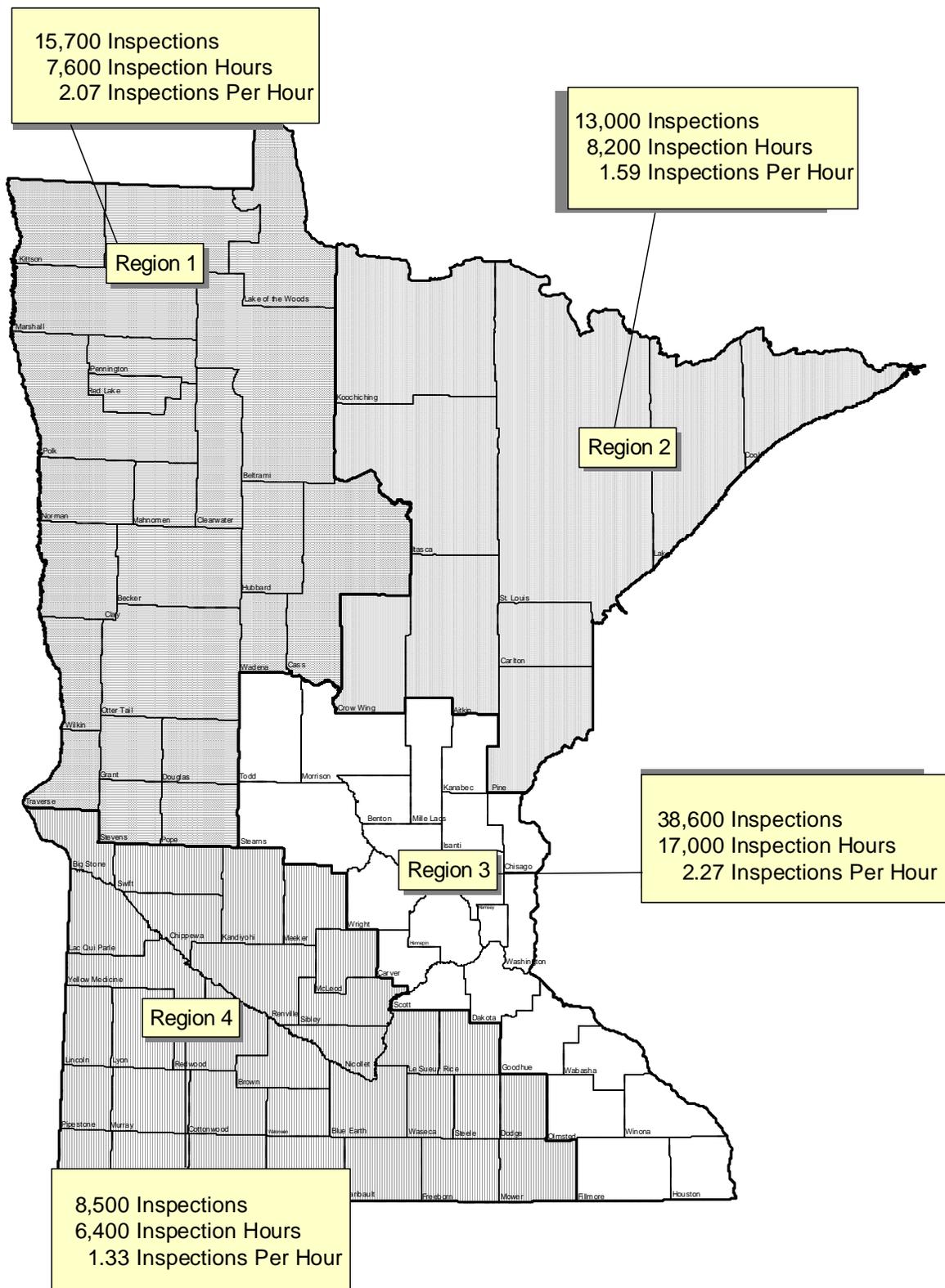


Figure 8. DNR watercraft inspections at public water accesses in 2011.

Increase public awareness

Each boater contacted by a watercraft inspector is asked a standard series of questions. These surveys provide important information on the public’s awareness of invasive species laws. According to survey information collected by watercraft inspectors, awareness of invasive species laws remains very high among Minnesota boaters (Figure 9).

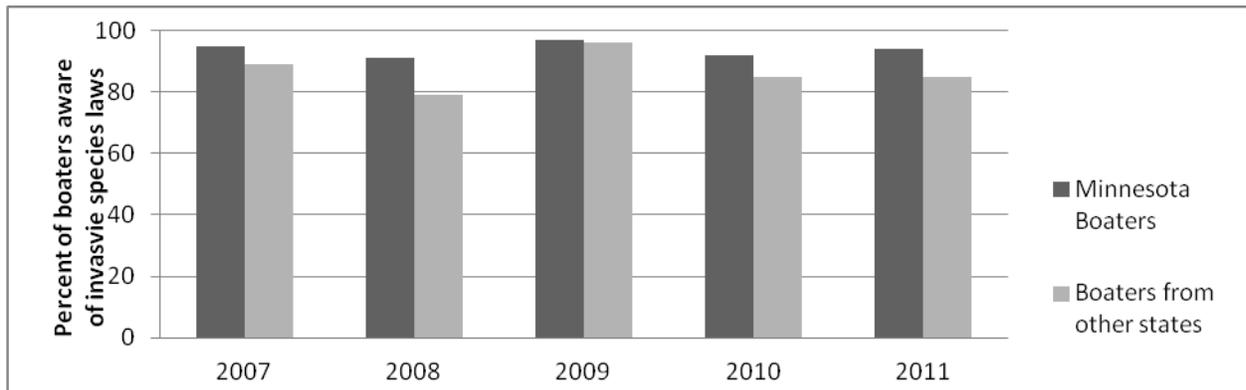


Figure 9. Percentage of boaters from Minnesota and other states that were aware of Minnesota’s invasive species laws.

Partnerships with citizen groups in 2011

During the 2011 season, the Invasive Species Program granted 23,500 hours of watercraft inspection time to Minnesota citizen groups. Of the 23,500 hours, 15,000 hours were performed by DNR staff and were granted to 29 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 also offered as a pilot project in 2011. Six grants for a total of 8,500 hours were awarded to LGUs around the state.

The Watercraft Inspection Program also helped citizen groups increase the number of hours of watercraft inspection at watercraft accesses by conducting volunteer training sessions so that citizens could do inspections at waters where they live or recreate. In 2011, the Watercraft Inspection Program more than doubled the number of volunteer or LGU training sessions from 18 in 2010 to 41 in 2011. The Watercraft Inspection Program also attended 12 events or meetings where we shared information about invasive species and how to prevent their transport. 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 and Proposed Changes) continues to help us educate boaters about the importance of draining all water before transporting their watercraft.

In 2011, inspectors did intercept many watercraft arriving at accesses in violation of state laws. There were 444 watercraft users found to have vegetation attached to their watercraft when entering water accesses in all four regions, with the highest number occurring in Region 3 (Figure 10). Twenty-four watercraft came to the access with zebra mussels in or on their watercraft in 2011. The highest number occurred in Region 2, with 12 watercraft arriving with zebra mussels; there were also four in Region 3 and eight in Region 4. All watercraft attempting to enter a water body with attached vegetation or zebra mussels were asked to remove them before launching their watercraft.

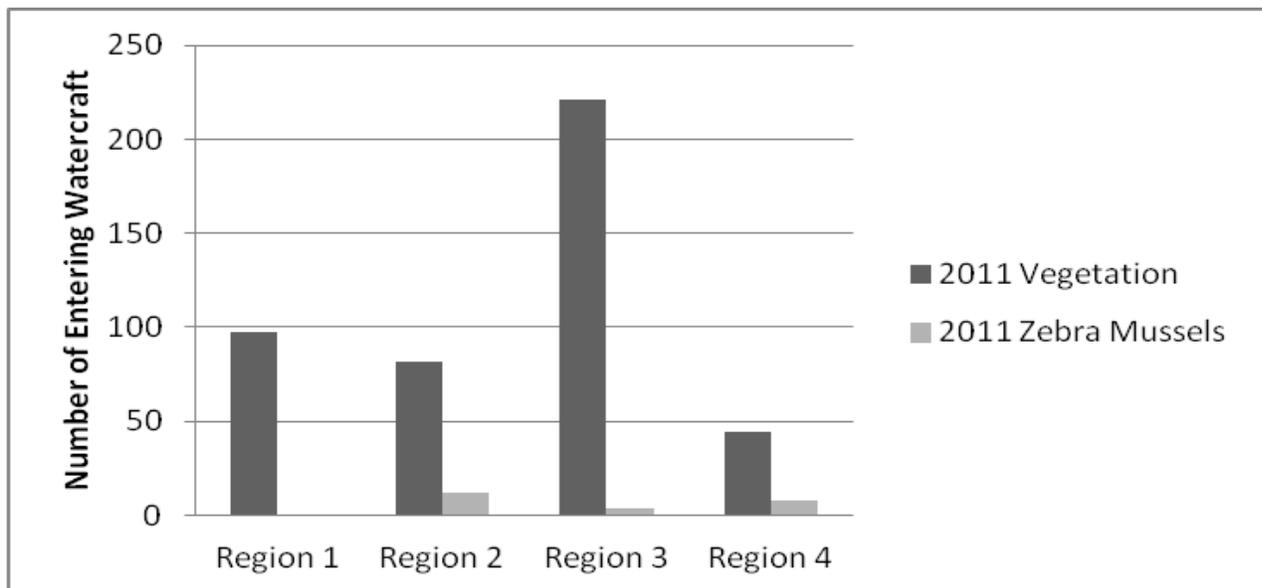


Figure 10. Number of watercraft entering a watercraft access with attached vegetation or zebra mussels per region.

New legislative authority in 2011

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 can, along with conservations officers, visually and tactilely inspect water-related equipment. Those inspections can include the removal, drainage, decontamination, 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 doesn’t remove water or aquatic

invasive species. Authorized inspectors can also require a watercraft to be decontaminated prior to launching into Minnesota waters (Figure 11). 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 will also be trained to use decontamination equipment at the access.

Decontamination Units in 2011

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. In preparation for this pilot program, two members of the Invasive Species Program, two enforcement officers, and a representative from the DNR Division of Parks and Trails traveled to Colorado to learn about its use of decontamination units (Figure 12). The trip to Colorado provided valuable insight into how another state was able to use decontamination units in its program and some of the challenges they had faced.

The Colorado Division of Wildlife also provided DNR staff with its handbooks for inspecting and decontaminating watercraft. We developed new watercraft inspection and decontamination handbooks and protocols with consideration of the Colorado Division of Wildlife and the Western Regional Panel's recommendations. Using the new DNR AIS Watercraft Inspection and Decontamination Handbook, we trained and authorized all Invasive Species Program staff to inspect and decontaminate watercraft. These Invasive Species Program staff members then ran the decontamination units until we were able to hire an additional 17 staff to take over this important work. The new staff started in early September and worked through October 25. The decontamination units were deployed around Detroit Lakes, Alexandria, Brainerd, and the Twin Cities at high-use accesses on zebra mussel-infested waters.



Figure 11. Watercraft Inspection Program staff decontaminating watercraft at Grays Bay access on Lake Minnetonka.

During this 11-week period, DNR staff spent over 1,300 hours at the access, completing inspections and decontaminations when necessary. A total of 2,113 watercraft were inspected; of those 23 (or approximately 1%) required standing water decontamination (a process to ensure water found in the watercraft upon the time of inspection is flushed and heated to ensure no invasive species are transported) and 111 (or approximately

5%) required full decontamination (standing water decontamination plus an exterior hot-water, high-pressure treatment) based on inspection results. Staff also offered courtesy decontamination to watercraft users at the access.

We learned a great deal from operating the decontamination units during this three-month period. We are using the knowledge gained in the 2011 season to modify our approach for the 2012 season. Changes include: new accessories for decontamination units, modified approach to set up at the access, and how inspectors interact with the public. Two members of the Invasive Species Program were able to travel to Nevada for the Lake Mead Watercraft Inspection and Decontamination Training Level II Responder and Trainer Training in early November. This training is sponsored by the Pacific States Marine Fisheries Commission. Training methods and technical information gained from this training also will be used to modify DNR training in 2012.



Figure 12. Invasive Species Program staff decontaminating a watercraft at the Lake Mead Watercraft Inspection and Decontamination Training.

Summary of the 2011 watercraft inspection season

Early in 2011, we made significant changes to the way that we allocate hours of watercraft inspection within the state in response to the growing number of infested waters, emphasizing containment at zebra mussel-infested waters, and the goal of becoming more effective with our time. The tiered system we developed for this effort was very successful and helped us to increase the number of inspections from 66,000 in 2010 to 76,000 in 2011, even though our hours of inspection were reduced by 5,500 in 2011 from 2010.

The biggest challenge the program faced in 2011 was the state government shutdown. The Watercraft Inspection Program lost 20 days of possible watercraft inspection time, including three weekends and the Fourth of July. These lost days resulted in the loss of more than 11,000 hours. The second challenge we dealt with was our inability to meet our goal of hiring 100 watercraft inspectors. Although we did hire 98 inspectors, not all

of them worked the entire season, and we were unable to fill several positions (due to lack of applicants) which meant we were not able to fulfill all of our grant hours.

Planning for the 2012 Watercraft Inspection Season

The Watercraft Inspection Program will face several changes in the 2012 season. The Program will be regionalizing, which means the addition of four regional watercraft inspection supervisors who will be supervised at the regional level. We also will be hiring approximately 100 Level 1 watercraft inspector interns who will be trained to inspect watercraft, and 40 Level 2 watercraft inspectors who will be trained to inspect and decontaminate watercraft. We will be purchasing an additional 20 decontamination units and will continue to use them at high-use, zebra mussel-infested waters. The Level 2 Inspectors and decontamination units will be placed primarily at zebra mussel-infested waters, and some smaller portions of time at destination lakes where boaters travel to after boating at zebra mussel-waters, and for DNR Enforcement checkpoints on roads near water bodies.

Management of Invasive Aquatic Plants – Stakeholder Engagement

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. This effort consists 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 1 was carried out in conjunction with Minnesota Waters by soliciting opinions and concerns from citizens at four meetings held around the state during February and March of 2011. Meetings were held in Fergus Falls (Feb. 16), Brainerd (Feb. 22), West Metro (Feb. 23) and Mankato (Mar. 2). The meetings consisted of two parts: a small group discussion with key stakeholders followed by an open discussion. More than 100 people attended the regional meetings. These meetings are the subject of a report which is available at: http://www.dnr.state.mn.us/eco/invasives/aquatic_plants.html

The report on the Phase 1 meetings was written to serve several purposes: a) reflect back to meeting participants the written opinions that were collected at the meetings; b) share with participants (as well as others who did not participate) some important patterns in the collected opinions; and c) organize Phase 1 information for use in Phase 2.

The goal of Phase 2 was to work with stakeholders to develop recommendations for possible revisions to Minnesota's approach to management of invasive aquatic plants. Phase 2 involved two meetings, one in September and another in November, 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 have about managing infestations, and made recommendations for improving the DNR management of invasive aquatic plants. Several sets of 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 meeting 2 of Phase 2, which was held in November. These improvements to management of invasive aquatic plants by the DNR may be generally described as:

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

The DNR is in the process of implementing these changes.

Management of Curly-leaf Pondweed

2011 Highlights

- The DNR provided grants for 26 pilot projects for lake-wide control of curly-leaf pondweed totaling \$370,000 in 2011.
- Continuing evaluations of lake-wide treatments indicate that:
 - Lake-wide treatments of curly-leaf pondweed reduced the invasive plant during the year of treatment.
 - Overall, most native plants were not harmed by these treatments. Nevertheless, there are enough examples of harm to certain native plants to warrant caution in conducting lake-wide treatments.
 - Reductions in curly-leaf alone are not likely to result in major impacts on clarity of lake water.



Introduction

Issue

Life history of curly-leaf pondweed

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

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).

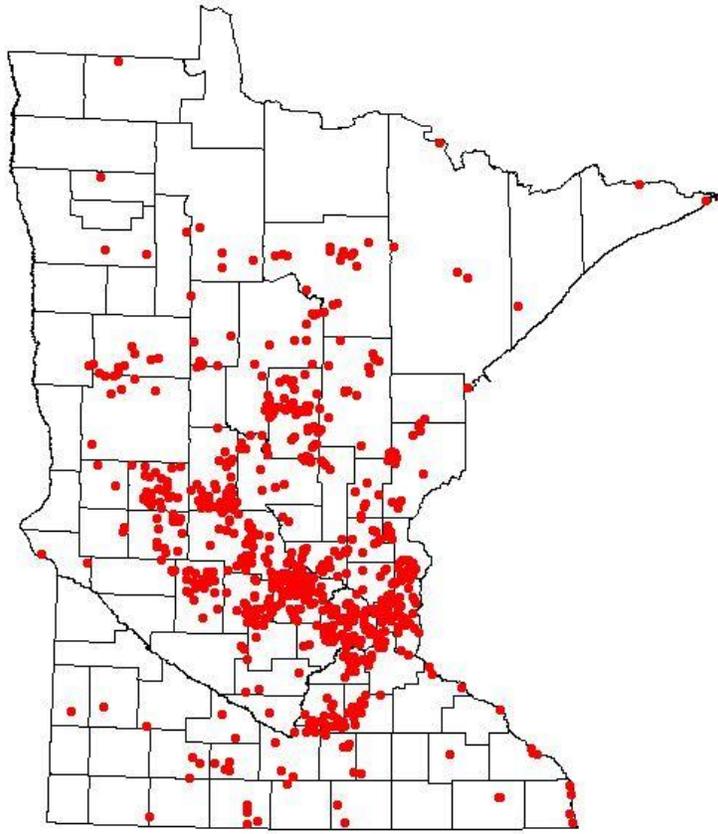


Figure 13. Curly-leaf pondweed locations in Minnesota as of November 2011 (compiled from reports from DNR Fisheries, Wildlife, and Ecological and Water Resources staff).

Prevention of spread

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

Progress in Management of Curly-leaf Pondweed - 2011

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

Lake-wide treatments are those that attempt to treat all, or almost all, of the curly-leaf pondweed in a lake. These treatments usually involve the use of endothall herbicide. To attempt to provide long-term reduction of curly-leaf pondweed, it has been hypothesized that the number of turions in the bottom sediments of a lake must be depleted by treatment for at least several years in succession. These treatments are

expected to significantly reduce the production in spring of new turions, which then sink to the bottom of the lake to sprout at a later time and produce new curly-leaf plants. Even with repeated treatments, it does not appear to be feasible to completely eradicate curly-leaf pondweed from a water body (Newman et al. 2010). This may be due to survival of some plants or turions, or germination of seeds. Research done by the Engineer Research and Development Center (ERDC) of the U.S. Army Corps of Engineers indicated that at least three years of repeated treatments, and possibly four, were needed to significantly reduce the frequency of curly-leaf pondweed in two small lakes (Skogerboe et al. 2008).

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

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

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

In 2011, the DNR received 29 applications for grants to support pilot projects involving lake-wide or bay-wide control of curly-leaf pondweed or primarily curly-leaf pondweed and Eurasian watermilfoil under this program. Of these, 26 proposals were approved (Table 9). Of these, 24 had curly-leaf as the only object of control.

In 2011, three of the pilot projects receiving a grant from the DNR this year have continued long enough to expect long-term control of curly-leaf, i.e., for four to five years (Table 9). Most pilot projects have not completed enough years of treatment to begin to expect to see long-term control. Most lakes with pilot projects are located in the central region, which includes the Twin Cities.

Table 9. Lakes that received grants from the DNR in 2011 to support pilot projects of lake-wide or bay-wide control of curly-leaf pondweed (CLP) or both CLP and Eurasian watermilfoil (EWM) in two cases: Schmidt and Sugar. Endothall herbicide was used for these projects.

Number	Region	County	Lake or Bay Name	DOW	Grant (\$\$\$)	Cost (\$\$\$)	Grant as % of Cost	Year with grant from the DNR
1	NW	Becker	Cormorant,	3.0588	25,000	47,830	52	3
2	NW	Becker	Toad, Big	3.0107	25,000	35,805	70	2
3	NW	Cass	Margaret	11.0222	4,919	4,919	100	3
4	NW	Todd	Latimer	77.0105	10,000	10,071	99	2
5	NW	Wadena	Blueberry	80.0034	25,000	28,730	87	5
6	NE	Aitkin	Gun	1.0099	16,500	15,900	100	1
7	NE	Crow Wing	Cullen, Lower	18.0403	6,560	6,56	100	3
8	NE	Itasca	Dixon	31.0921	18,328	18,328	100	3
9	Central	Anoka	Coon	02.0042	15,000	15,209	99	2
10	Central	Dakota	Orchard	19.0031	16,500	0	0	1
11	Central	Hennepin	Rebecca	27.0192	10,000	6,700	60	1
12	Central	Hennepin	Schmidt	27.1020	4,172	4,172	100	3
13	Central	Isanti	Long	30.0072	20,000	37,056	54	5
14	Central	Isanti	Paul	30.0035	13,605	13,605	100	3
15	Central	Morrison	Fishtrap	49.0137	21,500	22,300	97	1
16	Central	Morrison	Long	49.0015	557	557	100	3
17	Central	Ramsey	Bald Eagle	62.0002	30,000	41,631	72	2
18	Central	Scott	O'Dowd	70.0095	12,549	12,549	100	3
19	Central	Stearns	Brown, North	73.0147	11,500	17,400	66	1
20	Central	Stearns	Schneider	73.0082	6,122	6,122	100	3
21	Central	Wright	Beebe	86.0023	10,000	16,100	62	2
22	Central	Wright	Sugar	86.0233	20,000	27,440	73	3
23	S	Kandiyohi	Nest	34.0154	10,000	15,600	64	2
24	S	Le Sueur	Sakatah	40.0002	7,795	7,795	100	3
25	S	Meeker	Clear	47.0095	20,000	22,987	87	5
26	S	Rice	Roberds	66.0018	10,000	9,900	100	1
Sum					370,607	438,768	84	

Results of pilot projects to control curly-leaf pondweed

The DNR and our cooperators have accumulated a large amount of information on the effects of pilot projects to control curly-leaf pondweed. Here we provide brief summaries of current results in relation to the goals of these efforts.

Goal A. To reduce curly-leaf pondweed or milfoil or both lake-wide (or bay-wide) in the year of treatment

Lake-wide treatments with herbicides reduced the frequency, biomass, and surface matting of curly-leaf pondweed during the year of treatment (Johnson 2010?).

Goal B. To provide long-term reduction in curly-leaf pondweed or milfoil or both in the lake

In some cases, lake-wide treatments with the herbicides used reduced the amount of area occupied by curly-leaf pondweed in the year following treatment. The duration or longevity of these reductions is not yet well understood for curly-leaf pondweed. Since lake-wide treatments for four to five years have not eliminated curly-leaf pondweed, continued management would be required on lakes where there is desire to limit the problems caused by the plant.

Following the first year of lake-wide treatment, the average density of turions in lake sediments appeared to decrease by half (Johnson 2010). Thereafter, the density of turions in lake sediments remained stable during four to five consecutive years of treatment.

Goal C. To increase native submersed plants

In six of nine lakes treated to control curly-leaf pondweed, abundance, as reflected by biomass, of native plants appeared to increase over time (Newman et al. 2010, Jones 2010). The principal species that increased included coontail, elodea, and chara. In the other three lakes, biomass of native plants appeared to decrease over time.

Goal D. In the case of curly-leaf pondweed control projects, to reduce levels of phosphorus and algae, and to increase water clarity

Review of results from at least 11 lakes treated to control curly-leaf pondweed did not indicate a consistent trend of increasing water clarity. Control of this invasive species does not seem to be an easy or reliable way to improve water quality in lakes.

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

Lake residents and associations who manage curly-leaf pondweed to reduce nuisances undertake the majority of curly-leaf pondweed management done in Minnesota. This management uses both herbicides and mechanical harvesting. During 2011, DNR staff actively supported efforts to manage nuisance levels of curly-leaf pondweed by providing technical assistance to lake groups working to manage the plant. Technical assistance included conducting lake vegetation surveys, guidance on the best management practices for controlling curly-leaf pondweed, and assistance in writing Lake Vegetation Management Plans (LVMPs).

Effectiveness in Management of Curly-leaf Pondweed - 2011

Efforts by the DNR Invasive Species Program and our partners in lake associations, the University of Minnesota, local units of government, other state agencies, and the U.S. Army Corps of Engineers are producing information upon which to base realistic expectations for management of curly-leaf pondweed. Researchers at the University of Minnesota include Newman et al. (2010), who described results from lake-wide or whole-lake treatments of eight Minnesota lakes to control curly-leaf pondweed and provide ecological benefits (see above).

Participation by Others in Management of Curly-leaf Pondweed - 2011

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

Future needs for management of curly-leaf pondweed

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

References Cited

- Bolduan, B.R., G.C. Van Eeckhout, H.W. Quade, and J.E. Gannon. 1994. *Potamogeton crispus* - the other invader. *Lake and Reservoir Management* 10(2):113-125.
- Catling, P.M. and I. Dobson. 1985. The biology of Canadian weeds. 69. *Potamogeton crispus* L. *Canadian Journal of Plant Science* 65:655-668.
- 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. 2010. Evaluation of lake-wide, early-season herbicide treatments for controlling invasive curly-leaf pondweed (*Potamogeton crispus*) in Minnesota lakes. MS Thesis. University of Minnesota.
- Jones, A. R. 2010. Effects of repeated early season herbicide treatments of curly-leaf pondweed on native macrophyte assemblages in Minnesota lakes. MS Thesis. University of Minnesota, St. Paul, MN.
- 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.
- Newman, R.M., A. R. Jones, and J.A. Johnson. 2010. Evaluation of lake-wide herbicide treatments for controlling curly-leaf pondweed. Completion Report to Minnesota Department of Natural Resources – Ecological Services June 2011. Unpublished completion report submitted by the Fisheries, Wildlife and Conservation Biology Program, University of Minnesota, St. Paul, MN 55108 to the Minnesota Department of Natural Resources, Division of Ecological and Water Resources, 500 Lafayette Rd., Saint Paul, MN 55155. [June]
- Skogerboe, J. G., A. Poovey, K. D. Getsinger, W. Crowell, E. Macbeth. 2008. Early season, low-dose applications of endothall to selectively control curly-leaf pondweed in Minnesota lakes. Aquatic Plant Control Research Program Technical Note (ERDC/TN APCRP-CC-08) U.S. Army Engineer Research and Development Center, Vicksburg, MS.
- Wehrmeister and Stuckey. 1978. The life history of *Potamogeton crispus* with emphasis on its reproductive biology. *Ohio Journal of Science*. 78 (April program and abstract) supplement: 16.

Management of Eurasian Watermilfoil

2011 Highlights

- Eurasian watermilfoil was discovered in 10 additional Minnesota water bodies during 2011. There are now 257 Minnesota lakes, ponds, rivers, and streams where the submersed aquatic invasive plant is known to be present.
- Cooperators on two lakes were reimbursed by the DNR for lake-wide or bay-wide control of Eurasian watermilfoil or primarily Eurasian watermilfoil and secondarily curly-leaf pondweed.
- Cooperators on 22 lakes were reimbursed by the DNR for control of nuisances caused by dense and matted Eurasian watermilfoil in public use areas of the lakes.



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 2011.

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 2011

Milfoil was newly discovered in 10 lakes during 2011 (Figure 14). Milfoil is now known to occur in 257 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.

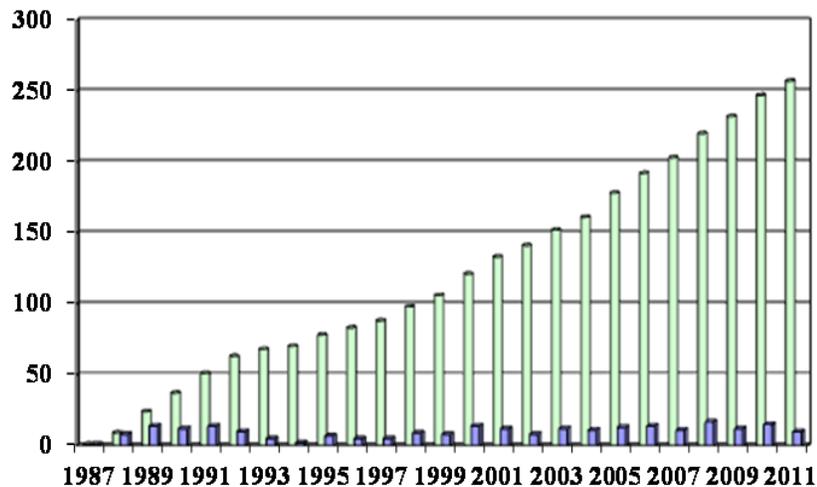


Figure 14. Discovery of water bodies in Minnesota with Eurasian watermilfoil; annual and cumulative numbers.

Discovery of new occurrences of Eurasian watermilfoil in Minnesota

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

Many false reports of milfoil result when other species of submersed vegetation, often forming mats, attract the attention of lake users. These individuals suspect that the abundant vegetation is milfoil and report the occurrence to the Invasive Species Program. During 2011, 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

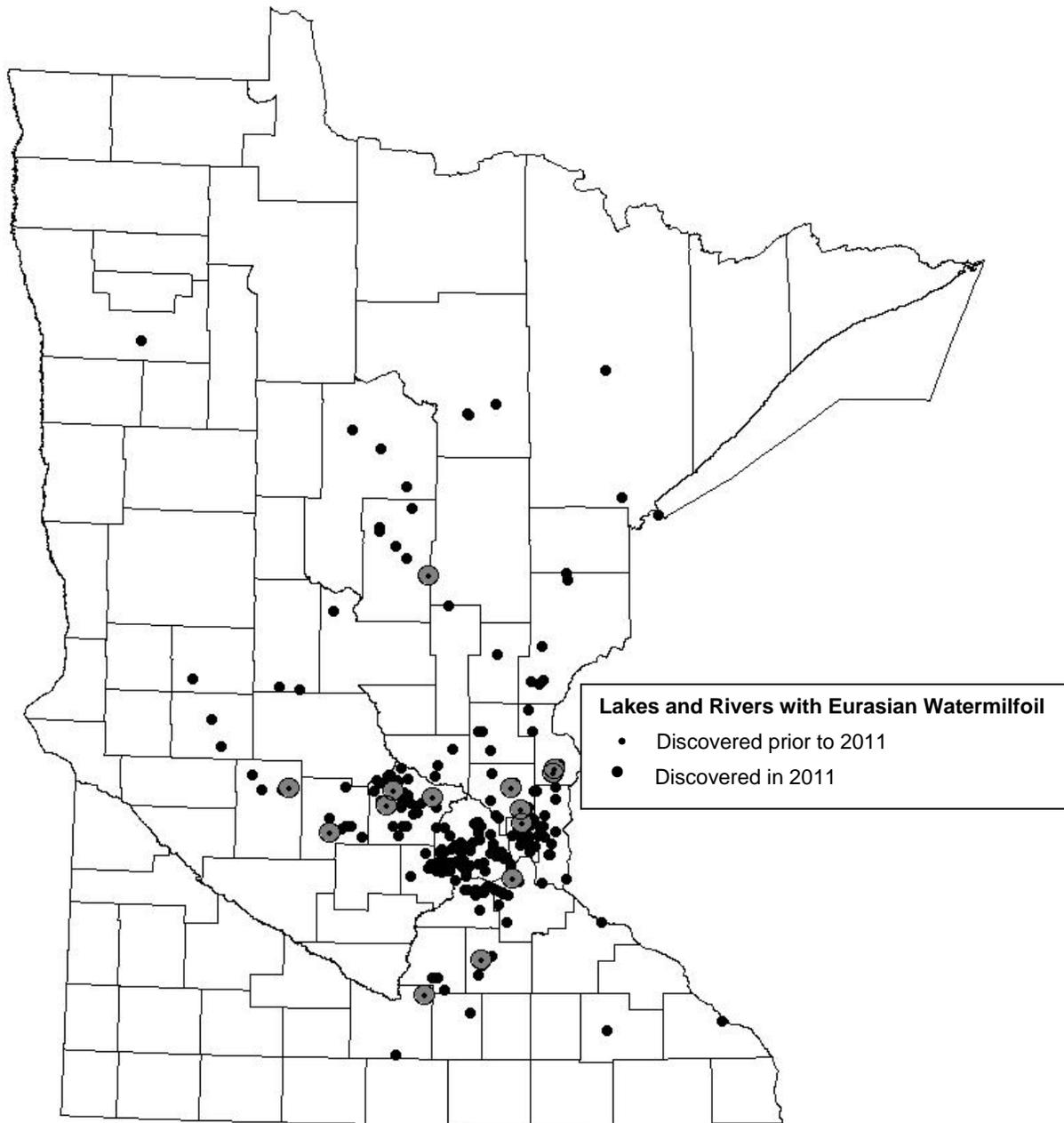


Figure 15. Distribution of water bodies with Eurasian watermilfoil in Minnesota as of November 2011.

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 - 2011

Classification of water bodies for management of Eurasian watermilfoil

In the spring of 2011, the Invasive Species Program classified the 247 bodies of water known to have milfoil (Table 10). One hundred sixty-nine lakes were eligible for management with state funds because they have public water accesses and are protected waters that are regulated by the state (Minnesota Statute 103G.005, Subd. 15). Some lakes were ineligible for management with state funds because they either do not have public water accesses or are not protected waters. Lastly, flowing waters such as rivers and streams are not usually considered for management of milfoil with state funds because 1) users of these waters in Minnesota rarely encounter problems caused by milfoil like those found in lakes; and 2) use of herbicides is less reliable and effective in rivers and streams than in lakes.

Six of the 10 water bodies that were discovered to have milfoil during 2011 were eligible for management with state funds because they have public water accesses. Four lakes found to have milfoil in 2011 have no public water access and, consequently, are ineligible for management with state funds.

Lake-wide or bay-wide control of Eurasian watermilfoil

In 2011, the DNR provided grants to support lake-wide or bay-wide control of Eurasian watermilfoil or Eurasian watermilfoil and curly-leaf pondweed on five bays in one lake and a second lake (Table 11). Control involved the application of two herbicides, triclopyr and, in some cases, endothall also.

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

Table 10. Classification of water bodies in Minnesota with Eurasian watermilfoil during 2011.

Classification	Spring 2011	New in Summer	Fall 2011
Lakes eligible for management with state funds	169	6	175
Lakes ineligible for management with state funds [lack of public access]	70	4	74
Rivers or streams	8	0	8
Total	247	10	257

Table 11. Pilot program - projects granted funding in 2011 for lake-wide or bay-wide control of Eurasian watermilfoil (EWM) or curly-leaf pondweed (CLP) or both. (Endo is endothall and tric is triclopyr) central region only had approved projects

No.	County	Lake or bay	DOW number	Grant from the DNR (\$\$\$)	Total Cost of control (\$\$\$)	Grant from the DNR as percentage of total cost	Herbicide	Year of treatment with a grant for the DNR	Target plant(s)
1	Hennepin	Minnetonka, Gray's	27.013301		0			4	EWM
2	Hennepin	Minnetonka, Carman's	27.013305	17,200	41,000	42	triclopyr	4	EWM
3	Hennepin	Minnetonka, Phelps's	27.013305	19,300	46,000	42	triclopyr	4	EWM
4	Hennepin	Minnetonka, Saint Alban's	27.013304	7,500	58,000	13	triclopyr	1	EWM
5	Hennepin	Minnetonka, Gideon's	27.013302	9,000	68,000	13	triclopyr	1	EWM
6	Sherburne	Big	71.0082	8,100	8,100	100	triclopyr & endothall	3	EWM & CLP
				61,100	221,100				

* Insufficient Eurasian watermilfoil found to treat in spring.

Partial-lake treatments of Eurasian watermilfoil to manage nuisances

During 2011, state funding and technical assistance were available from the Invasive Species Program to potential cooperators for partial-lake treatments of milfoil. The offer of state funding is described in an announcement that is available to potential local cooperators (DNR 2011) who are expected to take the lead in control of the milfoil. The offer is briefly summarized here. The most common activity on lakes that receive funds from the DNR was application of herbicide, followed by mechanical harvesting. These funds are intended to pay for control during spring or early summer of nuisances caused by dense and matted milfoil that will benefit a number of homeowners and the general public who use a lake.

The DNR received applications for state funding to control milfoil from potential cooperators on 27 lakes. Applications were reviewed by the Invasive Species Program in relation to the standards described in the announcement that is available to potential cooperators (DNR 2011). In most cases, the areas with milfoil where control was proposed in these lakes were inspected by staff of the Invasive Species Program. The results of these inspections and recommended modifications of proposed control projects were reported to the potential cooperators and staff in the Aquatic Plant Management Program who issue permits for control. On some lakes, proposals were modified by reducing the size of the area to be treated, and subsequently approved. Twenty-two of the applications were approved for funding. To date, most applicants have been reimbursed for control done in 2011. These reimbursements are expected to comprise a total of \$107,000 once reimbursements are completed.

Early detection and rapid response for Eurasian watermilfoil

In 2011, the DNR offered grants to support early detection and rapid response (EDRR) for Eurasian watermilfoil to be initiated by organizations such as lake associations, conservation districts, watershed districts, and municipalities. The purpose of these grants was to allow people on lakes with newly discovered populations of milfoil to aggressively treat the invasive species in an attempt to prevent spread within the lake. Though the DNR undertook EDRR on milfoil in the past, the experience of the DNR and cooperators was that these efforts did not prevent the spread of milfoil within a lake. While the DNR may initiate EDRR in some cases, e.g., Brazilian waterweed, *Egeria densa*, in Powderhorn Lake, Minneapolis, in 2007, the DNR would be unlikely to do so for milfoil in most cases.

Nevertheless, there is interest among lake associations and other groups in attempts to prevent the spread of new populations of milfoil or flowering rush within lakes, so the DNR is offering limited support for such attempts where specific requirements are met. The principal requirements to be met are that the distribution and abundance of milfoil must be very limited. In 2011, no applications for grants to support EDRR were received by the DNR.

Effectiveness of management of Eurasian watermilfoil in Minnesota lakes

Though the number of Minnesota lakes known to have milfoil increased in 2011, 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 2011 was essentially unchanged by comparison with the previous three years.

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

The Invasive Species Program initiated treatment of milfoil in 18 harbors on Mille Lacs Lake and six harbors on Leech Lake. The purposes of this type of control are to: 1) reduce the risk that users of the lake inadvertently transport milfoil from the lake to other bodies of water; and 2) improve access to the lake. The cost of these treatments was \$12,000.

Technical assistance to cooperators and other citizens

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

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

Cooperation between the Invasive Species Program and organizations outside the DNR such as lake associations and various local units of government was critical to the success achieved in management of milfoil in Minnesota. The Invasive Species Program 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 2011, the DNR established a Cooperative Research and Development Agreement with the U.S. Army Engineer Research and Development Center (ERDC). This agreement enables the DNR to provide funding to the ERDC to support research that is vitally important to Minnesota's efforts to improve management of milfoil and other invasive aquatic plants.

Recent large herbicide treatments targeting Eurasian watermilfoil and curly-leaf pondweed on entire bays in Lake Minnetonka have garnered significant attention from regulators, aquatic plant managers, and various stakeholders from Minnesota lakes. There are still a number of unanswered questions regarding the efficacy and selectivity

of these treatments. In 2011, ERDC researchers monitored the distribution and abundance of both invasive and native plants, before and after treatment with point-intercept surveys (Netherland et al 2011, Netherland and Dean 2011a), biomass (Netherland and Dean 2011b), and cover or biovolume using hydroacoustic sampling (Netherland and Dean 2011c). ERDC researchers also monitored concentrations of herbicide after treatments (Netherland and Dean 2011d).

In 2011, ERDC researchers conducted mesocosm trials in Lewisville, TX to determine the influence of treatment timing and exposure period against Eurasian watermilfoil and three species of native submersed plants (Netherland and Glomski 2011a). The ERDC researchers conducted additional mesocosm trials to evaluate the effects of triclopyr on two floating-leaf and one emergent native plants species (Netherland and Glomski 2011b).

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

- DNR (Minnesota Department of Natural Resources). 2011. Control of Eurasian watermilfoil in 2011: funds available from the Minnesota Department of Natural Resources. Unpublished document by the Minnesota Department of Natural Resources, Division of Ecological and Water Resources, Box 25, 500 Lafayette Road, St. Paul, MN 55155-4025.
- Netherland, Mike, and LeeAnn Glomski. 2011a. Mesocosm evaluation of triclopyr on Eurasian watermilfoil and three native species: The role of treatment timing and exposure. Draft report by the US Army Engineer Research and Development Center, Center for Aquatic and Invasive Plants, 7922 NW 71st Street, Gainesville, FL 32653 submitted to the Minnesota Department of Natural Resources, Division of Ecological and Water Resources, Invasive Species Program, 500 Lafayette Rd., Saint Paul, MN 55155. [Received on 28 November]
- Netherland, Mike, and LeeAnn Glomski. 2011b. Evaluation of liquid and granular triclopyr against waterlily, spatterdock, and hardstem bulrush. Draft report by the US Army Engineer Research and Development Center, Center for Aquatic and Invasive Plants, 7922 NW 71st Street, Gainesville, FL 32653 submitted to the Minnesota Department of Natural Resources, Division of Ecological and Water Resources, Invasive Species Program, 500 Lafayette Rd., Saint Paul, MN 55155. [Received on 28 November]
- Netherland, Michael D., and Dean Jones. 2011a. Aquatic Plant Surveys on St. Alban's and Gideon's bays, Lake Minnetonka, Minnesota in 2011 following large scale herbicide applications. Unpublished report by the US Army Engineer Research and Development Center, Center for Aquatic and Invasive Plants, 7922 NW 71st Street,

Gainesville, FL 32653 and UF IFAS, 1921 Kissimmee Valley Lane, Kissimmee, FL 34744. [8 December]

Netherland, Michael D., and Dean Jones. 2011b. Plant biomass collection on five bays in Lake Minnetonka following large scale triclopyr applications. Unpublished report by the US Army Engineer Research and Development Center, Center for Aquatic and Invasive Plants, 7922 NW 71st Street, Gainesville, FL 32653 and UF IFAS, 1921 Kissimmee Valley Lane, Kissimmee, FL 34744. [8 December]

Netherland, Michael D., and Dean Jones. 2011c. Hydroacoustic data collection on five bays in Lake Minnetonka to determine pre and post-treatment coverage and biovolume of submersed aquatic vegetation. Unpublished report by the US Army Engineer Research and Development Center, Center for Aquatic and Invasive Plants, 7922 NW 71st Street, Gainesville, FL 32653 and UF IFAS, 1921 Kissimmee Valley Lane, Kissimmee, FL 34744. [8 December]

Netherland, Michael D., and Dean Jones. 2011d. Herbicide residue collection on four bays in Lake Minnetonka to determine triclopyr longevity and spatial distribution. Unpublished report by the US Army Engineer Research and Development Center, Center for Aquatic and Invasive Plants, 7922 NW 71st Street, Gainesville, FL 32653 and UF IFAS (Osceola County Extension), 1921 Kissimmee Valley Lane, Kissimmee, FL 34744. [8 December]

Netherland, Michael D., John G. Skogerboe, Angela G. Poovey, and Dean Jones. 2011. Aquatic Plant Surveys on Gray's, Phelp's, and Carman's bays, Lake Minnetonka, Minnesota for 2007 through 2011 following four years of sustained management efforts. Unpublished report by the US Army Engineer Research and Development Center, Center for Aquatic and Invasive Plants, 7922 NW 71st Street, Gainesville, FL 32653; W. 500 Eau Galle Dam Rd., Spring Valley, WI 54767; 3909 Halls Ferry Rd., Vicksburg, MS 39180; and UF IFAS, 1921 Kissimmee Valley Lane, Kissimmee, FL 34744. [8 December]

Management of Flowering Rush

2011 Highlights

- Flowering rush research that was initiated in 2010 by the Pelican River Watershed District (PRWD), Detroit Lakes, Minnesota continued for its second year on the Detroit Lake chain. Research findings from year one were incorporated into the research plan for 2011. The PRWD was again the primary funding source and was complemented with funds from the city of Detroit Lakes and the DNR.
- 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 may also grow as a non-flowering submersed plant with limp, ribbon-like leaves.

The plant spreads primarily vegetatively from thick rhizomes (Figure 16), 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 has also been repeatedly introduced as an ornamental plant. As early as 1973, resource managers and researchers have expressed concern that flowering rush may grow aggressively in North America and displace native wetland vegetation (Anderson et al. 1974; Staniforth and Frego 1980).

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

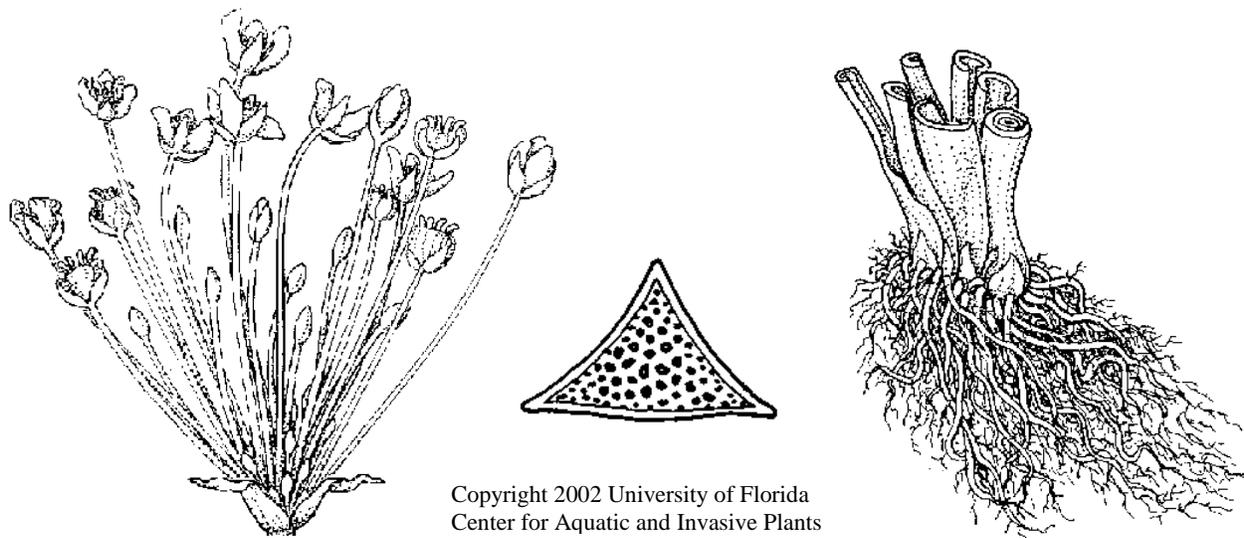


Figure 16. Flowering rush umbel, cross-section of a leaf, and rhizomes.

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 17).

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).

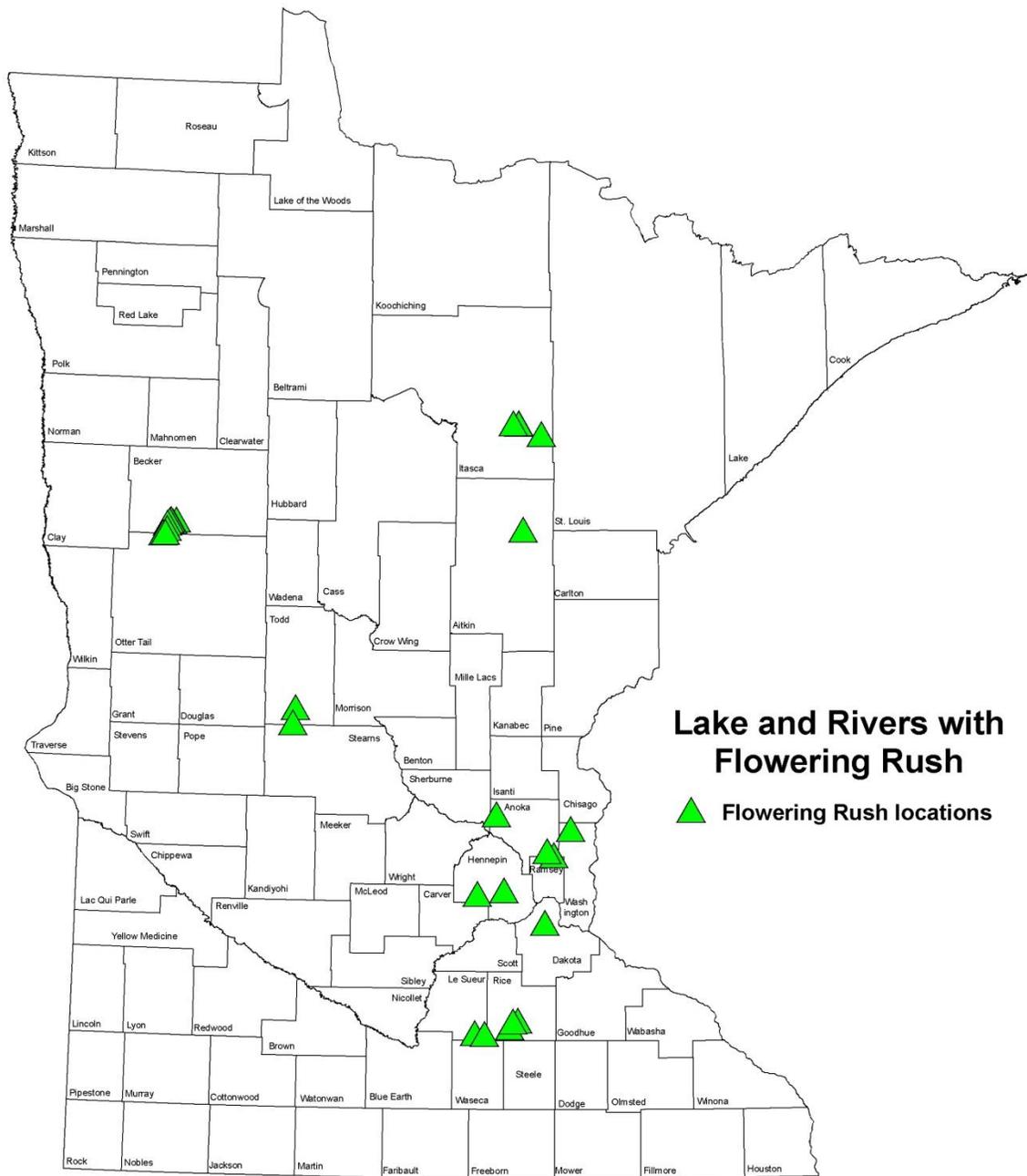


Figure 17. Flowering rush locations as of December 2011.

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 - 2011

In 2011, researchers from the University of Mississippi and Concordia College in Moorhead, Minnesota, continued year two of research projects with assistance from the PRWD, Professional Lake and Land Management of Pequot Lakes Minnesota, U.S. Army Engineer Research and Development Center, and the DNR.

Three research projects continued in 2011;

1. Phenology and assessment of *butomus umbellatus* in the Detroit Lakes area
2. In-lake herbicide trials on submersed *Butomus umbellatus* in Detroit Lake
3. Laboratory herbicide efficacy trials on *Butomus umbellatus*

Preliminary findings from 2010 research were presented and integrated into the research projects for 2011. A complete report on the research findings will be made available in late winter 2012. The DNR remains very appreciative of the initiative taken by organizations and individuals in the Detroit Lakes area to improve management of this invasive plant, and the DNR was able to provide \$30,000 in funds to assist in the research. Results and potential management approaches from these projects will assist the PRWD, the city of Detroit Lakes, the DNR, and others interested in flowering rush management in the future.

The Invasive Species Program also offered funds to support the control of flowering rush along the Detroit Lakes city beach. The city was awarded up to \$6,000 from the DNR to treat just over 9 acres along the mile-long city beach.

The DNR continued to work with riparian property owners and a lake-wide effort to allow flowering rush control through hand removal along the full frontage of an individual property was again permitted. An effort to manage around 25 acres of dense emergent flowering rush near shore on Detroit Lake and other connected lakes using imazapyr was also permitted and work was completed in August.

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 2011. PGOLID plans to continue to monitor for new infestations as flowering rush has not been 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 investigate new methods of controlling flowering rush and to evaluate the results of continuing 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.
- 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.
- 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 (MnDOT), 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 18). In 2011, two new purple loosestrife infestations were identified in Minnesota. There are now 2,408 purple loosestrife infestations recorded statewide (Table 12). 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 - 2011

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

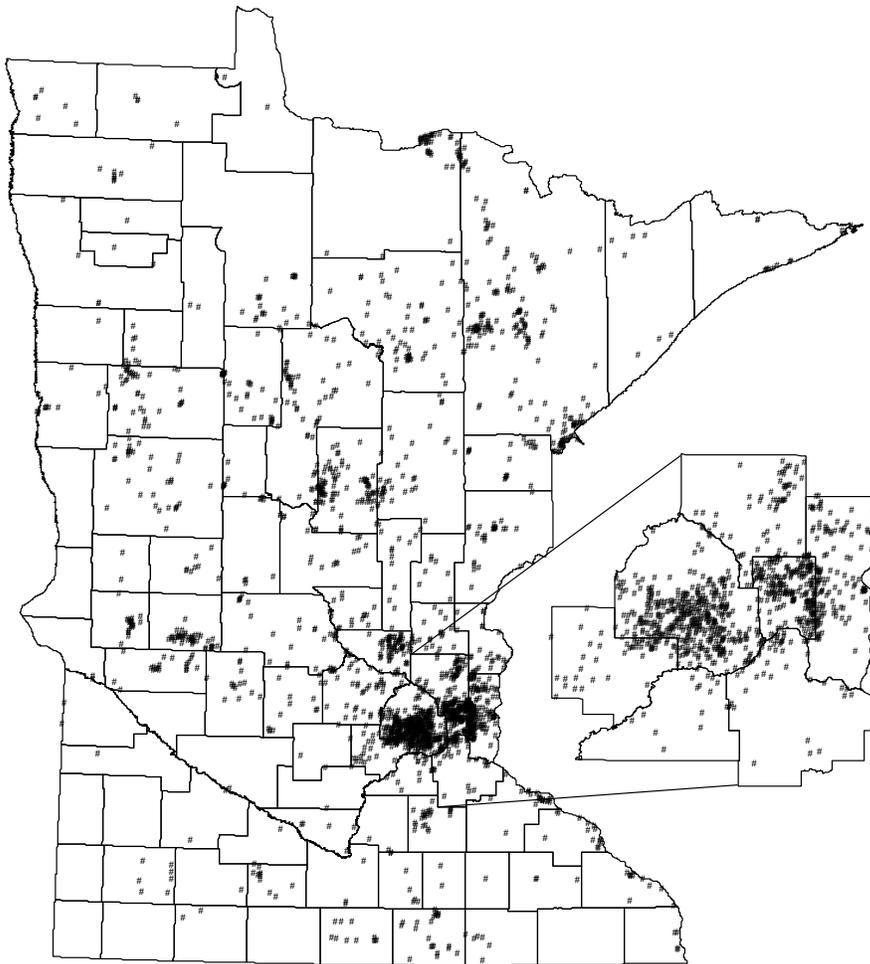


Figure 18. Purple loosestrife infestations in Minnesota as of December 2011.

Table 12. Purple loosestrife infestations in Minnesota recorded by the DNR in 2010 and 2011.

Site Type	Total sites 2010	New sites 2011	Total sites 2011
Lake	735	2	737
River	227	0	227
Wetland	769	0	769
Roadsides and ditches	510	0	510
Other ¹	165	0	165
Total	2,406	2	2,408

¹Includes gardens and other miscellaneous sites.

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

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

Between 1989 and 2011, the number of sites, number of plants, and total cost of treating purple loosestrife with herbicide, have generally decreased (Table 13). 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 2011, only DNR staff was used to treat purple loosestrife stands statewide. DNR staff visited 29 purple loosestrife stands for herbicide control work (Table 13). A total of 29 sites were treated with herbicides. Most of the sites were very small: 86% (25 sites) had fewer than 100 plants. Seven purple loosestrife plants were hand-pulled from four locations. This work took a total of 145 worker hours, and only 0.09 gallons of Rodeo concentrate. The total cost for this effort was \$4,100.

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 2011) is 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 13. Historical herbicide applications performed by DNR and applicators contracted by DNR in Minnesota (1989-2011).

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	145	.09	\$4,100

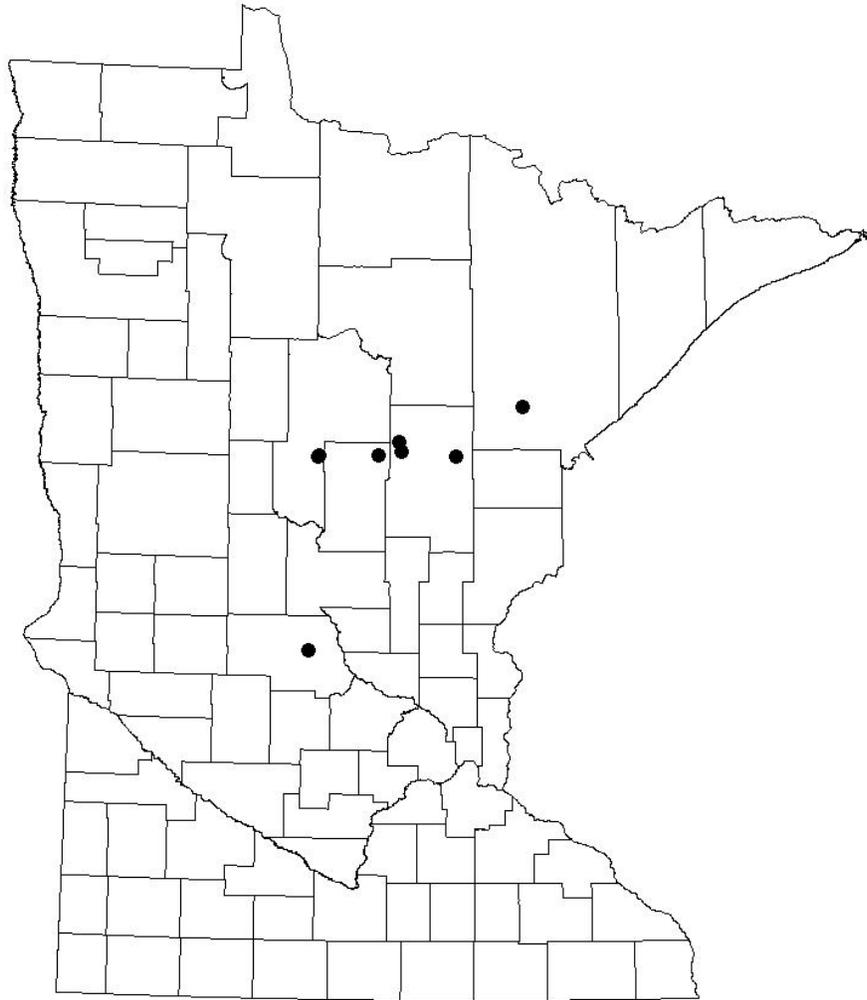


Figure 19. Locations where DNR staff used herbicides to control purple loosestrife in 2011.

Biological control of purple loosestrife

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

Leaf-Eating Beetles: In 1997, the DNR initiated an insect rearing program by providing county agricultural inspectors, MDA field staff, DNR area wildlife managers, Minnesota Sea Grant, nature centers, lake associations, schools, 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 2011, this cooperative effort has had a significant effect on total number of insects released (Figure 20).

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 2011, an estimated 5,000 leaf-eating beetles were collected and released on five sites. To date, the leaf-eating beetles have been released on 880 sites statewide (see Figure 20, Table 14).

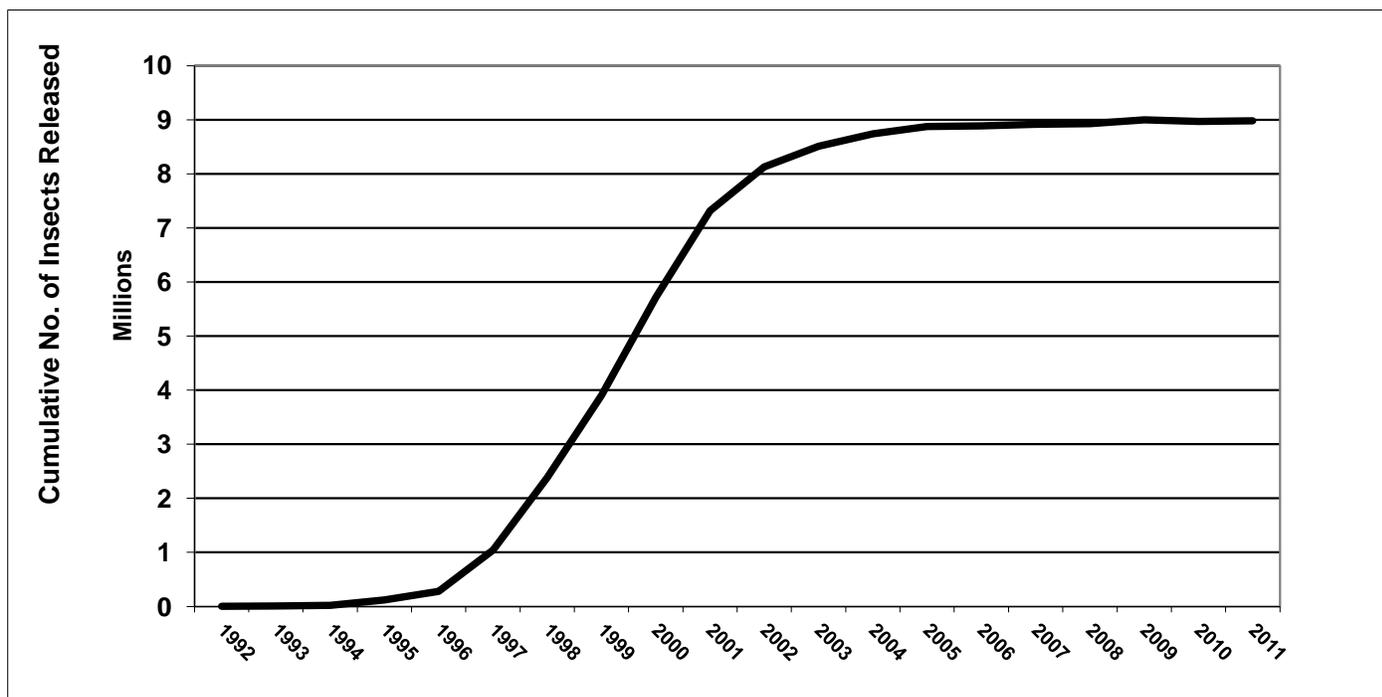


Figure 20. Cumulative number of insects released to control purple loosestrife by year.

Table 14. Summary of number of insects released in each region to control purple loosestrife (1992-2011).

Minnesota DNR Regions	Number of Release Sites	Number of Insects Released
1 – Northwest	143	1,370,116
2 – Northeast	233	1,645,403
3 – Central	439	5,260,677
4 – South	65	705,304
Totals	880	8,981,500

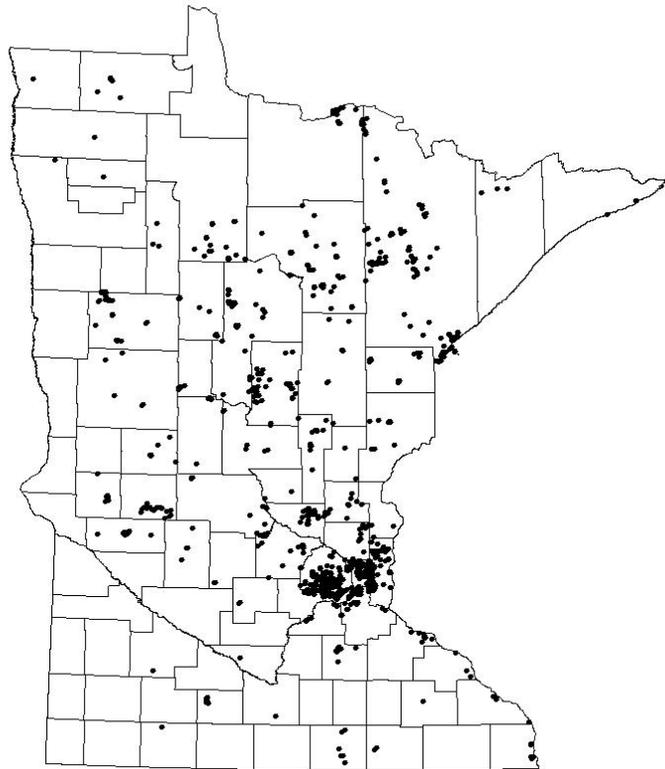
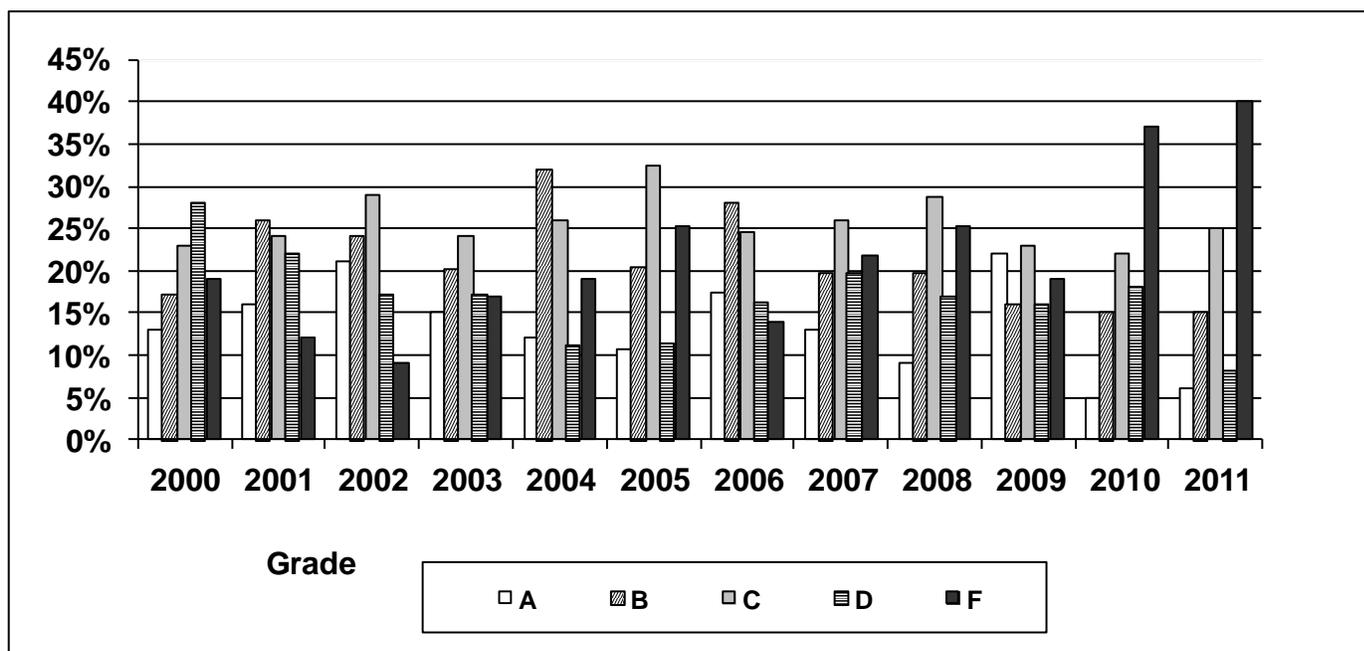


Figure 21. Locations of insects released to control purple loosestrife in Minnesota through 2011.

Biological control insects released between 1992 and 2011 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 2011, 92 insect release sites were assessed for insect establishment and level of control achieved. At 23% (20 sites) of the sites surveyed, insect

populations were increasing and causing damage to the loosestrife infestations. At 1% (7 sites) of all visited sites, the loosestrife was severely defoliated (90-100%) (Figure 22).

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 2011 demonstrated that *Galerucella* introductions have caused moderate to severe defoliation of loosestrife populations on 45% (43 sites) of 92 sites assessed in 2011 (Figure 21).



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 22. Sites graded for insect establishment and control.

The DNR continues to assess how loosestrife abundance changes over time and to determine what combinations of biological control agents provided the desired level of control. Over the last 12 years (1995-2007), a field study has been conducted within 10 purple loosestrife infestations to quantitatively assess the effects of *G. californiensis* and *G. pusilla* on purple loosestrife and non-target native plant communities in Minnesota. The overall results to date suggest that *Galerucella* spp. populations initially peaked between three and five years after establishment. At most sites, purple loosestrife density declined (up to 90%) in response to an increase in *Galerucella* spp. abundance. *Galerucella* spp. appear to have a strong numerical response to purple loosestrife density which led to multiple “boom and bust” cycles occurring on many of the sites during the 12-year period. Declines in *Galerucella* spp. typically allowed purple loosestrife populations to rebound. Generally, *Galerucella* spp. populations rebounded as loosestrife abundance increased. The number and amplitude of the boom and bust cycles appears to be related, in part, to the density of the initial purple loosestrife infestation. Sites where purple loosestrife approached 100% cover tended to cycle more frequently than sites with a higher plant diversity and abundance. It appears that in more diverse sites, increased plant competition prevented purple loosestrife from attaining pre-release densities. As purple loosestrife populations declined, plant species richness and/or abundance increased within release sites.

Research on Insects as Biological Control Agents

No new research is currently underway on purple loosestrife biological control. Research completed in 2007 (See Invasive Species of Aquatic Plants and Wild Animals in Minnesota Annual Report 2007) is now being revised and submitted for publication in scientific journals.

Future needs for management of purple loosestrife

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

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.

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 (*R. frangula*) are Eurasian woody species that invade a number of habitat types in the northeast and north-central regions of the United States and Canada. Both species are very adaptable, forming dense thickets that inhibit the growth of native forbs, shrubs, and tree seedlings (Heidorn 1991, Randall and Marinelli 1996) and have been linked to increased predation in songbird populations (Schmidt and Whelan 1999).

The DNR manages approximately 5.7 million acres or 95% of all the state-owned lands including Scientific and Natural Areas (184,000 acres), State Forests (4 million acres), Wildlife and Aquatic Management Areas (1.3 million acres), 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, education, and research.

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

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 15). Due to cuts from the state general fund, funds for fiscal years 11 and 12 were reduced from their highs in fiscal years 2009 and 2010. Funds of \$438,000 were awarded to land managers for July 1, 2010 - June 30, 2011. Funds of \$178,340 were awarded to land managers for August 1, 2011 - June 30, 2012. 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, and terrestrial portions of Aquatic Management Areas. Through this program more than 180,000 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 15. 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	Currently underway	26

Outcome Report: 2011 Funding Cycle

Four divisions and two regions completed 43 terrestrial invasives projects in FY11 (Table 16). The projects implemented treatment or inventory for more than 35 different invasive plant species (Table 17). Many of the proposals targeted the control of woody invasive species such as buckthorn, non-native bush honeysuckles, Siberian elm, amur maple, and Japanese barberry. Other projects targeted species that typically grow in open areas such as common tansy, leafy spurge, spotted knapweed, and Canada thistle.

Table 16. Types of funded terrestrial invasive plant inventory/management projects for FY11. Includes money spent in FY11 on projects with money rolled forward from FY10.

Division/Section	# of Projects	Project Type (# of projects)	Subtotal
Ecological and Water Resources	2	-SNA invasives inventory, control, and Op Order 113 implementation -Monitoring spread in Manitou project	\$126,595
Fisheries	2	-Terrestrial invasives inventories on Aquatic Management Areas, includes GPS equipment	\$13,054
Forestry	11	-Management of invasives (10) -Stop the Spread of Terrestrial Invasive Species Education Project (1)	\$123,270
Parks and Trails	13	-Inventory (part of 1) -Management of invasives (12) -Op Order 113 - boot brushes and signs (1)	\$111,279
Region 2	1	-Region 2 Headquarters invasives control	\$3,400
Region 3	1	-Region 3 Headquarters invasives control	\$23,000
Wildlife	13	-Inventory, includes equipment (part of 4) -Management of invasives (13)	\$109,107
TOTAL	43		\$509,705

Table 17. Results of funded terrestrial invasive plant inventory/management projects for FY11. Includes work done on projects in FY11 with money rolled forward from FY10.

Divison/ Section	Acres Inventoried	Targeted Species: Inventory	Acres Managed	Targeted Species: Management	Equipment Purchased
Ecological and Water Resources (SNA Program)	2,796	Birdsfoot trefoil, Canada thistle, cheatgrass, common buckthorn, crown vetch, leafy spurge, mullein, Siberian elm, spotted knapweed, tansy, wild parsnip	289	Birdsfoot trefoil, Canada thistle, cheatgrass, common buckthorn, crown vetch, leafy spurge, mullein, Siberian elm, spotted knapweed, tansy, wild parsnip	-15 boot brush kiosks -11 Trimble Juno GPS handheld units + software licenses -air compressor -mower
Forestry	-	-	1,402	Common buckthorn, ginnala maple, Japanese barberry, multiflora rose, non-native honeysuckle, reed canary grass, Siberian elm, Siberian peashrub, spotted knapweed, tansy, thistle	-55 gallon ATV sprayer - 2 chemical hose reels
Parks and Trails	1,592	Amur maple, birdsfoot trefoil, Canada thistle, common buckthorn, crown vetch, garlic mustard, leafy spurge, non-native honeysuckle, purple loosestrife, Siberian peashrub, spotted knapweed, tansy, wild parsnip	2,016	Amur maple, birdsfoot trefoil, Canada thistle, common buckthorn, crown vetch, garlic mustard, leafy spurge, non-native honeysuckle, purple loosestrife, reed canary grass Siberian peashrub, spotted knapweed, tansy, wild parsnip	-4 boot brush kiosks for state trails
Region 2	-	-	20	Amur maple, common buckthorn, non-native honeysuckles, spotted knapweed, tansy	-
Region 3	54	Burdock, common buckthorn, garlic mustard	18	Burdock, common buckthorn, garlic mustard	- sprayers
Fish and Wildlife/ Fisheries	2,178	Birdsfoot trefoil, bull thistle, Canada thistle, nodding thistle, non-native honeysuckles, orange hawkweed, oxeye daisy, purple loosestrife, reed canary grass, reed canary grass, sow thistle, smooth brome, tansy, wild parsnip	-	-	-3 Trimble Juno GPS handheld units + software licenses
Fish and Wildlife/ Wildlife	6,938	Birdsfoot trefoil, bull thistle, Canada thistle, chicory, common toadflax, cow vetch, curly dock, hairy vetch, nodding thistle, non-native honeysuckles, orange hawkweed, oxeye daisy, purple loosestrife, Queen Ann's lace, reed canary grass, Siberian elm, smooth brome, sow thistle, spotted knapweed, tansy, white and yellow sweetclover, wild parsnip	955	Birdsfoot trefoil, bull thistle, Canada thistle, chicory, common buckthorn, common toadflax, cow vetch, curly dock, hairy vetch, leafy spurge, musk thistle, Queen Ann's lace, Siberian elm, spotted knapweed, tansy, white and yellow sweetclover	-4 Trimble Juno GPS handheld units + software licenses -Pendragon software -155 gallon sprayer - Chainsaw -5 basal brush sprayers -6 leaf blowers - 2 pressure washers
TOTAL	13,558		4,700		

Current Terrestrial Invasives Funding Proposals ending June 2012

In response to the FY12 request for proposals for terrestrial invasive plant management, we received proposals for 45 projects totaling \$669,105. It was possible to fund 26 of the proposals for a total of \$178,340 (Table 18). The funded proposals included 13 proposals for controlling invasive plants, eight proposals for invasive plant inventories, four proposals to do both inventories and control, and one proposal to improve education surrounding spread of terrestrial invasives. Many of the proposals targeted the control of woody invasive species (such as buckthorn and honeysuckle), control of the woodland invader garlic mustard, control of invasive plants of prairies, and the purchase of survey equipment. Invasives control will be carried out at two DNR offices.

Table 18. Funded terrestrial invasive plant inventory/management projects for FY12.

Division/Section	# of Projects Funded FY12	Project Type (Number of projects)	Subtotal
Ecological and Water Resources	3	-SNA invasives inventory, control and Op Order 113 implementation -Monitoring spread in Manitou project -Management (1)	\$41,100
Fish and Wildlife/Fisheries	2	-Inventory (part of 1) -Management (2)	\$11,700
Forestry	7	-Inventory (part of 2) -Management of invasives (5) - Stop the spread of terrestrial invasives (1)	\$41,100
Parks and Trails	8	-Inventory (2) -Management of invasives (6)	\$41,040
Region 2	1	-Brainerd and Aitkin DNR offices invasives control	\$4,000
Region 3	1	-Region 3 Headquarters invasives control	\$10,000
Fish and Wildlife/Wildlife	4	-Inventory (4) -Management of invasives (part of 2)	\$29,400
TOTAL	26		\$178,340

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

Due to the growing threat of invasive species (both terrestrial and aquatic), and the Forest Stewardship Council’s Corrective Action Request (CAR) to “implement strategy to identify areas of greatest concern with respect to invasive species and implementation to control,” there is a need to address the spread and impact of invasive species by DNR resource management activities from a department-wide perspective. Therefore, the Invasive Species Operational Order 113 identified the need for each DNR Division to develop Invasive Species Divisional Guidelines for their work activities. Division Guidelines were finalized and implemented in 2008. In 2011, the Division of Ecological and Water Resources updated its Division Guidelines and merged the Division Guidelines of the former Waters Division and the Ecological Resources

Division. In 2010, a DNR intranet website was launched to help employees implement Op Order 113 and reduce the spread and impact of invasive species. The website was updated in 2011 and contains information on locations of power washers that are available to DNR employees, standard contract/grant/permit language that relates to invasive species practices, links to invasive species identification guides and new invasives to look for, training materials, and links to the Division Guidelines.

Inventory

Using standardized protocols developed by the DNR, 123,000 locations of invasive plant species on state-managed lands have been mapped using GPS/GIS technologies (Figure 23). This includes surveys conducted in over 50 state parks, 350 wildlife management areas, 14 state trails (more than 174 miles of trail), and 45 state forests. 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. This terrestrial invasive plant data is updated weekly to ensure managers have the latest available information. Managers are now using this information to target and monitor the results of control efforts on these populations.

Early Detection

Narrowleaf bittercress (*Cardamine impatiens*) and Oriental bittersweet (*Celastrus orbiculatus*) are invasive plants that are found in Minnesota, but have populations that are not widely distributed. Populations of both of these species were detected on DNR lands in 2011. DNR coordinated with MDA and MnDOT to work on addressing these species while populations are small.

Information and Education

The “Stop the Spread and Transport of Invasive Plants” poster was updated to reflect the 2011 changes in the Noxious Weed Law. In coordination with the Fish and Wildlife Division, 8,000 posters were printed and are being disseminated statewide.

In 2011, the DNR’s invasive species website was re-organized and a number of new topics were added to the terrestrial invasive species website (http://www.dnr.state.mn.us/invasives/index_terrestrial.html).

September 4, 2011, was “Terrestrial Invasive Species Day” at the DNR building at the Minnesota State Fair. A booth was set up and presentations were given on terrestrial invasive species. Preventing the spread of invasive species was a theme at the DNR building throughout the State Fair.

The Invasive Species Program provided funds to the DNR Division of Forestry to help pay for branding development for terrestrial invasive species outreach to recreationists. The campaign “Stop Aquatic Hitchhikers!” has been very successful at getting aquatic recreationists (boaters, angling community, etc.) to take actions to prevent the spread of aquatic invasive species. Invasive species can also be spread on land through pathways such as weed seeds in mud on boots and equipment and by moving firewood infested with invasive insects. The branding company will develop a campaign that can

bring the message of invasive species prevention to recreationists such as campers, and motorized and non-motorized trail users.

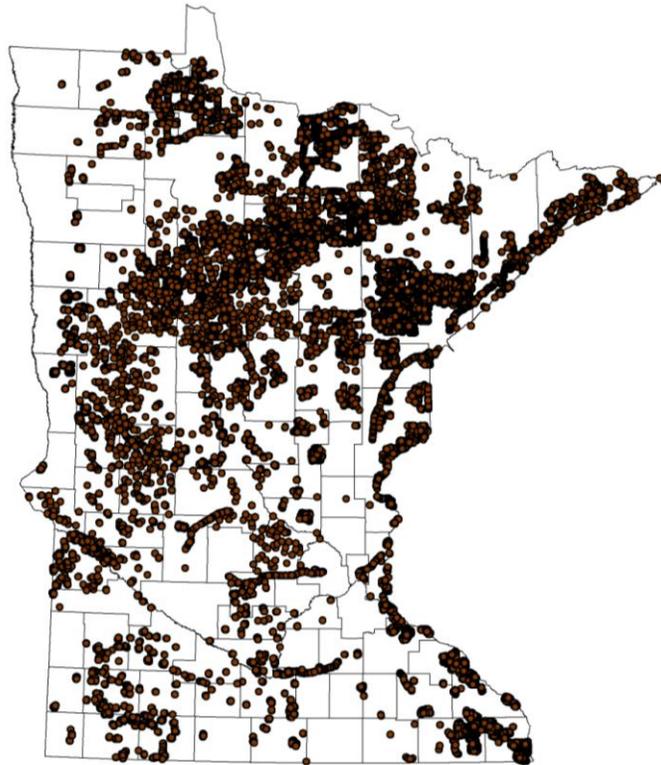


Figure 23. Terrestrial invasive plant inventories (all species), 2011.

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

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 Legislative-Citizen Commission on Minnesota Resources.

Research in Europe. Over the course of this project, researchers with CABI have surveyed, collected, and tested a variety of insects for potential biocontrol of *R. cathartica* and *F. alnus*. Host specificity studies (to make sure the insects will not eat plants native to Minnesota and the U.S.) were conducted for a number of insects. These species were tested for their ability to oviposition on these plants and their choice of oviposition plants. These species were also tested for their host specificity preference. These tests help to determine the effectiveness and efficiency of these species as biocontrol agents and any risk associated with other native related shrubs.

Once these surveys and tests were completed, CABI researchers reassessed the data collected and prioritized the species for further testing. No species demonstrated enough specificity for biocontrol of *F. alnus*, so work is currently focused on biocontrol insects for *R. cathartica*.

In 2011, work continued on the potential of the sap-sucking psyllid *Trichoermeres walkeri* (Hom., Triozidae), and the seed-feeding midge *Wachtiella krumbholzi* (Dipt., Cecidomyiidae) to be biocontrol agents for common buckthorn. Research also expanded to look at buckhorn seedling mortality in Europe and the potential role of pathogens.

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 possibility to develop in native North American species, has been the highest priority over the past four years. The focus of this work has been on the root feeder *Ceutorhynchus scrobicollis* followed by the two-stem miners *C. alliariae* and *C. roberti*. The results of these tests show high specificity of all species to garlic mustard. Although three European plant species also were attacked in tests, these species are not recorded as field hosts of the weevils. The implementation of safe garlic mustard biocontrol appears within close reach.

Host specificity testing of the final set of native plant species was completed for *C. scrobicollis* and a petition was submitted in April 2008, to USDA-APHIS to allow state agencies to field release *C. scrobicollis* in the United States. After review of the petition, additional plant species were recommended for host specificity testing. This work was completed in 2011. The results of this supplemental research were submitted to USDA-APHIS Technical Advisory Group (TAG) in September 2011. After TAG reviews the proposal, they will submit a recommendation to APHIS.

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 2011, 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 River towards Minnesota. There is 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 River and Illinois River and are present in large numbers in parts of the Mississippi River and its tributaries. Each of these species has unique characteristics and poses unique threats to fish and other aquatic species. Taken together they appear capable of having profound effects on aquatic resources and recreational opportunities.

Grass carp have been caught by Minnesota commercial fisherman in the Mississippi River since the 1990s, and numbers have been increasing. A grass carp was caught in the St. Croix River in spring 2006. 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 19).

In November of 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 represents a large extension in the range of that species in the Mississippi River. The previous northernmost confirmed report of a silver carp was near Clinton, Iowa—more than 150 miles downstream.

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.

Table 19. 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

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 and its tributaries.

Management Goals and Options

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

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

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

Progress in Management of Asian Carp - 2011

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 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 from the St. Croix River (above and below the dam at St. Croix Falls, Figure 24), the Mississippi River (below Lock and Dam #2 at Hastings, below Lock and Dam #1 at Minneapolis (Figure 25), above and below the Coon Rapids Dam at Coon Rapids (Figure 26), and above and below Upper the St. Anthony Falls Lock and Dam at Minneapolis), and from the lower Minnesota River. Samples from the Minnesota and St. Croix rivers are currently being analyzed. Samples tested positive for silver carp below Lock and Dam #1, below Lock and Dam #2 at Hastings, and above and below the Coon Rapids Dam, as shown below. There have been no positive eDNA tests for bighead carp.

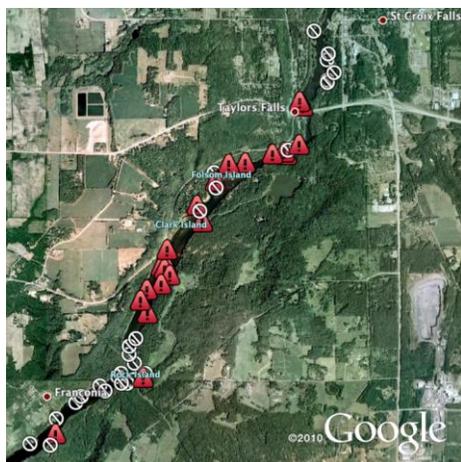


Figure 24

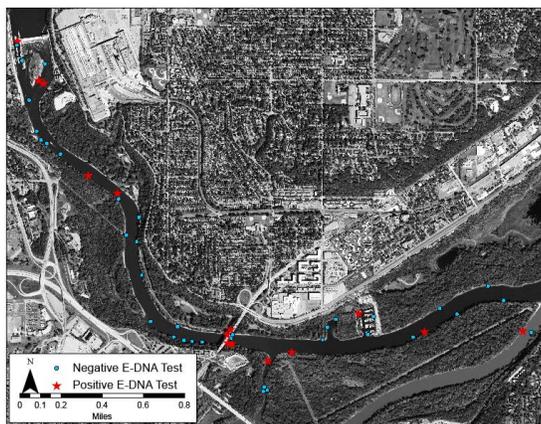


Figure 25

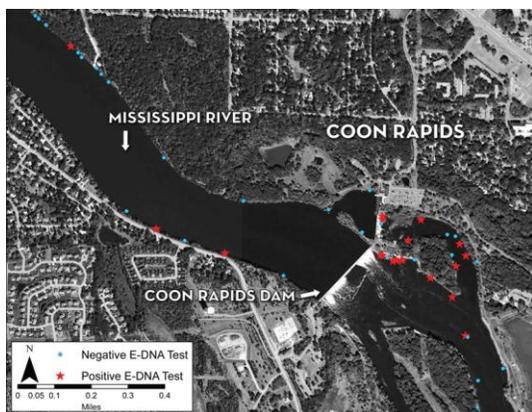


Figure 26

eDNA testing results. Samples positive for Asian carp are red triangles (Fig. 24) or red stars (Figs. 25 and 26):

- Figure 24 - below the St. Croix Falls Dam
- Figure 25 - below Lock and Dam #1 in Minneapolis
- Figure 26 - above and below the Coon Rapids Dam

Positive eDNA results do not confirm the presence of live silver carp as there may be other pathways for DNA to enter the water, such as disposed carcasses. These other potential sources are unlikely; however, they are being investigated. At this time, the risk is too high to assume live fish are not present based on the eDNA evidence.

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, the Task Force released an "Asian Carp Action Plan" for Minnesota. This plan builds upon previous efforts and identifies specific strategies regarding detection and monitoring, prevention and deterrence, mitigation and control, and information and education. The plan can be viewed at the following link: http://files.dnr.state.mn.us/natural_resources/invasives/aquaticanimals/asiancarp/asiancarpactionplan.pdf

In September, 2011, Minnesota Gov. Mark Dayton hosted an Asian Carp Summit 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. In November and December 2011, Gov. Dayton hosted follow-up Summits to further develop these plans and implementation strategies.

The DNR and other partners are currently in the process of implementing those actions where support and funding is available. Currently 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 the Lock and Dam #1 lock chamber to prevent upstream fish movement; completing a feasibility study to determine if a deterrent barrier is warranted at the mouth of the St. Croix River; completing a feasibility study on a permanent fish barrier at the Upper St. Anthony Falls and Lock and Dam #1 including emergency lock closure; evaluating a deterrent barrier at Lock and Dam #19 to prevent black carp and other invasive species from entering the Upper Mississippi River, expanding research on long-term control technologies, and improving habitat for native species in order that they can better compete with Asian carp.

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, 8 September 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 2011. Monitoring mute swans in the wild is a strategy necessary to help DNR respond to birds that may establish naturalized populations. During 2011, the DNR recorded reports of wild or escaped mute swans at locations in the state. DNR ordered the owner of one bird on Square Lake in Washington County to confine it as required by state regulations. A total of eight birds were reported in the wild in five counties (Table 20). None of the other reported swans could be removed from the wild.

Progress in Management of Mute Swans - 2011

Table 20. Unconfined mute swans sighted in Minnesota counties during 2011.

County	Number of Mute Swans Reported
Hennepin	1 - April
Nicollet	1 - November
Sherburne	1 - October
Wabasha	2 - September
Washington	3 - October
Total for all counties	8

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 - 2011

New Infestations: New infestations were reported from eight waters during 2011: Brophy, Cowdry, Taylor, North Union, Stoney, and Irene lakes in Douglas County and Rose Lake and the Pelican River in Otter Tail County (Figure 27). The infestation in the Pelican River is not surprising, as this is downstream of established zebra mussel populations in lakes Pelican and Lizzie. In addition, lakes Brophy, Cowdry, Taylor, North Union, and Stoney are a chain of lakes directly upstream of the Alexandria Chain of Lakes which was found to have zebra mussels in June 2009. However, the infestations in Rose Lake (Otter Tail County) and Lake Irene (Douglas County) were the result of equipment being moved from zebra mussel infested waters to non-infested waters without proper cleaning or drying. These two lakes are likely the first lakes in Minnesota where the details of how a water body became infested with zebra mussels were documented.

Brophy, Cowdry, Taylor, North Union, and Stoney Lakes: In August, a lakeshore owner reported finding what was suspected to be a zebra mussel attached to a rock picked off the bottom of Brophy Lake. Upon confirmation of the find, Invasive Species Program staff conducted a shoreline search in the immediate vicinity of the reported find and discovered small zebra mussels attached to scattered bottom substrate in the lake. Staff also searched Cowdry Lake, the last lake in the chain, and also found small zebra mussels attached to rocks near the outlet. Homeowners also reported finding zebra mussels attached to docks in Stoney Lake in the fall of 2011. These findings resulted in the listing of lakes Brophy, Cowdry, Taylor, North Union, and Stoney as infested with zebra mussels. 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. These lakes will also be subject to increased watercraft inspections and enforcement in the future.

Rose Lake: During the summer, a private individual moved a boat lift from a zebra mussel infested water to Rose Lake without proper cleaning. In September, the private individual removed the boat lift from the lake and found zebra mussels attached. Invasive Species Program staff then conducted a search near the area where the boat lift was located and found zebra mussels attached to vegetation and a nearby dock. However, zebra mussels were not found on docks and/or boat lifts that were located at other parts of the lake. Similarly, SCUBA divers found no other zebra mussels outside of the area where the boat lift was located. Based on this information, it appeared the zebra mussel infestation was localized to a small area of Rose Lake and it was decided that the DNR would attempt to eradicate the zebra mussels before the population expanded.

Lake Irene: Similar to Rose Lake, a private individual had a boat lift moved from zebra mussel infested water to Lake Irene early in the summer. In October, when the boat lift was removed from the water, the private individual observed zebra mussels attached to the boat lift. Docks and boat lifts from other parts of the lake were searched by Invasive Species Program staff but no zebra mussels were found. However, a diver found an abundance of zebra mussels on rocks in the area where the boat lift was located. Once again, it appeared the zebra mussel population was localized to a small area and an eradication attempt was planned.

For both Rose Lake and Lake Irene, the eradication effort consisted of several steps:

1. Zebra mussels that were found attached to aquatic vegetation or rocks were physically removed from the area around the boat lift. Care was taken to make sure this was only done during calm days or when wind was lightly blowing into shore. This was done to try to remove as many zebra mussels as possible while at the same time gathering more information on the distribution of the zebra mussels.
2. Following the removal, approximately 300 feet of silt fabric was installed around the area where the boat lift was located. The fabric was 3 to 5 feet deep with a floating top and a weighted bottom. This fabric helped to increase the contact time of the chemical by minimizing the amount of water movement in and out of the area.
3. Once the silt fabric was installed, a professional applicator was hired to treat 10 acres (inside and outside of the silt fabric) of the lake using a copper-based product called Cutrine®-Ultra. This product is commonly used to treat algae growth and swimmer's itch. Cutrine®-Ultra was chosen because it is toxic to zebra mussels, EPA approved for aquatic use, readily available, and had been used by the DNR at Lake Ossawinnamakee in an attempt to keep zebra mussels from expanding into the Mississippi River. To keep the concentration at a high enough level, three treatments were conducted (one every seven days).

Weather was favorable for all of the treatments and landowner cooperation was excellent. Notices of the treatments were sent out as press releases and significant media coverage existed for the initial Rose Lake treatment. Future monitoring for zebra mussels in these two lakes will determine the success of the eradication effort.

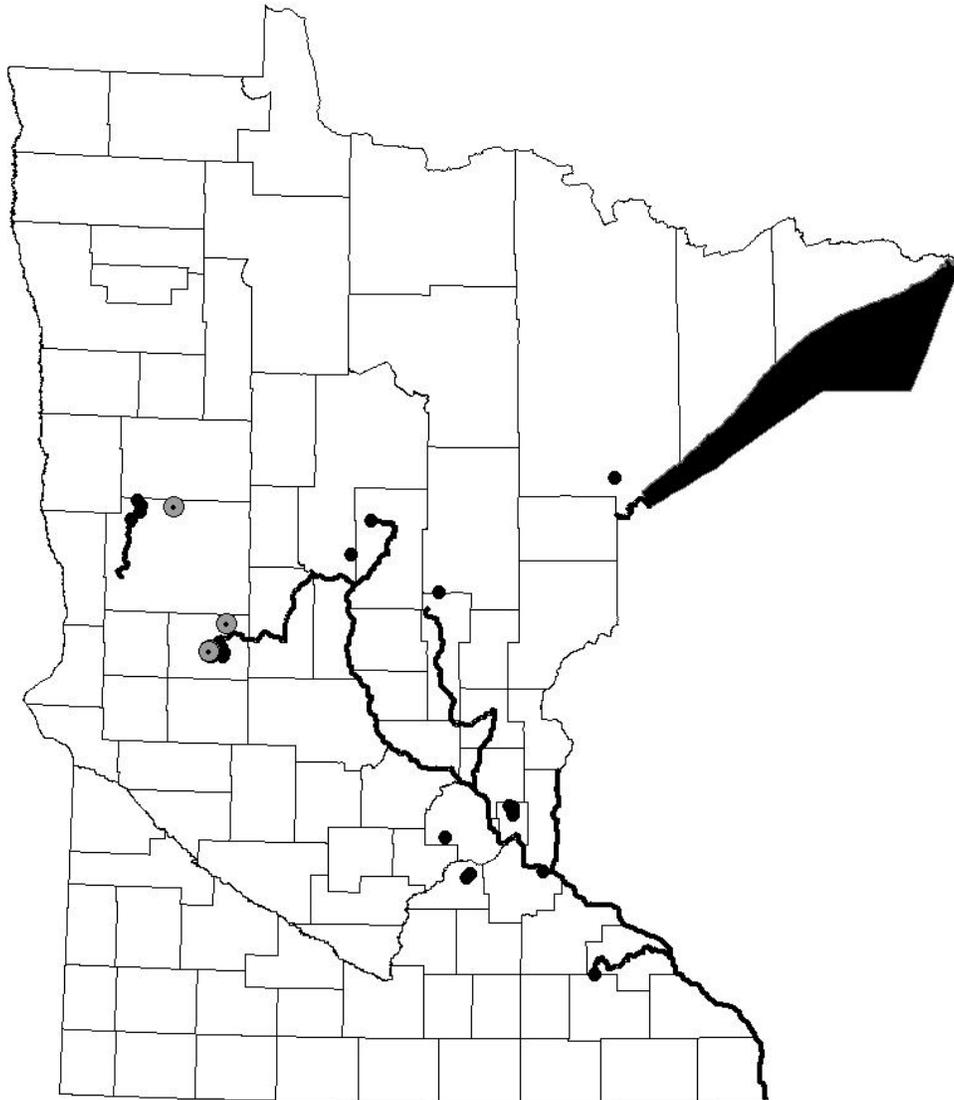


Figure 27. Zebra mussel infestations in Minnesota confirmed by the DNR. Gray circles indicate new lake infestations in 2011. Black dots indicate infested lakes prior to 2011 and bold black lines indicate infested river areas and Lake Superior.

Existing populations and efforts: Dive surveys in Mille Lacs Lake by DNR Fisheries and Ecological and Water Resources staff found a large increase in the population. Calculated densities in 2011 were estimated at over 1,000 zebra mussels per square foot, which is approximately a 73x increase in zebra mussels over numbers from 2010. For example, in one square foot at Three Mile Reef, 45 zebra mussels were found in 2010 compared to 4,500 zebra mussels found in 2011. Monitoring will continue by DNR staff, but it is uncertain how abundant the zebra mussels will become or what impact they will have on Mille Lacs Lake. Water column samples were collected throughout the lake by Fisheries staff during the summer, and zooplankton and veliger densities were analyzed. The long-term monitoring of the zooplankton community will help assess

what impacts zebra mussels may be having on fish populations in the lake. Complicating this analysis is the presence of spiny waterflea in Mille Lacs Lake.

Similar dramatic increases in zebra mussel reproduction and settlement were seen in other lakes in the state. Fisheries staff collected water samples from five lakes infested with zebra mussels in the Alexandria area. In Lake Le Homme Dieu, water samples showed very high densities in veliger counts. Veliger counts were higher in Geneva and Darling lakes, suggesting growth of the mussel populations in these waters. Carlos Lake had a substantial increase in veliger densities in water samples, and plant surveys found many tiny zebra mussels attached to vegetation. Additionally, substrate samples collected settled zebra mussels to depths of 30 feet or more. The population in Carlos appears to be rapidly building. In Otter Tail County, the zebra mussel populations in Pelican Lake and Lake Lizzie also exhibited a large increase in abundance. Reports from Prior Lake, reported last season as newly infested, also recorded high numbers of newly settled mussels. Lake Minnetonka zebra mussel distribution expanded nearly lakewide from data collected from settling samplers. Additionally, water samples collected from the lake were analyzed for veliger and zooplankton densities. Across the state, infested waters all seemed to have much higher reproduction success.

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 fluorescens*, trade named Zequanox, (a common soil bacteria) in zebra mussels control. This bacterial strain was shown to kill zebra mussels when high enough doses were consumed. The testing done by the company has been primarily aimed at industry, with tests in facilities and pipe conditions. DNR staff provided technical assistance and comments on a proposal for field research with Zequanox that was developed by the company for a citizens group concerned about zebra mussels in Douglas County. In late summer, DNR staff met with researchers from the USGS Experimental Research Center in La Crosse, Wisconsin, as well as biologists from adjacent states and federal agencies to discuss ongoing research efforts with bacterial control. The main focus of the research has been to assess the potential of Zequanox for use in native unionid restoration efforts. DNR staff worked with the USGS to provide potential inland infested water sites for inclusion in the USGS research study. Researchers with the USGS have placed settling substrates in two locations: Lake Pepin and Carlos Lake (Douglas County). These substrates will be removed next summer and used to test bacterial control in a research trailer. Zequanox is not registered for open water use, so no applications will be made within the lake. Future research needs for this control 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.

Volunteer Zebra Mussel Monitoring Program: The Volunteer Zebra Mussel Monitoring Program continued with mailing of report forms to all lakeshore residents who had participated last year. Information on the program as well as reporting forms have been placed on the DNR website to allow users to report electronically. Over 150 people annually have participated in the Volunteer Zebra Mussel Monitoring Program, checking

lakes across the state for zebra mussels. These efforts provide a much more extensive examination of Minnesota waters for this invasive than could be conducted by the Invasive Species Program alone.

Other Invasive Animal Species in Minnesota

Introduction

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

Eurasian Collared-dove

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

Distribution - The bird has been observed in 65 Minnesota counties from 1999 to 2011: Becker, Big Stone, Blue Earth, Brown, Carver, Chippewa, Clay, Cottonwood, Dakota, Dodge, Douglas, Faribault, Fillmore, Freeborn, Goodhue, Grant, Hennepin, Houston, Itasca, Jackson, Kandiyohi, Kittson, Koochiching, Lac qui Parle, Le Sueur, Lincoln, Lyon, Martin, McLeod, Meeker, Mower, Murray, Nicollet, Nobles, Norman, Olmsted, Otter Tail, Pennington, Pipestone, Polk, Pope, Red Lake, Redwood, Renville, Rice, Rock, Roseau, St. Louis, Sherburne, Sibley, Stearns, Steele, Stevens, Swift, Todd, Traverse, Wabasha, Wadena, Waseca, Washington, Watonwan, Wilkin, Winona, Wright and Yellow Medicine.

In 2011, there were a total of 129 sightings across 40 counties. Collared doves were reported in five new counties in 2011: Becker, Douglas, Le Sueur, Murray, and Wadena. The birds also are likely to be in other Minnesota counties and continue to spread throughout the state.

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

Faucet Snail

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

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



Impacts - Faucet snails are hosts to three parasitic trematodes or flukes (*Sphaeriodotremma globulus*, *Cyathocotyle bushiensis*, *Leyogonimus polyoon*), that have contributed to the deaths of about 10,000 scaup and coots since 2007 on 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.

Distribution – There was an expansion of an infested chain of waters in 2011. First Crow Wing Lake and Second Crow Wing Lake in Hubbard County; and the Crow Wing River, from Highway 87 in Hubbard County downstream to the confluence with the Mississippi River (Cass, Hubbard, Morrison, Todd, and Wadena counties) were designated as infested waters.

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

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, 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. Ehippia (resting eggs) can remain viable after passage through fish.

***Bythotrephes* sp. - 2011:** No new infestations were reported in 2011. However, 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 ehippia, or inadvertently by recreational anglers or boaters.

Existing work: DNR biologists are assisting National Park Service staff from Voyageurs National Park in 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. This data can assist in determining if impacts may be occurring in the lake from the infestation. Area Fisheries managers in the northern part of the state have sent zooplankton tows from 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. This season, this invasive was present throughout most of the summer at varying levels in most of the sites sampled. It is unknown what population

levels may be found long-term in this lake, which is distinctly different morphologically from many other infested waters.

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

Species	Status	Legal Status	Last annual report to include info on this species
Two earthworm species in the genus <i>Amyntas</i>	University of Minnesota researchers reported that two species used in composting were discovered in the Twin Cities area of the state.	Unlisted	2007
Annelida (<i>Pristina acuminata</i>)	U.S. Environmental Protection Agency in Duluth reported that its monitoring efforts during 2006 in the Duluth-Superior Harbor detected this oligochate that was first noted as a non-native to the Great Lakes in the late 1970s in Lake Erie.	Unlisted	2007
Cnidaria (<i>Cordylophora caspia</i>)	U.S. Environmental Protection Agency in Duluth reported that its monitoring efforts during 2006 in the Duluth-Superior Harbor detected this invasive invertebrate (a hydroid) that is known in other Great Lakes.	Unlisted	2007
Common carp	Research is ongoing at U of MN	Regulated	2009
<i>Daphnia lumholtzi</i>	<i>D. lumholtzi</i> were first found in reproductive densities in Lake Pepin in 2003 and in samples since then. No active sampling is occurring.	Unlisted	2005
Didymo (<i>Didymosphenia germinate</i>)	Didymo is an algal diatom that attaches to hard substrates that can form mats that look slimy, hence the name "rock snot." Where it is not native, it can cover the bottoms of streams and rivers, impacting habitat and water quality. Through consultation with diatom experts and a literature search, it was found that didymo has been a resident of Lake Superior's North Shore for at least 40 years. At this time, there is no evidence to suggest that it poses a risk to Lake Superior; however, it may pose threats to inland waters if spread.	Unlisted	2009
European earthworms (various genera)	Continued public education has focused on preventing the release of earthworms.	Unlisted	2003
Eurasian swine (<i>Sus scrofa</i>)	No confirmed reports of wild Eurasian swine in the wild in 2009.	Prohibited	2002
Fallow deer (<i>Dama dama</i>)	There continues to be escapes from Cervidae farms.	Unlisted	2001

Table 21. (Continued)

Species	Status	Legal Status	Last annual report to include info on this species
New Zealand mudsnail (<i>Potamopyrgus antipodarum</i>)	This tiny snail, native to New Zealand, was collected for the first time in Minnesota waters during fall of 2005. Hundreds of the snails were found by a research scientist who was surveying for new invaders in the Duluth Harbor for the U.S. EPA. No new infestations have been found.	Prohibited	2009
Orange-banded arion (<i>Arion fasciatus</i>)	This non-native slug that is invading forests, is found across the northeastern U.S.; records in Wisconsin since 1948; one of the most common slugs in Ontario. Minnesota infestations include Wood Rill SNA and Chippewa National Forest; otherwise little is known about its distribution in Minnesota. This slug is well established at this site and is a strong herbivore on various understory wildflower species.	Unlisted	2007
Red deer (<i>Cervus elaphus</i>)	Report to DNR of one escaped in 2009. It was dispatched by DNR.	Unlisted	1999
Round goby (<i>Neogobius melanostomus</i>)	No new waterbodies in 2010.	Prohibited	2005
Ruffe (<i>Gymnocephalus cernua</i>)	No new waterbodies since 1988.	Prohibited	2002
Tubenose goby (<i>Proterorhinus marmoratus</i>)	The tubenose goby was first discovered in the St. Louis River estuary in 2001. It has also been documented in several other lakes and rivers within the Great Lakes Basin.	Prohibited	2005
Sea lamprey	Sea lampreys are present in Lake Superior and portions of its tributaries. Their management is done by the USFWS and the Great Lakes Fishery Commission.	Prohibited	

Appendix A - Invasive Species Program Staff

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

Appendix 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
Silviculture Lands and Roads Supervisor	Keith Jacobson	651-259-5270
Invasive Species Coordinator	Susan Burks	651-259-5251

U of Minnesota Sea Grant - Aquatic Invasive Species Information Center

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

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

The MDA is responsible for the prevention and early detection of new and emerging terrestrial plant pests and management of noxious weeds. MDA's 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. MDA prepares an annual report for these programs.

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
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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.