

Invasive Species of Aquatic Plants and Wild Animals in Minnesota

**Annual
Report
2010**

*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.

Table of Contents

| | Page |
|---|-------------|
| List of Tables | iii |
| List of Figures | v |
| Summary | 1 |
| Introduction | 9 |
| Expenditures | 13 |
| Prevention and Containment | 20 |
| Education and Public Awareness | 30 |
| Enforcement | 40 |
| Regulations and Proposed Changes | 46 |
| Watercraft Inspections and Awareness Events | 50 |
| <u>INVASIVE PLANTS</u> | |
| Management of Curly-leaf Pondweed | 59 |
| Management of Eurasian Watermilfoil | 69 |
| Management of Flowering Rush | 78 |
| Management of Purple Loosestrife | 86 |
| Other Aquatic Invasive Plant Species in Minnesota | 95 |
| Terrestrial Invasive Plant Management | 99 |
| <u>INVASIVE ANIMALS</u> | |
| Management of Mute Swans | 108 |
| Management of Zebra Mussels | 110 |
| Other Invasive Animal Species in Minnesota | 115 |
| Introduction | 115 |
| Eurasian Collared-dove | 115 |
| Faucet Snail | 115 |
| Mystery Snails | 118 |
| Spiny Waterflea | 118 |

Table of Contents (Continued)

| | Page |
|--|-------------|
| Appendix A - Invasive Species Program efforts that address specific invasive species | 122 |
| Appendix B - Invasive Species Program Staff | 123 |
| Appendix C - Other State Contacts for Invasive Species Prevention and Control Programs and Interagency Groups | 124 |

List of Tables

| | Page |
|---|-------------|
| Table 1. State and local funding (in thousands of dollars) received by the Invasive Species Program, fiscal years 2003-2010 | 13 |
| Table 2. Recent proposals submitted by the Invasive Species Program that received federal funding | 14 |
| Table 3. Invasive species related expenditures in fiscal year 2010 (FY10) (in thousands of dollars) | 19 |
| Table 4. Summary of DNR Prevention Grants awarded in 2010 | 25 |
| Table 5. Invasive species violations for the open water season of 2010 | 45 |
| Table 6. Data for specific invasive species enforcement work crews in 2010 (this is a subset of all invasive species enforcement actions and efforts in 2010) | 45 |
| Table 7. Invasive species enforcement hours worked by DNR conservation officers in 2010 | 45 |
| Table 8. Number of watercraft inspections conducted by watercraft inspectors in 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, and 2010 (totals are rounded values) | 51 |
| Table 9. Lakes with curly-leaf pondweed, <i>Potamogeton crispus</i> , with sizes and percentages of phosphorus budgets accounted for by curly-leaf and external loading | 60 |
| Table 10. Pilot program-projects granted funding for lake-wide or bay-wide control of curly-leaf pondweed (CLP) or both CLP and Eurasian watermilfoil (EWM) in 2010 | 64 |
| Table 11. Number of pilot projects to control Eurasian watermilfoil or curly-leaf pondweed on a lake-wide (or bay-wide) basis during 2010 classified by duration | 65 |
| Table 12. Number of pilot projects to control Eurasian watermilfoil or curly-leaf pondweed on a lake-wide (or bay-wide) basis during 2010 classified by DNR region | 65 |
| Table 13. Classification of water bodies in Minnesota with Eurasian watermilfoil | 73 |
| Table 14. Pilot program – projects granted funding in 2010 for lake-wide or bay-wide control of Eurasian watermilfoil (EWM) or curly-leaf pondweed (CLP) or both (Endo is endothal and tric is triclopyr) | 73 |
| Table 15. Number of Minnesota lakes where management of nuisances caused by Eurasian watermilfoil was supported with state funds in 2006-2010 | 75 |
| Table 16. Purple loosestrife infestations in Minnesota recorded by the DNR in 2008 and 2010 | 87 |

List of Tables (continued)

| | Page |
|---|-------------|
| Table 17. Historical herbicide applications performed by DNR and applicators contracted by DNR in Minnesota (1989-2010) | 89 |
| Table 18. Summary of number of insects released in each region to control purple loosestrife (1992-2010) | 91 |
| Table 19. Other Aquatic Invasive Plant Species in Minnesota | 98 |
| Table 20. History of terrestrial invasive plants funding program | 100 |
| Table 21. Types of funded terrestrial invasive plant inventory/management projects FY10 | 101 |
| Table 22. Results of funded terrestrial invasive plant inventory/management projects FY10 | 102 |
| Table 23. Funded terrestrial invasive plant inventory/management projects for FY11 | 103 |
| Table 24. Unconfined mute swans reported in Minnesota counties during 2010 | 109 |
| Table 25. Other invasive and non-native wild animal species that have been found in the wild in Minnesota | 120 |

List of Figures

| | Page |
|--|-------------|
| Figure 1. Faucet snail infested rivers and lakes in Minnesota as of November 2010 | 2 |
| Figure 2. Aquatic Invasive Species Program spending (Invasive Species Account and General Fund only) in FY10 by major categories | 8 |
| Figure 3. Aquatic Invasive Species Program spending (Invasive Species Account and General Fund only) in FY10 by major categories | 18 |
| Figure 4. Example fish ruler product by the Big Sandy Lake Association with local and DNR prevention grants funds | 24 |
| Figure 5. Billboard produced and posted by the Crow Wing County Lakes and Rivers Alliance with local and DNR prevention grants funds | 24 |
| Figure 6. Burma Shave style signs produced and posted by the Fifty Lakes Property Owners Association with local and DNR prevention grants funds | 24 |
| Figure 7. Watercraft accesses on infested waters per watercraft inspector | 52 |
| Figure 8. Percent of watercraft inspector hours spent at infested and non-infested water bodies | 53 |
| Figure 9. DNR Watercraft inspections at public water accesses in 2010 | 54 |
| Figure 10. Percentage of boaters from Minnesota and other states that were aware of Minnesota’s invasive species laws | 55 |
| Figure 11. Number of watercraft entering a watercraft access with attached vegetation or zebra mussels per region | 57 |
| Figure 12. Curly-leaf pondweed locations in Minnesota as of November 2010 (compiled from reports from DNR Fisheries, Wildlife, and Ecological and Water Resources staff) | 62 |
| Figure 13. Discovery of water bodies in Minnesota with Eurasian watermilfoil; annual and cumulative numbers | 70 |
| Figure 14. Distribution of water bodies with Eurasian watermilfoil in Minnesota as of November 2010 | 71 |
| Figure 15. Flowering rush umbel, cross-section of a leaf, and rhizomes | 79 |
| Figure 16. Flowering rush locations as of December 2010 | 81 |
| Figure 17. Purple loosestrife infestations in Minnesota as of December 2010 | 87 |
| Figure 18. Locations where DNR staff used herbicides to control purpose loosestrife in 2010 | 90 |

List of Figures (Continued)

| | Page |
|---|-------------|
| Figure 19. Cumulative number of insects released to control purple loosestrife by year..... | 91 |
| Figure 20. Locations of insects released to control purple loosestrife in Minnesota through 2010 | 92 |
| Figure 21. Sites graded for insect establishment and control | 93 |
| Figure 22. Non-native waterlilies growing on the northeast shore of Aaron Lake, Douglas County, July 21, 2010 | 96 |
| Figure 23. Non-native waterlilies growing on the north shore of Tamarac Lake, Otter Tail County, August 30, 2010 | 97 |
| Figure 24. Terrestrial invasive plant inventories (all species), 2010 | 105 |
| Figure 25. Zebra mussel infestations in Minnesota confirmed by the DNR. Gray circles indicate new infestations in 2010. Black dots and bold black lines indicate infested river areas and Lake Superior | 112 |
| Figure 26. Distribution map of where faucet snails (<i>Bithynia tentaculata</i>) have been Found as of December 2010 | 117 |

Invasive Species of Aquatic Plants and Wild Animals in Minnesota: Annual Report for 2010

Summary

The Problem

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

Status of Invasive Species in Minnesota: 2010

Aquatic Plants

Eurasian watermilfoil was discovered in 14 additional water bodies during 2010. The total number of milfoil infested water bodies is 246.

Purple loosestrife was found in 12 new sites in 2010, bringing the total number of known infestations to 2,406.

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

Flowering rush was not found in any new locations in 2010.

Wild Animals

Zebra mussels were discovered in three new inland lakes including Minnetonka, Gull, and Victoria (see Regional Updates for more information). They are currently found in 19 inland lakes, isolated areas of Lake Superior, the Mississippi River from Crow Wing County to the Iowa border, the St. Croix River from Stillwater downstream, Pelican Brook, and the Zumbro River downstream from Lake Zumbro.

No new **New Zealand mudsnail** infested waters were discovered in 2010.

Spiny waterfleas were discovered in Burntside Lake near Ely and continue to spread along Minnesota-Canada border waters.

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

Faucet snails were discovered in the Mississippi River below Lake Winnibigoshish and in the Crow Wing River south of First Crow Wing Lake. These are expansions of existing populations in the area (Figure 1).



Mute swans were found at three locations in 2010. A total of four birds were reported in the wild.

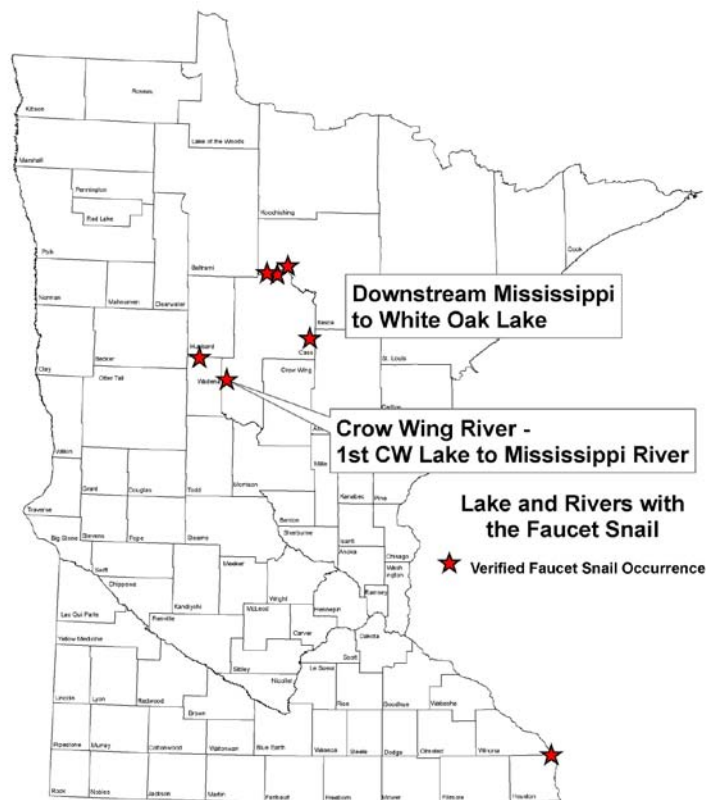


Figure 1. Faucet snail infested rivers and lakes in Minnesota as of November 2010.

The Response

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

Program Goal Highlights

1. Prevent introductions of new invasive species into Minnesota

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

Regulations

The 2010 Minnesota Legislature passed a new law (Minnesota Statutes 2008, section 84D.10) requiring the draining of boating-related equipment holding water and live wells and bilges by removing the drain plug before leaving waters of the state and transporting the watercraft and associated equipment on public roads. Drain plugs,

bailers, valves, or other devices used to control drainage of water from ballast tanks, bilges, and live wells must be removed or opened while transporting watercraft on a public road. Marine sanitary systems and portable bait containers are excluded from this requirement. Draining of bait buckets still applies when leaving designated infested waters with zebra mussels and spiny waterfleas. In addition, the DNR is required to report to the Minnesota Legislature each odd-numbered year, on additional measures to protect state water resources from human transport of invasive species. The law went into effect July 1, 2010.

Education

Education efforts explain the risks posed by invasive species and the steps that people and businesses can take to prevent new introductions. New education efforts, including training sessions, presentations, and informational materials, were offered to the public and bait dealers to help raise awareness about aquatic invasive species. Training workshops were held statewide to teach professional dock installers, dock people, fishing guides, and marina operators how not to spread aquatic invasive species.

2. Prevent the spread of invasive species within Minnesota

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

Stakeholder input

The DNR and Minnesota Waters partnered to hold a series of five meetings and public open houses across the state in Duluth, Minnetonka, Walker, Fergus Falls, and Willmar. Held in January 2010, these sessions focused solely on aquatic invasive species prevention. The purpose of the stakeholder meetings was to inform citizens of current DNR prevention efforts, to gain citizen input and share new ideas on improving prevention, and to develop new partnerships focused on local and state action. Over 200 citizen leaders, local government officials or staff, and community business representatives participated in the meetings and open houses. It was clear that the citizens of Minnesota take the threat of aquatic invasive species seriously and feel that not enough is being done to effectively prevent the spread of aquatic invasive species. In particular, those who attended the meetings are most concerned with the spread of zebra mussels, Eurasian watermilfoil, and Asian carp, among others. Stakeholders stated that state agencies need to take bold action or aquatic invasive species will continue to spread in the state. Many also stated that not enough resources are available to meet the invasive species prevention needs. A smaller group of stakeholders participated in additional meetings to work through the ideas generated and develop a recommended suite of actions for the legislature, DNR, and local government and organizations to consider implementing.

Watercraft inspections

In 2010, 90 watercraft inspectors worked through the summer to check boats and provide information to the public. Inspections began in late April and continued through mid-October in order to reach waterfowl hunters. Within this 25-week period, watercraft

inspectors logged 50,000 inspection hours and inspected 66,000 watercraft. In addition, inspections were conducted at 40 fishing tournaments.

The Watercraft Inspection Program also worked cooperatively with 42 associations and citizen groups to increase inspection hours in their areas. These citizen groups funded additional hours of inspection at their accesses and often matched them with DNR grants. The Invasive Species Program also provided training, equipment, and supervision.

Enforcement

Conservation officers spent more than 12,800 hours enforcing the invasive species laws and rules. This was a 2.5 fold increase over 2009 hours (4,800). Statewide, there were 158 civil citations, one criminal citation, and 350 written warnings issued to individuals for violation of invasive species laws. Conservation officers statewide carried out a 'Pick it or Ticket' campaign on the 4th of July weekend targeting recreational boater and getting the word out on the new drain plug law.

3. Reduce the impacts caused by invasive species

Grant program for control of aquatic invasive plants

The DNR continued its grant program to support pilot projects for lake-wide control of curly-leaf pondweed or Eurasian watermilfoil during 2010. Grants totaling \$346,000 were given to 24 lakes under this program for control efforts. In addition, \$125,000 in grants was given to 25 lakes to control nuisance populations of Eurasian watermilfoil and flowering rush. In 2010, grants were offered for management of new, small populations of Eurasian watermilfoil and flowering rush. One Early Detection and Rapid Response grant for \$2,300 was awarded for Chub Lake in Carlton County for Eurasian watermilfoil control.

Regional Updates

Region 1- Northwest

New infestations

- Zebra mussels were discovered near Alexandria in Lake Victoria.
- Faucet snails were discovered in the Mississippi River downstream of Lake Winnibigoshish, Little Winnibigoshish Lake, and the Crow Wing River downstream of First Crow Wing Lake.

Prevention activities

- Enforcement was increased around the infested lakes; watercraft inspections doubled from 7,954 in 2009 to 15,491 in 2010.
- Training was provided to private dock removal companies and other lake professionals on proper cleaning and movement of equipment.
- A total of \$29,000 was awarded to 14 groups to initiate new or continue customized projects and an additional \$72,000 was awarded for 6,000 hours of watercraft inspections to 37 entities at the local level.

- A prevention, awareness, and education plan was initiated with the Leech Lake Band of Ojibwe and its Department of Resource Management to better deal with Aquatic Invasive Species (AIS) issues on and around the reservation lands and waters.

Management activities

- On Leech Lake, Eurasian watermilfoil was chemically treated in six harbors and hand pulled in six harbors to reduce the risk of spread to new lakes.
- Technical assistance, surveys, and information were provided to lake groups with curly-leaf pondweed and/or Eurasian watermilfoil infested lakes including Washburn and Town Line lakes (Cass County), Union Lake (Polk County), Barrett Lake (Grant County), and Big Pine Lake (Otter Tail County). Upper Cormorant (Becker County), Blueberry (Wadena County), and Margaret lakes (Cass County) were included in the pilot program to evaluate lake-wide treatment of curly-leaf pondweed or Eurasian watermilfoil. Washburn, Townline, and Union lakes were all chemically treated for Eurasian watermilfoil.
- The DNR continued to work closely with the Pelican River Watershed District, the city of Detroit Lakes, area lake associations, and riparian owners to find ways to minimize the impacts of flowering rush. A cooperative research plan was developed with university researchers, local officials and stakeholders, and the DNR. Small-scale efforts such as hand removal, harvesting, and chemical applications took place at the city beach and other properties on Detroit and Curfman lakes.

Region 2 - Northeast

New infestations

- Zebra mussels were found on Gull Lake near Brainerd (Crow Wing County).
- Eurasian watermilfoil was confirmed on Tame Fish Lake (Crow Wing County).
- Japanese knotweed was confirmed in Cohasset (Itasca County).
- Spiny waterflea infestation was confirmed in Burntside Lake (St. Louis County).
- Viral Hemorrhagic Septicemia (VHS) confirmed in Minnesota waters of Lake Superior.

Prevention activities

- More than 1,200 hours of watercraft inspection were completed at Mille Lacs Lake.
- Training and testing for bait dealers who harvest bait in zebra mussel-spiny water flea, and faucet snail-infested waters was held in Brainerd.
- AIS information was presented to numerous lake association and community groups including: Serpent Lake, White Sand Lake, Hubert Lake, Ross-Twin-Stark Lakes (Crow Wing County), Cedar Lake (Aitkin County), LARA (Aitkin County), Itasca County ICOLA, Splithand Lake (Itasca County), Chub Lake (Carlton County), Windemere lakes (Pine County); Soil and Water Conservation Society annual meeting, Cross Lake Community Library monthly meeting, the Todd County (Enviro Fest) for sixth graders, and Aitkin County Rivers and Lakes Fair.
- Stop Aquatic Hitchhiker! signs were provided through the DNR Grant Program to 14 lake associations in five counties.

- Updated signs were posted at public water accesses from St. Louis Bay to Silver Bay indicating the presence of VHS in Lake Superior waters.

Management activities

- Plant surveys and technical assistance were provided to lake associations and lake improvement districts planning management activities. Curly-leaf pondweed: Serpent Lake, Hubert Lake, Middle Cullen Lake, Pelican Lake, Round Lake, North Long Lake, Crooked Lake, Hanks Lake, Crow Wing Lake, Little Pine Lake, Sebie Lake, Sibley Lake, Mayo Lake (Crow Wing County), Dixon Lake, Black Water Lake (Itasca), Lake Vermilion (St. Louis County) Farm Island Lake and Gun Lake (Aitkin County). Eurasian watermilfoil: Ruth Lake, Tame Fish Lake, Upper Mission Lake (Crow Wing County), Sand Lake, Sturgeon Lake (Pine County), Chub Lake (Carlton County).
- Point intercept plant surveys, early season mapping, and fall turion surveys were conducted on curly-leaf pondweed grant lakes including Lower Mission Lake, Lower Cullen Lake (Crow Wing County), Dixon Lake (Itasca County).
- Eurasian water milfoil was treated in 17 harbors and water accesses on Mille Lacs Lake.

Region 3 - Central

New infestations

- Zebra mussels were discovered in Lake Minnetonka in July. Surveys confirmed established populations in multiple locations.
- Eurasian watermilfoil was discovered in eight new lakes in the central region.

Prevention activities

- In response to the Lake Minnetonka zebra mussel infestation, target enforcement efforts were carried out around the lake, new signs posted, and public meetings were held with citizens to inform them about impacts to the lake and what precautions are required to minimize impacts to users and prevent the spread.
- 33,700 watercraft were inspected in the region in 2010.
- New invasive species awareness signs were posted at public accesses

Management activities

- 18 lakes received funding for management of curly-leaf pondweed and Eurasian watermilfoil. Technical assistances for treatments, pre- and post-treatment surveys and reports were carried out for these lakes.
- The U.S. Army Engineer Research and Development Center continued monitoring the efforts of herbicide treatments of Eurasian watermilfoil in Gray's and Phelp's bays on Lake Minnetonka. Results of these efforts are helping the DNR and its partners evaluate the efficacy and also the potential risks of bay-wide treatments.

Region 4 - South

New infestations

- Eurasian watermilfoil was discovered in the following lakes: Calhoun (Kandiyohi County), Mazaska (Rice County), Circle (Rice County), Madison (Blue Earth County), and Minnie-Belle (Meeker County).

Prevention activities

- Enforcement was increased around infested waters; watercraft inspections increased from 4,300 in 2009 to 6,140 in 2010.
- Worked at local fairs and events including Kids Day Fishing and Cannon River Festival.
- A total of \$29,000 was awarded to 14 groups to initiate new or continue customized public awareness projects and an additional \$72,000 was awarded for 6,000 hours of watercraft inspections to 37 entities at the local level.

Management activities

- Clear Lake in Meeker County completed its fifth year in the pilot program to control curly-leaf pondweed on a lake-wide basis. The program has been successful in reducing curly-leaf pondweed in biomass.
- Technical assistance, surveys, and information were given to the following lake groups: Lake Calhoun (Kandiyohi County), Florida Lake (Kandiyohi County), Diamond Lake (Kandiyohi County), Norway Lake (Kandiyohi County), Green Lake (Kandiyohi County), Lake Mazaska (Rice County), Circle Lake (Rice County), Lake Roberds (Rice County), Gorman Lake (Le Sueur County), Madison Lake (Blue Earth County), Lake Minnie-Belle (Meeker County), Lake Benton (Lincoln County), Jefferson-German chain of lakes (Le Sueur County), Clear Lake (Waseca County), Little Mud Lake (Meeker County), and Lake Washington (Meeker County). Lake Sakatah (bay only) (Le Sueur County) continued the pilot program to treat curly-leaf pondweed.
- Citizen Lake Monitoring training was provided to interested lake associations at various times of the season.

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 \$4,935,000 for all invasive species prevention and management activities for the 2010 fiscal year.

Aquatic invasive species spending (\$3,893,000) for fiscal year 2010 is shown in Figure 2. The Management/Control and Inspections/Enforcement categories account for 76% of aquatic invasive species spending. These two spending categories along with expenditures for Education/Public Awareness activities, reflect the importance the DNR places on efforts to prevent the spread of invasive species and to help manage the problems those species cause once they become established.

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

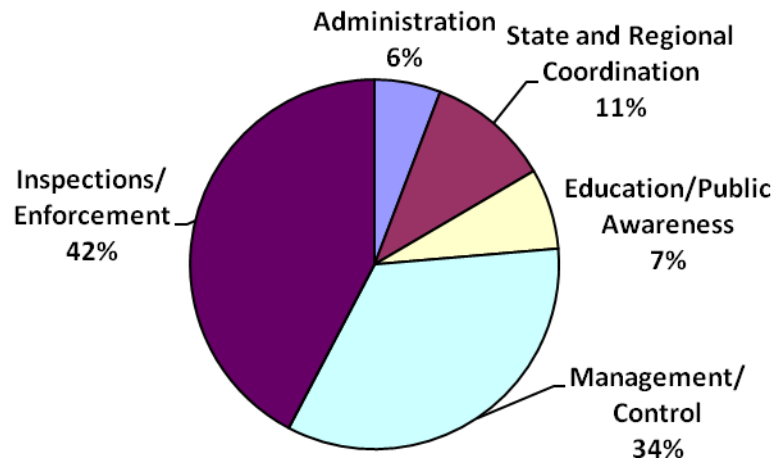


Figure 2. Aquatic Invasive Species Program spending (Invasive Species Account and General Fund only) in FY10 by major categories.

Introduction

Overview of DNR's Invasive Species Program

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

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

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

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

The DNR Invasive Species Program addresses many invasive species that are present in Minnesota such as Eurasian watermilfoil, purple loosestrife, zebra mussels, and spiny waterfleas (see Appendix A). The Program also attempts to prevent the introductions of invasive species that have the potential to move into Minnesota such as hydrilla, water chestnut, and Asian carp. To do so, the Program identifies potentially invasive species in other areas of North America and the world, predicts pathways of spread, and develops and implements solutions that reduce the potential for introduction and spread. 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 and Water-Invasive Species Program (See Appendix B). In addition, the Invasive Species Program hires about 90 students during the summer to inspect boats at public water accesses and help implement management activities. Staff from the DNR divisions of Fish and Wildlife and Enforcement, as well as the 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 2007 Minnesota Legislature increased the funding for invasive species from \$2.4 million to \$4.9 million annually. The increase in funding has allowed the Invasive Species Program to restructure to build capacity for the future, react quickly to new threats, and provide more support to those trying to manage invasive species. The DNR is expanding activities focused on both aquatic and terrestrial species. Specific target areas include:

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

Many of these program expansions have been implemented including, 1) hire additional invasive species specialists to work at the local level with lake associations, lake improvement districts, and local units of government on prevention and management efforts; 2) hired eight conservation officers who will work approximately half time on invasive species issues; 3) increase the number of watercraft inspectors from 75 to 90; and increase funding for prevention and management of aquatic invasive species. You can read about these efforts in detail in the following chapters of this report.

Other DNR Support

Staff from the DNR divisions of Fish and Wildlife and Enforcement, and the Office of Communication and Outreach contributes significantly to the implementation and coordination of invasive species activities.

Pesticide enforcement specialists from Ecological and Water Resources and Aquatic Plant Management Specialists in DNR Fisheries assist with the management of various invasive plants including purple loosestrife, Eurasian watermilfoil, curly-leaf pondweed, and flowering rush. In addition to these staff, other individuals from the Division of Fish and Wildlife and the Division of Ecological 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.

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).

Other State Invasive Species Control Programs

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

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

Participation in Statewide, Regional, and National Groups

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

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

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

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

Development of a Statewide Invasive Species Management Plan

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

Minnesota Invasive Species Advisory Council (MISAC), co-chaired by the 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.

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

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

Expenditures

Funding Sources

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

State Funds

The primary funding source is a \$5 surcharge on the registration of watercraft in Minnesota. The surcharge on Minnesota watercraft generates sufficient funds to allow an annual appropriation of approximately \$1,200,000. The 2007 Legislature established a new \$2 fee on non-resident fishing licenses that generated approximately \$400,000 in FY10. The program is also supported with funds from general fund appropriations. In addition, the 2007 Legislature created an “Invasive Species Account” in which all watercraft surcharge and non-resident fishing license proceeds are held.

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

Table 1. State and local funding (in thousands of dollars) received by the Invasive Species Program, fiscal years 2003-2010.

| Fiscal Year | Surcharge ² | Invasive Species Acct | General Fund | Legislative-Citizen Commission on Minnesota Resources ¹ | Local Contributions | Total |
|-------------|------------------------|-----------------------|--------------|--|---------------------|-------|
| 2003 | 1,191 | | | 45 | 11 | 1,247 |
| 2004 | 1,582 | | | 55 | 19 | 1,656 |
| 2005 | 1,641 | | | 54 | 17 | 1,712 |
| 2006 | 1,795 | | | 100 | 42 | 1,937 |
| 2007 | 1,795 | | 550 | 100 | 53 | 2,498 |
| 2008 | 53 | 1,349 | 1,520 | 100 | 45 | 3,067 |
| 2009 | 53 | 2,142 | 2,740 | 100 | 46 | 5,081 |
| 2010 | 53 | 2,142 | 2,640 | 100 | -- | 4,935 |

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.

| Category | Federal Fiscal Year ¹ Grant Awarded | Calendar Year(s) Used | Grant Amount (1000s of \$) | Source |
|---|---|--------------------------|-------------------------------|--------|
| Implement St. Croix management plan for aquatic nuisance species | | | | |
| | 2005 | 2006 | 70 | USFWS |
| | 2006 | 2007 | 46 | USFWS |
| | 2007 | 2008 | 37 | USFWS |
| | 2008 | 2009 | 41 | USFWS |
| | 2009 | 2010 | 28 | USFWS |
| Research on biological control of garlic mustard | | | | |
| | 2007-10 | 2007-10 | 115 | USFS |
| | 2003-06 | 2004-07 | 225 | USFS |
| | 2006 | 2006 | 10 | USFWS |
| | 2007-08 | 2008-09 | 75 | USFS |

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

Local Funds

Local groups work with the DNR to manage invasive aquatic species and, in some cases, provide funds to expand planned efforts (Table 1). During 2010, 13 local groups provided funding so that the number of watercraft inspections on specific lakes could be

increased. See Watercraft Inspections and Awareness Events for a more detailed account of these cooperative efforts.

Timeframe

This report covers activities in calendar year 2010, which includes the last half of the Minnesota fiscal year 2010 (FY10), January 1-June 30, 2010, and the first half of fiscal year 2011 (FY11), July 1-December 31, 2010. To provide a comprehensive review of expenditures and to meet the report's January 15, 2011 due date, we report on expenditures that were incurred in FY10 (July 1, 2009-June 30, 2010).

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 2010

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 2010 (FY10) Expenditures

Expenditures on aquatic invasive species activities during FY10 (July 1, 2009-June 30, 2010) totaled \$3,893,000. 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, \$802,000 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 \$1,977,000 of “Invasive Species Account” expenditures during FY10 (Table 3) were less than the \$2,142,000 appropriated by the Legislature (Table 1). The unspent FY10 funds will be spent in FY11. A portion of the appropriated general fund went unspent in FY10. \$90,000 was unallotted to help balance the state budget deficit. The remaining unspent funds were allocated for grants for management of invasive aquatic plants that went unused by potential grantees and will be used in FY11.

Figure 3 provides a broad outline of how the funding was spent from the “Invasive Species Account” and the general fund for aquatic invasive species. Within Figure 3, the Management/Control category (\$1,205,000) and Inspections/ Enforcement category (\$1,496,000) represent the two largest segments of the budget; these two categories accounted for 76% of aquatic invasive species expenditures in FY10. The focus on those two categories, plus Education/Public Awareness which represents an additional 7% of FY10 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.

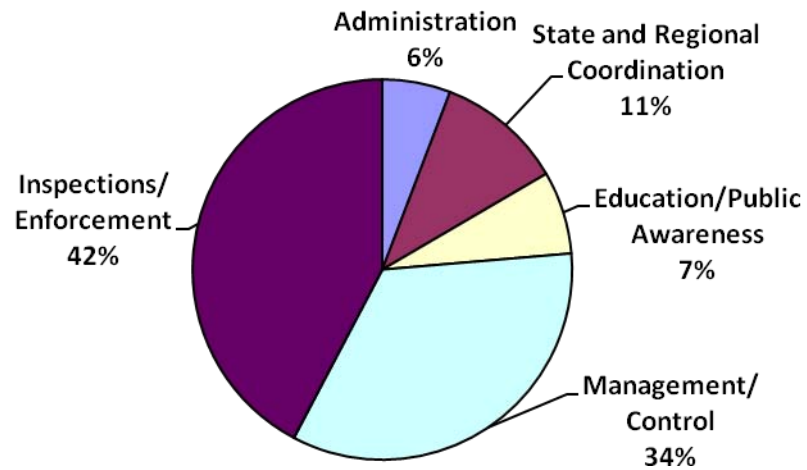


Figure 3. Aquatic Invasive Species Program spending (Invasive Species Account and General Fund only) in FY10 by major categories.

Fiscal Year 2010 (FY10) Future Expenditures

Since this report is due in the middle of FY10, projected expenditures for that fiscal year are not reported. A comprehensive review of FY11 expenditures will be provided in the 2011 Annual Report.

Table 3. Invasive species related expenditures in fiscal year 2010 (FY10) (in thousands of dollars).

| Categories of Expenditures | Invasive Species Account | General Fund | Other Funding Sources |
|---|--|--|---|
| | FY10 | FY10 | FY10 |
| Administration Division Support Costs Regional Representation Clerical Administrative Support Subtotal | 103 | 101 | 0 |
| State and Regional Coordination State coordination Support regional/federal activities Training, supervising, related work Equipment and services Other Subtotal | 331 | 50 | 8 |
| Education/Public Awareness Radio spots, TV, website development Other Subtotal | 102 | 148 | ³ 106 |
| Management/Control <u>Aquatic</u> Eurasian watermilfoil Purple loosestrife Zebra mussel Curly-leaf pondweed Flowering rush <u>Terrestrial invasive species</u> Subtotal | -- 523 | 682 548 1,230 | ^{1,3} 19 - 19 |
| Inspections/Enforcement Watercraft inspections Enforcement - access checks Prevention - laws/risk assessments Subtotal | 903 -- -- 903 | 43 550 -- 593 | ^{1,3} 156 ¹ 53 -- 209 |
| Research Aquatic species Terrestrial Invasive Plants Subtotal | 15 15 | 26 26 | --- ^{1,2, 3} 228 228 |
| Total | 1,977 | 2,148 | 570 |

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

Prevention and Containment

Introduction

Issue

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

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

Goals

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

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

"Continue to contain infestations where eradication is not possible"

Progress in Prevention and Containment - 2010

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 significantly increased and resulted in significantly 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 \$29,000 was awarded to 14 groups to initiate new or continue customized projects and an additional \$72,000 for was awarded 6,000 hours of watercraft inspections to 37 entities at the local level.
- DNR watercraft inspectors logged over 50,000 inspection hours (33,000 DNR, 12,000 through DNR grants and local match, and 5,000 local contracts) resulting in a total of 66,000 watercraft/trailers being inspected.

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

Early Detection and Rapid Response

In 2010, there was one new invader to the waters of the state — the fish virus Viral Hemorrhagic Septicemia (VHS) was detected in Lake Superior. Several steps were taken by DNR in response:

- DNR issued a news release about the finding;
- Revised and reprinted a VHS brochure;
- Posted Invasive Species Alert signs with VHS stickers at the water accesses;
- Designated Lake Superior and its tributaries as infested waters with VHS;
- Greatly increased enforcement along Lake Superior especially on the Fishing Opener Weekend to focus on boaters and anglers draining water; and
- Established emergency rules requiring smelt and cisco used as bait to be preserved.

There are also several ongoing actions that were continued:

- Watercraft inspections at public water accesses on Lake Superior and the St. Louis River estuary;
- No longer taking walleye spawn from the St. Louis River for DNR hatcheries (now use Pike River strain for stocking).
- No longer using French River Hatchery for short-term trout holding before stocking in NE Minnesota;
- No longer hatching white sucker eggs at the Duluth Hatchery (sucker fry were used for forage);
- Surveillance testing of fish for VHS in Lake Superior (St. Louis River estuary) annually;
- Required testing of fish for VHS before being stocked in Minnesota waters; and
- State surveillance testing for VHS through USDA-APHIS grants. Surveillance testing includes targeting high-use recreational water bodies, such as the large walleye lakes, and our eastern border waters with Wisconsin including the Mississippi River. Other surveillance includes testing fish from state and private fish production facilities and ponds used to raise fish for stocking into state's waters.

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 Minnetonka and Gull lakes, faucet snails in waters below Lake Winnibogoshish, as well as, findings of Eurasian watermilfoil in several lakes triggered standard responses by the Invasive Species Program. Responses at these waters included:

- 1) Assessing of the infestation size and distribution by DNR staff,
- 2) Notifying local lake associations,
- 3) Issuing a news release about the new infestation,
- 4) Posting Invasive Species Alert signs at the water accesses,
- 5) Starting watercraft inspections at public water accesses on the new 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 species management chapters.

Priority Containment Lakes

Several lakes in the state were the focus of elevated containment efforts in 2010: Mille Lacs, Minnetonka, Gull, and Winnibigoshish. They were the focus of increased signing, public awareness actions, 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.

At Lake Minnetonka, containment was intended to prevent spread of the zebra mussel. The lake and connected waters were designated as infested waters in August 2010 and updated versions of both *Invasive Species Alert* and *Stop Aquatic Hitchhikers!* signs were posted at water accesses around the lake in partnership with the Lake Minnetonka Conservation District. DNR also worked with the LMCD and other organizations and businesses to survey the lake, raise awareness of the new infestation, and take other response actions (see Management of Zebra Mussels). New informational items with regulations related information were produced and distributed at the lake. Training for lake service providers and new permits for them were issued to transport boats and equipment from the lake. Also, new procedures were established for boaters who wanted to transport their boats to a cleaning and winter storage location.



adult zebra mussel 1/2 to 2"

— Attention —

ZEBRA MUSSELS

are in Lake Minnetonka



young zebra mussels 1/8 to 1/2"

It's the Law! Before you leave a water access at Minnetonka you must:

- ✓ **Drain water** from motor, boat bilges, livewells, and other boating equipment holding water. Drain plugs must be **removed** from bilges and livewells and all water draining devices must remain open while transporting on a public road. (MN Rule 6216.050, Subp. 3; MN Statutes, sections 84D.10 and 84D.13)
- ✓ **Drain water from bait containers.** (MN Rule 6216.0500, Subp. 3) **If you want to keep your live bait – you must replace water in bait containers with tap or spring water.** Place *unwanted* bait in the trash where it is convenient.
- ✓ **Remove all aquatic plants and zebra mussels** from your boat, trailer, anchors, and other boating equipment (MN Statutes 84D.05, 84D.09, & 84D.13)

For more information:
 Contact the Department of Natural Resources
 1-888-MINNDNR or mndnr.gov/minnetonka_zebra_mussels



Prevention Grants

In 2010, 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 \$29,000 was awarded to 14 groups to initiate new or continue customized Stop Aquatic Hitchhikers! projects and an additional \$72,000 was awarded to 37 entities at the local level for 6,000 hours of watercraft inspections during 2010 (Table 4). The DNR funded portions of the grant proposals were capped at \$10,000.

The five types of grants or partnership projects eligible in 2010 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 no participants in this type of grant during 2010, although the Lake Minnetonka Conservation District used a combination of DNR and locally hired inspectors in 2010.

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 4. Example fish ruler produced by the Big Sandy Lake Association with local and DNR prevention grants funds.



Figure 5. Billboard produced and posted by the Crow Wing County Lakes and Rivers Alliance with local and DNR prevention grants funds.



Figure 6. Burma Shave style signs produced and posted by the Fifty Lakes Property Owners Association with local and DNR prevention grants funds.

Table 4. Summary of DNR Prevention Grants awarded in 2010.

| Local Entity | Grant | Grant Types | Specific Grant Activities |
|--|--------------------------|--|--|
| 50 Lakes Property Owners Association | \$1,826.00 | Public Awareness | Radio Ads, "Burma Shave" theme road signs |
| Aitkin County Soil and Water Conservation District | \$2,050.00 | Public Awareness | Fish Rulers, AIS information cards, travelling exhibit |
| Association of Cass County Lakes | \$1,200.00 | Public Awareness | AIS information cards |
| Big Cormorant Lake Association | \$1,680.00 | DNR Watercraft Inspections | 140 Inspection Hours |
| Big Mantrap Lake Association | \$1,680.00 | DNR Watercraft Inspections | 140 Inspection Hours |
| Big Sandy Lake Association | \$1,638.51 \$2,040.00 | Public Awareness DNR Watercraft Inspections | Billboards, Fish Ruler, 170 Inspection Hours |
| Carlton County | \$384.00 | DNR Watercraft Inspections | 32 Inspection Hours |
| Chisago County | \$9,996.00 | DNR Watercraft Inspections | 833 Inspection Hours |
| City of Big Lake | \$1,200.00 | DNR Watercraft Inspections | 100 Inspection Hours |
| Clear Lake Property Owners Association | \$1,300.00 | Public Awareness | AIS Brochures, SAH Floor mats |
| Cowdry Lakes Association | \$498.00 | DNR Watercraft Inspections | 41 Inspection Hours |
| Crow Wing Lake and Rivers Alliance | \$4,000.00 | Public Awareness | Billboard, Radio Ads, AIS information cards, Water Patrol Training |
| Douglas County Lakes Association | \$4,600.00 \$5,400.00 | Public Awareness DNR Watercraft Inspections | Billboard, Placemats/Table Tents, Radio Ads, SAH Road Signs, Public Presentation, 450 Inspection Hours |
| Floyd Shores Lake Association | \$1,344.00 | DNR Watercraft Inspections | 112 Inspection Hours |
| Friends of Lower Hay Lake | \$840.00 | DNR Watercraft Inspections | 70 Inspection Hours |
| Green Lake Property Owners Association | \$2,496.00 | DNR Watercraft Inspections | 208 Inspection Hours |
| Gull Chain of Lakes Association | \$2,016.00 | DNR Watercraft Inspections | 168 Inspection Hours |

Table 4. (Continued)

| Local Entity | Grant | Grant Types | Specific Grant Activities |
|---|--------------------------|--|---|
| Hubbard County COLA | \$3,570.00 \$3,720.00 | Public Awareness DNR Watercraft Inspections | Billboards, Radio Ads, AIS Brochures, 310 Inspection Hours |
| Hubbard County Long Lake Area Association | \$1,680.00 | DNR Watercraft Inspections | 140 Inspection Hours |
| Ida Lake Association | \$984.00 | DNR Watercraft Inspections | 82 Inspection Hours |
| Kandiyohi County Lakes Association | \$1,000.00 | Public Awareness | |
| Lake Darling Area Association | \$1,200.00 | DNR Watercraft Inspections | 100 Inspection Hours |
| Lake Hubert Conservation Association | \$672.00 | DNR Watercraft Inspections | 56 Inspection Hours |
| Lake Mary Organization | \$432.00 | DNR Watercraft Inspections | 36 Inspection Hours |
| Lake Miltona Association | \$672.00 | DNR Watercraft Inspections | 56 Inspection Hours |
| Lake Washburn Association | \$840.00 | DNR Watercraft Inspections | 70 Inspection Hours |
| Lake Washington Improvement Association | \$972.00 | DNR Watercraft Inspections | 81 Inspection Hours |
| Little McDonald-Kerbs Lakes Association | \$2,016.00 | DNR Watercraft Inspections | 168 Inspection Hours |
| Lake Minnetonka Association | \$1,152.14 \$6,720.00 | Public Awareness DNR Watercraft Inspections | AIS Brochures, TV show, 560 Inspection Hours |
| North Long Lake Association | \$672.00 | DNR Watercraft Inspections | 56 Inspection Hours |
| Otter Tail Lakes Property Owners Association | \$4,704.00 | DNR Watercraft Inspections | 392 Inspection Hours |
| Pelican Lakes Association | \$1,000.00 \$2,520.00 | Public Awareness DNR Watercraft Inspections | 210 Inspection Hours |
| Pelican Group of Lakes Improvement District | \$3,360.00 | DNR Watercraft Inspections | 280 Inspection Hours |
| Roosevelt and Lawrence Area Lakes Association | \$2,000.00 \$3,360.00 | Public Awareness DNR Watercraft Inspections | Radio Ads, 280 Inspection Hours |
| Sportsmen's Club of Lake Vermillion | \$1,185.32 \$1,998.00 | Public Awareness DNR Watercraft Inspections | AIS regulation and ID cards, Print Ads, Placemats, 166 Inspection Hours |
| Thunder Lake Association | \$2,000.00 \$1,680.00 | Public Awareness DNR Watercraft Inspections | AIS brochures, SAH signs, Training, 140 Inspection Hours |

Table 4. (Continued)

| Local Entity | Grant | Grant Types | Specific Grant Activities |
|--|------------|----------------------------|---------------------------|
| Whitefish Area Property Owners Association | \$2,490.00 | DNR Watercraft Inspections | 207 Inspection Hours |
| White Bear Lake Association | \$1,680.00 | DNR Watercraft Inspections | 140 Inspection Hours |

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):

- were proposals focused on zebra mussels and/or spiny waterfleas;
- were proposals located at or near infested waters or high-use waters;
- were proposals located in high-use or popular traveler destination areas;
- was the proposal 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 2010 to rank and award the grants because there was a much higher demand for grants than funds available. All eligible applications were not funded.

In 2011, DNR is planning to expand the total prevention grant amount available for public awareness projects and watercraft inspections to about \$250,000. This increase is due to new federal funding that is available to the DNR. A request for proposals for watercraft inspections grants in 2011 was issued in early January by DNR and a new RFP for public awareness grants will be issued in mid-January 2011.

Infested Waters Permits

Minnesota Rules, Chapter 6216 prohibit the diversion and transport of water from designated infested waters except by permit. In 2010, there were several requests to transport infested water and to divert infested waters. The following entities obtained infested waters permits in 2010 from the DNR Invasive Species Program:

- St. Paul Regional Water Services - Appropriation for St. Paul municipal water supply and for maintenance of supply pipes;
- Center for Drug Design, University of Minnesota; and
- Minnesota Pollution Control Agency - Appropriation and transport of infested water for water quality testing.

Prohibited Invasive Species Permits

State law prohibits the possession, transport, sale, purchase, and import of prohibited invasive species except by permit. In 2010, 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:

- Xcel Energy - zebra mussels;
- XIK Corporation - purple loosestrife;
- Breezy Point Resort - zebra mussels;

- University of Minnesota - purple loosestrife;
- John Madsen - flowering rush;
- Hamline University - purple loosestrife;
- University of Minnesota-Duluth - sea lamprey;
- University of Minnesota-Twin Cities - bighead and silver carp;
- Center for Drug Design, University of Minnesota - curly-leaf pondweed and Eurasian watermilfoil;
- Bluewater Science - zebra mussels; and
- Freshwater Scientific Services, LLC - invasive aquatic plants

In addition, dozens of permits to transport boats and equipment from Lake Minnetonka for cleaning and winter storage were issued 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.

Asian Carp Prevention

None of the four Asian carp species (black, grass, bighead, and silver) were reported as caught in Minnesota in 2010. There was no significant progress in establishing behavioral fish barriers in Minnesota waters of the Mississippi River in 2010 to slow the upstream spread of Asian carp species. The lack of progress was primarily due to the absence of federal funding to allow the U.S. Army Corps of Engineers to work on the issue.

However, there was considerable interest in using the Coon Rapids Dam as a physical fish barrier to protect the Mississippi River watershed above that point in the river. Because the dam has structural and operational issues that need attention, there were meetings held, a commission formed, and a contract issued to review the dam's issues and potential for it to be a permanent fish barrier.

DNR Fisheries staff review of the current structure as a barrier for Asian carp stated, "A conservative assumption is that the dam could be passable as frequently as every year during high water periods. A slightly less conservative value might be to assume that greater forward momentum would be required when leaping the dam, meaning that perhaps a vertical drop of greater than eight feet may be impassable. Using this value, the dam may still be passable every other year under the current operating plan. It should go without saying that the lower the elevation, the greater the risk" (Personal communication Brian Nerbonne, DNR Stream Habitat Specialist).

A report from Stanley Consultants, under contract with DNR, estimated it would cost \$17 million to modify and repair the dam to provide a long-term solution to the dam's structural integrity issue and to enhance its effectiveness as a fish barrier. Their report

(and Nerbonne concurs) found that with modifications that seem to be acceptable to the Commission, the dam could be made 99% effective as an Asian carp barrier. Modification of the dam to make it 100% effective will probably not be possible due to legal reasons.

Future Needs

New ideas for prevention that were recommended by a stakeholder group and proposed DNR responses for the future are included in a separate report — Report to the Minnesota Legislature on Aquatic Invasive Species Prevention Measures.

Education and Public Awareness

2010 Highlights

- A multi-media public awareness campaign and enforcement effort was held beginning July 1 and continuing through the July 4 weekend at key locations in the state to help raise awareness about aquatic invasive species and the new “drain plug” law.
- The DNR partnered with the Lake Minnetonka Conservation District, Minnehaha Creek Watershed District, Lake Minnetonka Association, Three Rivers Park District, and Freshwater Society on a public awareness campaign in response to the discovery of zebra mussels in Lake Minnetonka in late July.
- DNR was a co-sponsor of the Minnesota-Wisconsin Invasive Species Conference held in November.
- DNR’s Prevention Grant Program awarded 17 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.

Goals

Public awareness efforts in Minnesota are designed to:

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

Progress in Public Awareness - 2010

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, Memorial Day, Fourth of July, and Labor Day. The stations were selected for their listener profiles which correspond with those of boat owners. In addition, paid ads and public service announcements were aired on Minnesota News Network, reaching nearly 60 commercial radio stations throughout greater Minnesota in May, July, and August.

In late summer, ads were placed in the Duluth market, Brainerd Lakes area, Twin Cities, and southeastern Minnesota (Rochester and Winona) where zebra mussel infestations occur. Broadcast ads were also placed on stations in Baudette and International Falls to raise awareness about spiny waterfleas and other invasive threats along Minnesota's northern border waters.

In addition, public service announcements (PSAs) were made available to Minnesota radio stations along with communication encouraging program managers to play the announcements. The PSAs also are available from the DNR's website, making them readily accessible to station managers when needed. PSAs were distributed throughout the spring and summer boating season and into fall for the waterfowl hunting season.

Television

Paid television advertising was used again this year in the Duluth market during July and August to remind viewers of the continuing concerns about invasive species in the area. The 30-second ad features a DNR conservation officer alerting boaters and anglers 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 summer and early fall on "Minnesota Bound," a popular half-hour program that appeals to both outdoor enthusiasts and general audiences. The ad also aired in the LaCrosse area during both morning and evening newscasts to reach viewers in southeastern Minnesota/southwestern Wisconsin.

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

Newspapers and informational materials

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 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.

A second ad design was used during the special July 4 “Pick it” or “Ticket!” public awareness and enforcement effort. The ad, featuring a conservation officer writing a ticket, was designed to raise awareness of the fines that can be assessed for failure to clean a watercraft properly. Enforcement also used this opportunity to inform boaters about the new drain plug law that became effective July 1.

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 2010 *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 a Stop Aquatic Hitchhikers! message with former Minnesota Twins player and outdoor enthusiast Kent Hrbek, challenging anglers to make the commitment to stop aquatic hitchhikers. More than one million copies of the fishing regulations were printed and distributed.

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

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

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

Outdoor media

DNR partnered with Wildlife Forever, U.S. Forest Service, USFWS, Coalition of Lake Associations in Hubbard and Becker counties, Sportsmen’s Club of Lake Vermilion, and Minnesota Sea Grant to develop and post billboards with the “Stop Aquatic Hitchhikers!” message at 18 locations and three “Pick it” or “Ticket!” messages on key state travel routes to and from lake areas. The billboards were placed beginning in May and continued through September.



DNR website

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

This year, in response to the discovery of zebra mussels in Lake Minnetonka, the DNR created an informational page on its website devoted exclusively to this topic. Developed out of a partnership between the DNR and the Lake Minnetonka Conservation District, Lake Minnetonka Association, Minnehaha Creek Watershed District, Three Rivers Park District, and Freshwater Society, the site included zebra mussel location maps along with photos and information on the biology and identification of this invasive as well as contact information for the partnering agencies. Updates to the site were made regularly so that lakeshore owners, boaters, and marine business operators would have a single, reliable source of information about this issue (see Management of Zebra Mussels).

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. The display was updated recently to include a new, three-sided kiosk with information for water gardeners and aquarium owners, tips for preventing the transport of nuisance species, and updates on new areas of concern. An estimated 800,000 people visit the DNR's exhibits at the Minnesota State Fair each year.

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

Special Events

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

A special “Pick it” or “Ticket!” public awareness campaign was held starting on July 1 and continuing through July 5 in order to reach boaters during the busy holiday weekend. Major components of the campaign included radio and print advertising, outdoor media, and informational banners in addition to public awareness and media events held at six boat accesses in key locations around the state. Watercraft inspectors and conservation officers provided additional education to boaters about the new drain plug law during the events.

DNR was a co-sponsor of the Minnesota-Wisconsin Invasive Species conference held November 8-10 in St. Paul. Many other members of the Minnesota Invasive Species Advisory Council helped host the event. The focus of the conference was to strengthen awareness of invasive species issues, prevention, and management. Nearly 600 people participated in the event including researchers, land managers, natural resource professionals, university staff, landscapers, nursery, agricultural, and forestry employees, environmental specialists, lake association members, students, businesses and governmental organizations.

Presentations

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

Stakeholder meetings and open houses

The DNR partnered with Minnesota Waters to offer a series of meetings and open houses to facilitate an exchange of ideas and recommendations for invasive species prevention. More than 200 representatives from local units of government, businesses, and citizen groups attended the sessions which were held in Duluth, Fergus Falls, Minnetonka, Walker, and Willmar (see Summary).

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 2010 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).

Exhibits

Underwater Adventures

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

Minnesota Zoo

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

Cabela's

A new educational exhibit is currently under development for Cabela's Owatonna store.

Boat washing program

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

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

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

Public water accesses

DNR watercraft inspectors completed more than 50,000 hours of inspection (see Watercraft Inspections and Awareness Events), providing boaters with information and tips on ways to reduce the spread of invasive species. In addition to the expanded efforts of watercraft inspectors, conservation officers spent more than 12,800 hours enforcing regulations and invasive species laws (see Enforcement).

Help Stop Aquatic Hitchhikers! signs (see right) 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 2010 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 Invasive Species Advisory Council

In addition to the Minnesota-Wisconsin Invasive Species Conference, the Minnesota Invasive Species Advisory Council (MISAC) produced a 2011 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. 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 2010. They lead a cooperative effort to place "Stop Aquatic Hitchhikers!" billboards along key travel corridors in Minnesota and other states. This year, the organization produced several broadcast programs that aired on cable television. 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 34,721,467 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 30 university-based programs administered through the National Oceanic and Atmospheric Administration (NOAA). Several highlights of Minnesota Sea Grant's outreach and research activities in 2010 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, Minnesota-Wisconsin Invasive Species Conference 2010 Executive Planning Committee, Great Lakes Panel on ANS (at-large member), 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 reached nearly 13,500 people through direct programming at 82 events, meetings, workshops, and conferences. More than 42 talks were given to groups, communities, businesses, industries, agencies, and task forces across Minnesota and beyond.

Of those people reached, Sea Grant promoted the *Stop Aquatic Hitchhikers!* campaign at 51 events including the Mills Fleet Farm's *Kid's Fishing Day*, *Lake Superior Days* in Duluth, and the *Tall Ships Festival* also held in Duluth.

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 15 events, reaching over 1,200 people.

Sea Grant provided leadership and expertise during 15 events related to ballast water and maritime commerce. Staff have been actively engaged in many activities related to ballast water AIS outreach, education, and policy development across the Great Lakes, including the GLBWC. The Jan-March issue of the Great Lakes Seaway Review features "The Ballast Water Collaborative - Setting Tangible Goals and Deadlines for Progress." In May, the GLBWC met in Montreal, Canada. In July, they met in Duluth, Minnesota. Participants included ballast water treatment system vendors, vessel owners, policy makers, and technical staff.

In September, Sea Grant staff met with the U.S. Environmental Protection Agency Director, international shipping representatives, St. Lawrence Seaway Administration and Department Administrator, and U.S. Coast Guard Ballast Water Program Director.

Staff worked collaboratively with the University of Minnesota Extension's Shoreland Education Team to sponsor workshops for lake associations and realtors on shoreland buffers, plantings, and plant identification. An edition of the *From Shore to Shore* newsletter featured a story on the *Minnesota State Management Plan for Invasive Species*. See http://www.shorelandmanagement.org/downloads/sept_oct_2010.pdf.

New Funded Outreach Projects

Based on funding through the Great Lakes Restoration Initiative, Sea Grant partnered with the National Park Service to promote *Stop Aquatic Hitchhikers!* awareness. Staff activities included: hosting booths, presentations, written works and product development, and radio interviews. This partnership has nearly doubled AIS outreach capacities in communities along the North Shore.

The Great Lakes Sea Grant Network (GLSGN), led by Minnesota, began to implement a two-year comprehensive outreach initiative targeting 15 pathways aimed at preventing the spread of AIS. Featuring *Stop Aquatic Hitchhiker!*, *Nab the Aquatic Invader*, *Habitattitude*, *AIS-HACCP* program, and new Web-based social networking components, the campaign will employ proven and new strategies to protect the Great Lakes. Driven by Sea Grant survey results and social marketing, 30 new/improved outreach products will be produced reaching 40 communities and 4.85 million media exposures.

Based on a grant from NOAA-Sea Grant, the GLSGN, led by Wisconsin, began to conduct a two-year outreach effort in partnership with fishing tournament organizers and professional anglers. Minnesota Sea Grant will raise awareness and help prevent the

spread of AIS by tournament anglers and organizational activities during three events each year in Minnesota and beyond.

Youth Education

Sea Grant reached over 2,800 students about AIS in the Duluth area and beyond. Events included: Lake Superior College *Earth Fair*; Lester Park Elementary *Earth Day Fair*; Nettleton Elementary; Lake Superior Zoo *Earth Tracks*; *River Quest*; Mills Fleet Farm *Kids' Fishing Day* (11 locations in Minnesota); *Lake Superior Days*, and Great Expectations Charter School (Grand Marais).

Research

Sea Grant co-sponsored and lead research-based 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 first ever Minnesota-Wisconsin Invasive Species Conference in St. Paul in November. Conference materials are posted at http://www.minnesotaswcs.org/2010_mn_wi_invasive_species_conference.html
- Sea Grant organized a *Genetic Biocontrol of Invasive Fish Symposium* to discuss the potential for managing invasive aquatic animals through genetic technologies and methods, June 21-24, 2010 in Minneapolis, Minnesota. Nearly 80 participants learned about the current status of biocontrol technology and the issues surrounding its use. For more information, see http://www.seagrants.umn.edu/newsletter/2010/12/genetic_biocontrol_the_future_of_managing_invasive_fish.html.

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 and other stakeholders to pursue research and outreach funding through National Sea Grant, the Great Lakes Restoration Initiative USFWS, foundations, and other sources.

Enforcement

Introduction

Enforcement of Minnesota's invasive species regulations is key to the ultimate goal of preventing the spread into and throughout Minnesota. Enforcement activities, whether educational opportunities or issuing citations and warnings, are geared 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 enforcement in its endeavors. The new "pull the plug" law not only gives officers a valuable enforcement tool, but provides a valid 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 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.
- Hosting the first annual "Pick it or Ticket" campaign. Enforcement made it a priority to schedule work crews around the state and to provide public education on the busiest recreation weekend of the summer.
- 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.

Progress in Enforcement Efforts - 2010

Expanded Enforcement

This was the second 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.

The efforts to increase enforcement of invasive species laws for the 2010 open water season began long before the ice went out. Enforcement and Ecological and Water Resources management and field staff met in the fall of 2009 and again in the spring of 2010 to map out strategies and to prepare an enforcement plan on a statewide as well as regional and district levels. At the joint staff meetings, Water Resource Enforcement Officers (WREOs) were able to sit down with their field staff counterparts from Ecological and Water Resources and discuss the best course of action for their respective areas. These ideas were brought back to the group as a whole for discussion. 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, 2010, through the present, Minnesota conservation officers have worked 12,850 hours of invasive species enforcement and held 240 specific aquatic invasive species (AIS) work details.

In 2010, 158 civil citations and one criminal citation were issued for invasive species violations statewide (Table 5).

Regional Enforcement Highlights

Region 1

Region 1 WREOs attended community meetings throughout 2010 in regard to aquatic invasive species. The meetings included representatives from the Pelican River Watershed District, Alexandria chain of lakes, DNR officials, Detroit Lakes City Council, and lake associations.

Upon being advised of the arrival of zebra mussels in the area, WREOs, Enforcement District Supervisors, and local conservation officers met with local units of governments to formulate a plan of action. The officers took on the task of notifying lake service companies who were currently doing removal and storage work for the season. Officers facilitated training for lake service providers along with staff from Ecological and Water Resources. Bait harvesters, both commercial dealers and private citizens, were informed of the infestations and the rules that apply to the taking of bait.

With the recent discovery of zebra mussels in the Alexandria and Pelican Rapids areas, WREOs along with local officers coordinated work crews focusing on enforcement of invasive species transportation laws. Work crews were held throughout the northwest region from the Fishing Opener to Labor Day. During the July 4th weekend, some of these events were attended by local state legislators.

Region 2

Viral Hemorrhagic Septicemia (VHS) was confirmed in Lake Superior as well as the Duluth Harbor this year. As a result of this new discovery, many questions were addressed from the public along with a dramatic change in work priorities for the conservation officers along the coastal waters. A public information campaign which included discussions with local user groups, and utilizing all media forms available were conducted by WREOs and local conservation officers to educate the public on the VHS issue as well as the new “pull the plug” law.

Conservation officers in the southern portion of the region concentrated work crew efforts on educating fishing contest participants and fishing guides leaving infested waters in the Brainerd Lakes area. Officers regularly came together when small unpermitted fishing contests were discovered. District 9 also responded immediately to the discovery of zebra mussels in the Gull chain of lakes. Officers were already working with fishing guides and were in position the day of discovery to help educate boaters about the new infestation. Also working with Parks and Trails staff, officers responded to an incident where a contractor was appropriating water from the heavily infested Crow Wing River. Water appropriation was stopped, the equipment cleaned, and contractor educated.

Conservation officers dramatically increased enforcement and education efforts, especially around Mille Lacs Lake. Officers incorporated invasive species work crews into regular angling enforcement resulting in a significant number of educational and enforcement contacts and raising awareness among boaters/anglers of invasive species regulations. Officers also gave presentations to community organizations and contacted resorts, dock companies, and bait harvesters. Officers from the region worked together along with the Enforcement Aviation Section on special details during the Mille Lacs night fishing ban. Accesses all around the lake were covered by officers as anglers rushed off the lake at the 10:00 p.m.

Education efforts included: several presentations to lake associations including Gull and North Long lakes and working with Invasive Species Program Specialists to provide three training sessions for lake service companies (dock service, resorts, guides, etc.) and training for minnow harvesters with permits for infested waters. Three training sessions were also conducted for local law enforcement officers in Crow Wing and Cass counties in cooperation with the Crow Wing Lakes and Rivers Alliance. Conservation officers were given training in enforcement and in the biology of invasive species in March.

Region 3

Invasive species enforcement changed dramatically in the metro area with the discovery of zebra mussels in Lake Minnetonka. Officers assisted in training sessions, work crews, and educational efforts to educate the users in preventing the spread. Region 3 officers worked traditional invasive species enforcement as well as branching out into new areas. All districts were given one day training in AIS laws at Spring Lake Park in Dakota County during spring 2010.

Work crews were held throughout the region during the open water season. These details varied from formal planned events to events that local officers conducted on the spur of the moment. The officers' presence was very well received and numerous contacts were made with the public. Officers also gave AIS enforcement training to the Ramsey County Sheriff's Office and spoke to the Hennepin County Chiefs meeting about AIS.

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

Region 4

The Region 4 WREO coordinated with area conservation officers in implementing the new "pull the plug" law before leaving all lakes and rivers. A large component of the endeavor was on the prevention of zebra mussels moving into central Minnesota and southern Minnesota lakes. Working together with local lake associations and watercraft inspectors taking preventive measures to keep zebra mussels out of the central and southern regions. DNR Enforcement partnered with local organizations and watercraft inspectors to prevent the spread of AIS, increasing public education and enforcement by conducting over 75 work crews toward the goal of compliance by all.

The WREO along with area 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. The WREO and area conservation 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 from sloughs and wildlife areas and private hunting land.

A large part of the education process included working with and providing training to lake associations, lake service providers, and bait dealers as they all have responsibility in this process.

Goals for 2010

The Division of Enforcement believes that enforcement and education play a critical role in reducing the spread of invasive species. Historically this type of natural resource enforcement has never been experienced by officers. We will continue to monitor and evaluate our actions to provide the most effective measures available. We will work with the public and private entities on legislative issues to provide enforcement with the tools necessary to prevent the spread of AIS. We will continue to host the annual "Pick it or Ticket" campaign over the July 4th weekend, and to plan our work around how we can be the most effective. A large part of this effort focuses on educating the public.

For 2010, WREOs developed plans for education and enforcement of invasive species laws that are customized to the geographic areas they patrol. These plans focus on both species and activities that are unique to these areas. All enforcement efforts are

directed toward the goal of compliance to prevent the future spread of AIS and to receive complete buy-in from all involved parties.

Participation of Others

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

Officers are working with other Department staff to develop a schedule to train local 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 5. Invasive species violations for the open water season of 2010*

| Violation Type | January 1, 2010 to November 30, 2010 |
|---------------------------------------|--------------------------------------|
| Transportation of Aquatic Macrophytes | 100 |
| Fail to Drain Water/Pull Plug | 52 |
| Miscellaneous | 7 |

*Total citations entered to date

Table 6. Data for specific invasive species enforcement work crews in 2010 (this is a subset of all invasive species enforcement actions and efforts in 2010).

| Aquatic Invasive Species Work Crew Data | | | | | |
|---|------------|-------------|--------------------|-------------------|----------------|
| | # Contacts | # Citations | # Written Warnings | # Verbal Warnings | Violation Rate |
| Total | 7053 | 128 | 353 | 707 | 17% |

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

Table 7. Invasive species enforcement hours worked by DNR conservation officers in 2010.

| Central Office | Region 1 | Region 2 | Region 3 | Region 4 | Total |
|----------------|----------|----------|----------|----------|--------|
| 142 | 3,079 | 4,673 | 2,750 | 2,204 | 12,850 |

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

It is the DNR's responsibility to designate *infested waters* (see M.S. 84D.03). Water bodies are designated infested if they contain specific invasive species such as Eurasian watermilfoil, faucet snail, flowering rush, New Zealand mudsnail, ruffe, round goby, spiny waterfleas, white perch, or zebra mussels. The most current list of infested waters was posted on the DNR website in December 2010.

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 - 2010

Federal

Ballast Water – At the national level, the following occurred regarding national ballast water regulations during 2010:

- U.S. Coast Guard (USCG) - The Ballast Water Discharge Standard Notice of Proposed Rulemaking (NPRM) was published in the Federal Register on August 28, 2009 for public review and comment. The comment period for this proposed rule was extended from November 27 to December 4, 2009. The USCG has revised their expected publication date of the Ballast Water Discharge Standard rulemaking. It is now expected to publish in April 2011, rather than December 2010.
- U.S. Environmental Protection Agency (EPA) - EPA is beginning research and development of its next Vessel General Permit (VGP). The current VGP expires on December, 19, 2013. EPA is planning to propose a new VGP before the expiration of the existing VGP. In order to better inform EPA's understanding of ballast water discharges, the Agency has commissioned two scientific studies which appear to be complementary. These studies may prove useful in development of the next VGP. The first study is being led by the National Academy of Sciences National Research Council (NAS). The NAS study is assessing risk associated with ballast water discharges. As part of the study, EPA and U.S. Geological Survey researchers prepared a background paper titled "Density Matters" for the NAS committee's use. The second study is being led by EPA's Science Advisory board. This study is evaluating the status of ballast water treatment technologies. As part of this study, EPA and USCG staff prepared a white paper presenting key issues and background regarding ballast water treatment technology. EPA expects both of these studies to be completed by June 2011.

Injurious Wildlife - In late 2010, President Obama signed into law a bill that will aid in the fight against the further spread of Asian carp in the United States. The federal Asian Carp Prevention and Control Act, S.1421, added the bighead carp species of Asian carp to a list of injurious species that are prohibited from being imported or shipped in the United States under the Lacey Act.

Listing the bighead species of Asian carp under the Lacey Act will help prevent the intentional introduction of the species by prohibiting the interstate transportation or importation of live Asian carp without a permit. This legislation will complement existing state regulations of Asian carp, and it will allow states to issue permits to transport or purchase live Asian carp for scientific, medical or educational purposes. The Fish and Wildlife Service has already listed black and silver carp as injurious under the Lacey Act.

State Statute Changes

The Legislature passed legislation in 2010 that addresses the transport of water in boats for the purpose of curbing the spread of aquatic invasive species, such as zebra

mussels and spiny waterfleas that can be transferred in water. Minnesota Statutes 2008, section 84D.10, was amended by adding a subdivision to read:

*Subd. 4. **Persons leaving public waters.** (a) A person leaving waters of the state must drain boating-related equipment holding water and live wells and bilges by removing the drain plug before transporting the watercraft and associated equipment on public roads. 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. Marine sanitary systems and portable bait containers are excluded from this requirement. A person must not dispose of bait in waters of the state. (b) The commissioner shall report, by January 15 of each odd-numbered year, to the chairs and ranking minority members of the House of Representatives and senate committees and divisions having jurisdiction over water resources policy and finance. The report shall advise the legislature on additional measures to protect state water resources from human transport of invasive species.*

DNR Permanent Rules

No new rules were adopted related to invasive species, although new emergency rules were adopted related to preventing the spread of the fish disease VHS from Lake Superior. The rules, which require smelt and cisco used as bait to be preserved, were published in the *State Register* and became effective on October 4, 2010.

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. MPCA staff also assisted the Wisconsin Department of Natural Resources in its feasibility determination for ballast water treatment systems to achieve discharge standards 100 times more stringent than the standards proposed by the International Maritime Organization.

DNR Commissioner's Orders

Four Commissioner's Orders were issued in 2010 to designate additional infested waters. The orders were published in the *State Register* on May 3, June 21, August 16, and December 27, 2010.

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.
- Address the new recommendations for legislative changes that came from stakeholder meetings on AIS prevention in 2010.

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 meets this requirement by completing approximately 50,000 hours of watercraft inspection each year.

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 educational efforts with citizen groups;
- Giving out information at local events around the state.

Progress in Watercraft Inspections - 2010

Complete required hours of watercraft inspection

In 2010, approximately 90 watercraft inspectors worked through the summer 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 50,000 inspection hours (Table 8). A total of 66,000 watercraft/ trailers were inspected throughout the state (Figure 4).

During the open water season inspections were conducted at 40 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 8,200 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 MN in 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, and 2010. (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 | 1.4 |
| 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 |

The Watercraft Inspection Program has primarily focused on water bodies:

- with infestations of aquatic invasive species
- with 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 7). This means that we have fewer available hours per infested water access in 2010 than we did from 2000 to 2005. This has been offset somewhat by increased funding and inspectors over the last three years.

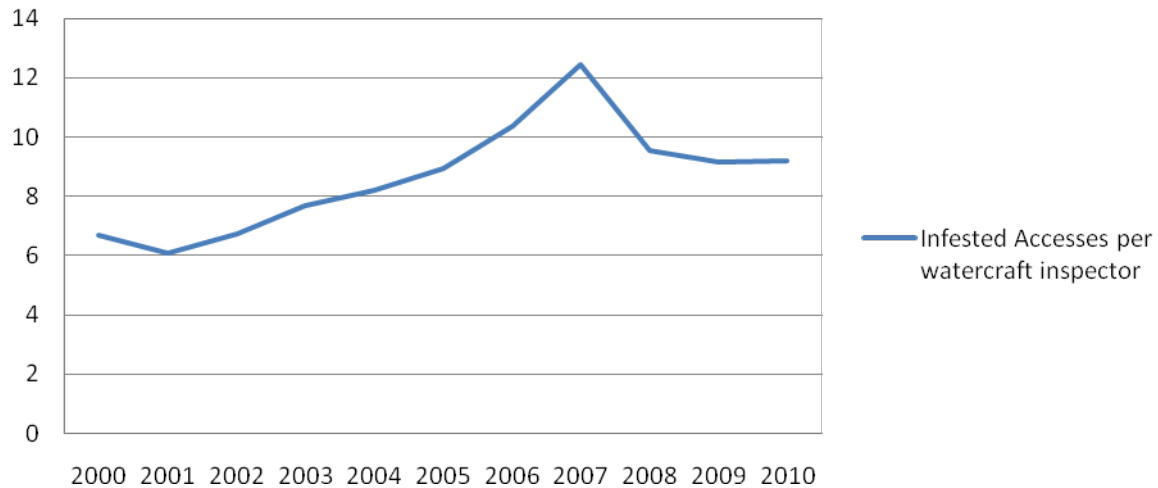


Figure 7. Watercraft accesses on infested waters per watercraft inspector.

The number of inspection hours completed on infested waters was also impacted by the addition of Invasive Species Prevention Grants in 2010. Citizen groups want additional hours of inspection on lakes where they live or recreate. The Invasive Species Program has worked to meet those requests through prevention grants and allowing groups to contract for additional inspection hours. Watercraft inspection grants provide a one-to-one match for hours paid for by citizen groups. Contracts allow citizen groups to increase the number of hours of inspection by paying their full cost; this means that more hours of watercraft inspection get completed statewide. Organizations purchasing contract hours have not been required to use them only on infested waters. This is the same for grants, however, applications are given a higher rating to water bodies that are infested or are near infested waters. This means that grant and contract hours can be completed at lakes that are non-infested and are potentially low use. Often the citizen groups that are receiving grants or contracts are interested in protecting a specific water body even though this practice may be less effective than having inspectors at infested water bodies (Figure 8).

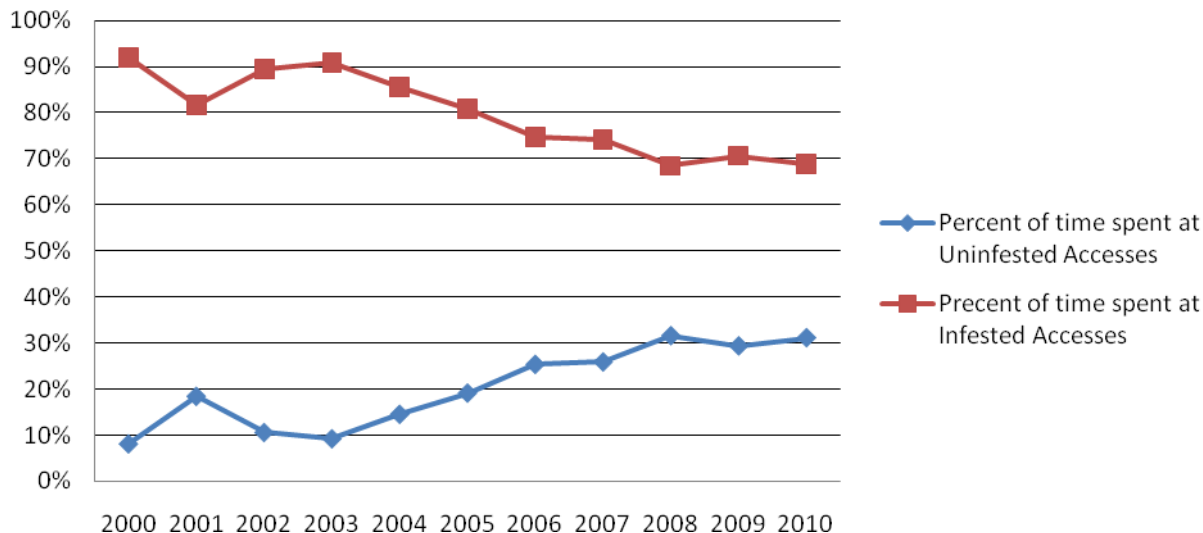


Figure 8. Percent of watercraft inspection hours spent at infested and non-infested water bodies.

We also have had a significant increase in hours and inspections in outstate areas since 2005, the largest occurring in region one (northwest). While it is important to have a presence in outstate areas, it does mean that the inspections per hour decrease since the population in these areas is lower and there are fewer people using each water body.

Approximately 31% of the inspection hours (11,800 hours) were spent on non-infested water bodies which is similar to 2009 (29%, 12,500 hours). During 2010, inspections on non-infested waters represented about 21% of the total inspections (14,000 inspections) vs. 29% (19,000 inspections) in 2009. The increase in time spent at non-infested waters is directly related to increased funding and grants for watercraft inspections. The primary groups applying for grants are lakes that are trying to keep invasive species out.

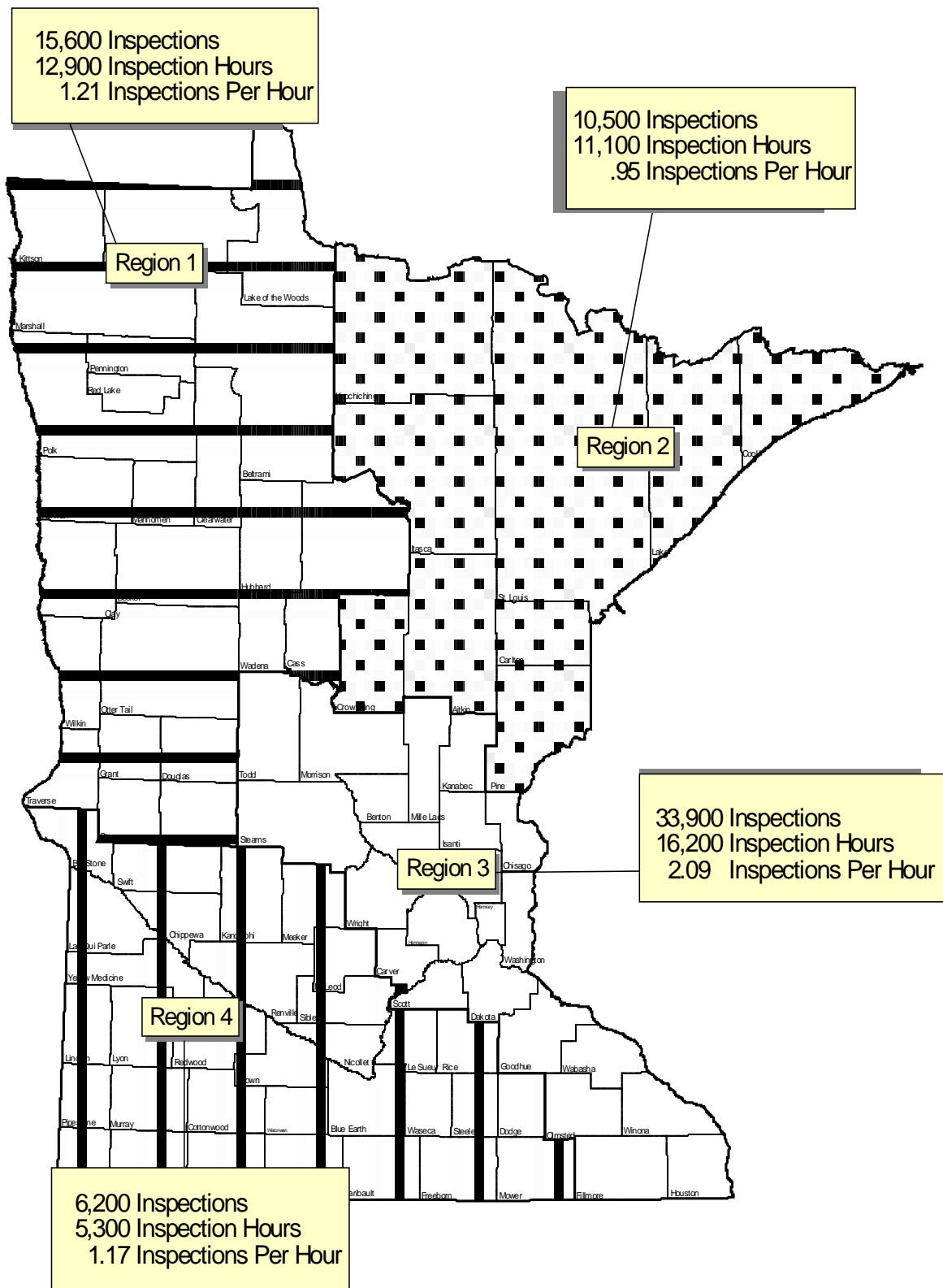


Figure 9. DNR watercraft inspections at public water accesses in 2010.

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 10).

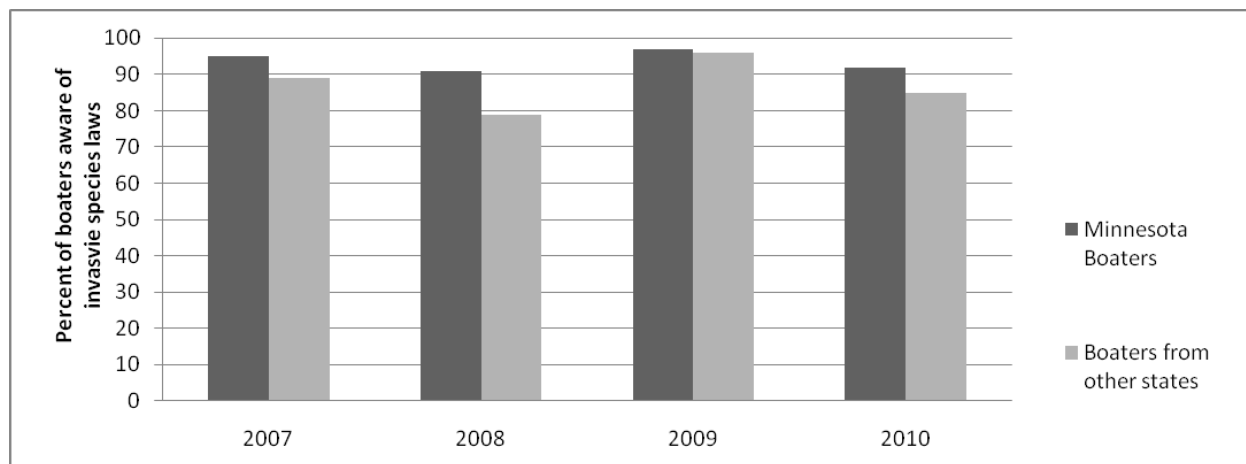


Figure 10. Percentage of boaters from Minnesota and other states that were aware of Minnesota’s invasive species laws.

Partnerships with citizen groups in 2010

During the 2010 season, the Invasive Species Program granted approximately 12,000 hours of watercraft inspection time to Minnesota citizen groups. The watercraft inspection program also entered into contracts with citizen groups for an additional 5,000 hours of inspection time. The 12,000 hours of watercraft inspection time was granted to 33 different groups around the state and there were 9 contracts for additional hours of inspection time.

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 can do inspections at waters where they live or recreate. In 2010, the Watercraft Inspection Program gave 18 volunteer training sessions around the state and attended 17 events or meetings where we shared information about invasive species and how to prevent their transport. Watercraft inspectors also worked at the State Fair, speaking to the public about invasive species and participated in Mills Fleet Farm Kids' Fishing Appreciation Day.

Examples of watercraft inspection hours in 2010

The Watercraft Inspection Program visited 530 watercraft accesses during the 2010 season. Three lakes that were important for the Watercraft Inspection Program to staff included Mille Lacs and Gull lakes in the Brainerd area, and Lake Minnetonka in the Twin Cities. All of these are high-use lakes and infested with zebra mussels. Users of these water bodies are at risk of transporting zebra mussels if they fail to inspect their boats, remove any attached plants or organisms, and drain their watercraft.

During the 2010 season, watercraft inspectors spent over 1,200 hours at Gull Lake and completed 3,683 inspections at four accesses. Information collected from the inspection process showed that 225 of those watercraft users had come from a water body that was infested with zebra mussels other than Gull Lake. At the end of each inspection, boaters were asked where they plan to go next—208 watercraft users said they would be going to a water body other than Gull Lake the next time they used their watercraft.

The Watercraft Inspection Program spent over 960 hours at 18 accesses on Lake Mille Lacs and completed 2,103 inspections. Of the inspections completed, 40 of the watercraft users had come from zebra mussel infested waters other than Mille Lacs and 171 reported that they planned to go to another water body on their next boating trip.

The Watercraft Inspection Program spent over 2,800 hours (including 1,120 grant hours and 1,100 contract hours) at eight accesses on Lake Minnetonka and completed 13,884 inspections during that time. Of the inspections completed, 586 watercraft users were coming from zebra mussel infested waters other than Lake Minnetonka and 257 reported that they would be going to a water body other than Minnetonka the next time they used their watercraft.

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, the concern over transport of zebra mussel infested water has become even greater. The initiation of the “pull the plug” law (see Regulations and Proposed Changes) will help us in educating boaters about the importance of draining all water before transporting their watercraft. In 2010, watercraft users were found to have vegetation attached to their watercraft when entering water accesses in all four regions, with the highest number occurring in region three (Figure 11). Region two also had one watercraft with attached zebra mussels attempt to launch at the St. Louis River in Duluth. All watercraft attempting to enter a water body with attached vegetation or zebra mussels were asked to remove them before launching their watercraft.

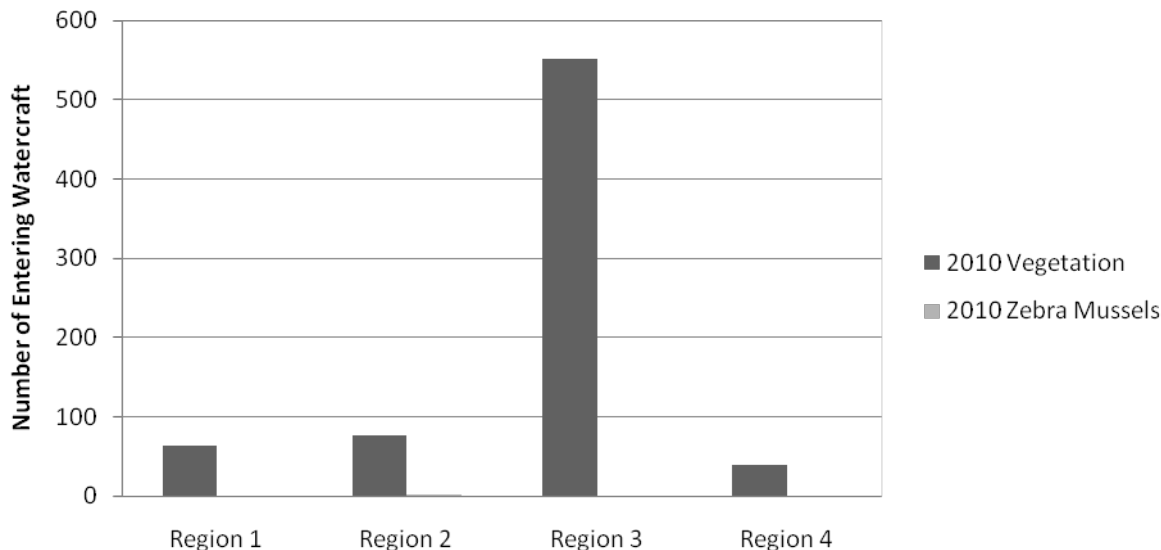


Figure 11. Number of watercraft entering a watercraft access with attached vegetation or zebra mussels per region.

Planning for the 2011 watercraft inspection season

The Watercraft Inspection Program faces a number of challenges in the 2011 season. The number of infested water bodies has increased each year which makes it difficult for the Program to keep pace. Continued increases mean fewer inspection hours per infested access than in the past. The increased number of water bodies infested with zebra mussels means more sources for infested water and a higher risk of spread. Several high-use water bodies became infested with zebra mussels during the 2010 season and it will be important for the Watercraft Inspection Program to spend a significant amount of time in these areas inspecting boats and educating the public about this issue.

To be most effective with limited resources, the Watercraft Inspection Program will be making changes in how inspection hours are allocated in 2011. In 2010, we targeted 30,000 hours of watercraft inspection at infested and high-use waters. An additional 12,000 hours were awarded to citizen groups as grants for additional hours of inspection and 5,000 hours were given out as contracts for additional hours of inspection. In 2011, we are planning to focus more time and resources on water bodies that have been identified as infested and high-use and less time on non infested and low-use water bodies. Since it is most efficient to inform watercraft users at the source of infestations, we will focus on water bodies that are infested, especially those that are newly infested or infested with zebra mussels or spiny waterfleas. The Watercraft Inspection Program will try to hire at least 100 watercraft inspectors, which is an increase of 10 inspectors and approximately 5,000 hours. Those hours will be added to our base hours in order to increase time spent at high-use infested water bodies such as Lake Mille Lacs or Lake Minnetonka. Along with the 35,000 hours of base watercraft inspection time, we will offer 15,000 hours of grant and contract time to citizen groups who wish to partner with the DNR.

In conjunction with the change in where we spend inspection time, we will also be evaluating how watercraft inspections are currently carried out and looking to improve inspection effectiveness for the 2011 season. Changes might include revised inspection protocol, how inspectors interact with boaters, how potential violations are handled, a question about the new “pull the plug” law, or new opportunities to work with conservation officers.

Management of Curly-leaf Pondweed

2010 Highlights

- The DNR provided grants for pilot projects for lake-wide control of curly-leaf pondweed totaling \$306,000 to 22 lakes in 2010.
- Continuing evaluations of lake-wide treatments indicate that:
 - Lake-wide treatments of curly-leaf pondweed reduced the invasive plant during the year of treatment.
 - Overall, most native plants were not harmed by these treatments. Nevertheless, there are enough examples of harm to certain native plants to warrant caution in conducting lake-wide treatments.
 - Reductions in curly-leaf alone are not likely to result in major impacts on clarity of lake water.
- More study will be needed to determine the longevity of reductions in curly-leaf once treatments are stopped.



Introduction

Issue

Life history of curly-leaf pondweed

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

Relationships between curly-leaf pondweed and water quality

Before describing the relationship between curly-leaf pondweed and water quality, it would be helpful to review the general relationship between submersed aquatic plants and water quality. It has long been known that aquatic plants are associated with, and may maintain, relatively high water clarity in lakes. Scheffer et al. (1993:275) showed that lakes with abundant submersed plants tend to have higher clarity than lakes with similar levels of nutrients in which vegetation is sparse or absent. Submersed vegetation helps maintain water clarity by stabilizing bottom sediments and preventing bottom materials from being re-suspended in the water column (James and Barko 1994). The importance of submersed plants in maintaining water clarity is reflected in observations of decreases in water clarity following lake-wide reductions in submersed

plants due to treatment with herbicide (O'Dell et al. 1995:314, Welling et al. 1997, Valley et al. 2006, Wagner et al. 2007).

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

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

Table 9. Lakes with curly-leaf pondweed, *Potamogeton crispus*, with sizes and percentages of phosphorus budgets accounted for by curly-leaf and external loading.

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

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

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

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

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

Methods for control of curly-leaf pondweed

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

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

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

Goals

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

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

Distribution of curly-leaf pondweed locations in Minnesota

Curly-leaf pondweed is known to occur in 759 Minnesota lakes in 70 of the 87 counties (Figure 12).

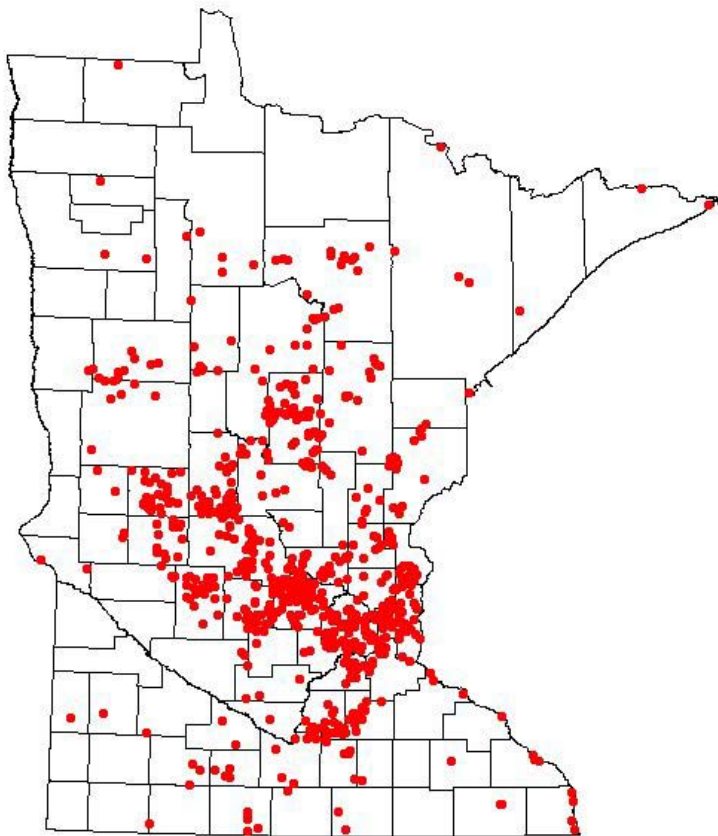


Figure 12. Curly-leaf pondweed locations in Minnesota as of November 2010 (compiled from reports from DNR Fisheries, Wildlife, and Ecological and Resources staff).

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 - 2010

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

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

To attempt to provide long-term reduction of curly-leaf pondweed, it has been hypothesized that a lake must be treated for several years in a row. This is so that the bank of turions will be depleted. Even with repeated treatments, it does not appear to be feasible to completely eradicate curly-leaf pondweed from a water body (Newman et al. 2010). This may be due to survival of some plants or turions, or germination of seeds. Research done by the ERDC 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 2010, 56 applications were submitted to the DNR for grants to support pilot projects involving lake-wide or bay-wide control of curly-leaf pondweed or both curly-leaf pondweed and Eurasian watermilfoil under this program. Of these, 26 proposals were approved. Of these, 22 had curly-leaf as the primary object of control (Table 10).

In 2010, five pilot projects have continued long enough to expect long-term control of curly-leaf, i.e., for three to five years (Table 11). 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 12).

Table 10. Pilot program - projects granted funding for lake-wide or bay-wide control of curly-leaf pondweed (CLP) or both CLP and Eurasian watermilfoil (EWM) in 2010.

| Number | Region | County | Lake or Bay Name | DOW | Grant (\$\$\$) | Cost (\$\$\$) | Grant as % of cost | Herbicide | Year of treatment with a grant from the DNR | Target plant(s) |
|--------|---------|-----------|------------------|---------|----------------|---------------|--------------------|--------------|---|-----------------|
| 1 | NW | Becker | Cormorant, Upper | 3.0588 | 25,000 | 47,830 | 52 | endothall | 2 | CLP |
| 2 | NW | Becker | Toad, Big | 3.0107 | 25,000 | 35,805 | 70 | | 1 | CLP |
| 3 | NW | Cass | Margaret | 11.0222 | 4,919 | 4,919 | 100 | endothall | 2 | CLP |
| 4 | NW | Wadena | Blueberry | 80.0034 | 25,000 | 28,730 | 87 | endothall | 4 | CLP |
| 5 | NW | Todd | Latimer | 77.0105 | 10,000 | 10,071 | 99 | | 1 | CLP |
| 6 | NE | Crow Wing | Cullen, Lower | 18.0403 | 6,560 | 6,56 | 100 | endothall | 2 | CLP |
| 7 | NE | Crow Wing | Mission, Lower | 18.0243 | 13,596 | 13,596 | 100 | endothall | 5 | CLP |
| 8 | NE | Itasca | Dixon | 31.0921 | 18,328 | 18,328 | 100 | endothall | 2 | CLP |
| 9 | Central | Anoka | Coon | 02.0042 | 15,000 | 15,209 | 99 | endothall | 1 | CLP |
| 10 | Central | Isanti | Long | 30.0072 | 20,000 | 37,056 | 54 | endothall | 4 | CLP |
| 11 | Central | Isanti | Paul & Elins | 30.0035 | 13,605 | 13,605 | 100 | endothall | 2 | CLP |
| 12 | Central | Hennepin | Schmidt | 27.1020 | 4,172 | 4,172 | 100 | endothall | 2 | CLP |
| 13 | Central | Morrison | Long | 49.0015 | 557 | 557 | 100 | Endothall | 2 | CLP |
| 14 | Central | Ramsey | Bald Eagle | 62.0002 | 30,000 | 41,631 | 72 | endothall | 1 | CLP |
| 15 | Central | Sherburne | Rush and Julia* | 71.0145 | 7,605 | 7,605 | 100 | endothall | 5 | CLP |
| 16 | Central | Stearns | Schneider | 73.0082 | 6,122 | 6,122 | 100 | endothall | 2 | CLP |
| 17 | Central | Scott | O'Dowd | 70.0095 | 12,549 | 12,549 | 100 | endo/tric | 2 | CLP |
| 18 | Central | Wright | Beebe | 86.0023 | 10,000 | 16,100 | 62 | endothall | 1 | CLP |
| 19 | Central | Wright | Sugar | 86.0233 | 20,000 | 27,440 | 73 | [check this] | 2 | CLP/EWM |
| 20 | S | Le Sueur | Sakatah | 40.0002 | 7,795 | 7,795 | 100 | endothall | 2 | CLP |
| 21 | S | Meeker | Clear | 47.0095 | 20,000 | 22,987 | 87 | endothall | 4 | CLP |
| 22 | S | Kandiyohi | Nest | 34.0154 | 10,000 | 15,600 | 64 | endothall | 1 | CLP |
| | | | | | 305,808 | 387,769 | 87.23 | | | |

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

Table 11. Number of pilot projects to control curly-leaf pondweed on a lake-wide (or bay-wide) basis during 2010 classified by duration.

| Duration of Project (years) | Number of Projects |
|-----------------------------|--------------------|
| 5 | 2 |
| 4 | 3 |
| 3 | 0 |
| 2 | 11 |
| 1 | 6 |
| (Total) | 22 |

Table 12. Number of pilot projects to control curly-leaf pondweed on a lake-wide (or bay-wide) basis during 2010 classified by DNR region.

| DNR Region | Number of Projects |
|------------|--------------------|
| NW | 5 |
| NE | 3 |
| Central | 11 |
| S | 3 |
| (Total) | 22 |

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 all herbicides used (endothall and fluridone) reduced the frequency, biomass, and surface matting of curly-leaf pondweed during in 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.

We hypothesized that a lake must be treated for several years in a row in order to reduce curly-leaf pondweed for the long-term. The basis for this control during consecutive years may deplete the numbers of curly-leaf pondweed propagules, known as turions, in the lake sediment. Lake-wide treatments with herbicides nearly eliminated production of turions by curly-leaf pondweed. 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 (Johnson 2010).

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 2010, 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 - 2010

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 - 2010

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.

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Management of Eurasian Watermilfoil

2010 Highlights

- Eurasian watermilfoil was discovered in 14 additional Minnesota water bodies during 2010. There are now 246 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 and curly-leaf pondweed.
- Cooperators on 23 lakes were reimbursed by the DNR for control of nuisances caused by dense and matted Eurasian watermilfoil in public use areas of the lakes.
- Cooperators on one lake were reimbursed by the DNR for early detection and rapid response for Eurasian watermilfoil.



Issue

Eurasian watermilfoil (*Myriophyllum spicatum*) is an invasive submerged aquatic plant that was inadvertently introduced to Minnesota. Eurasian watermilfoil, hereinafter called milfoil, was first discovered in Lake Minnetonka during the fall of 1987. Milfoil can limit recreational activities on water bodies and alter aquatic ecosystems by displacing native plants. As a result, Minnesota established the DNR Invasive Species Program to manage milfoil and other invasive species. Milfoil is classified as a *prohibited invasive species*, which means that it may not be bought, sold, or possessed in Minnesota. In this report, we describe the efforts of the Invasive Species Program to manage milfoil and limit its spread in Minnesota during 2010.

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 2010

Milfoil was newly discovered in 14 lakes during 2010 (Figure 13). Ten of these lakes are located outside the seven-county metropolitan area (Figure 14). Milfoil is now known to occur in 246 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.

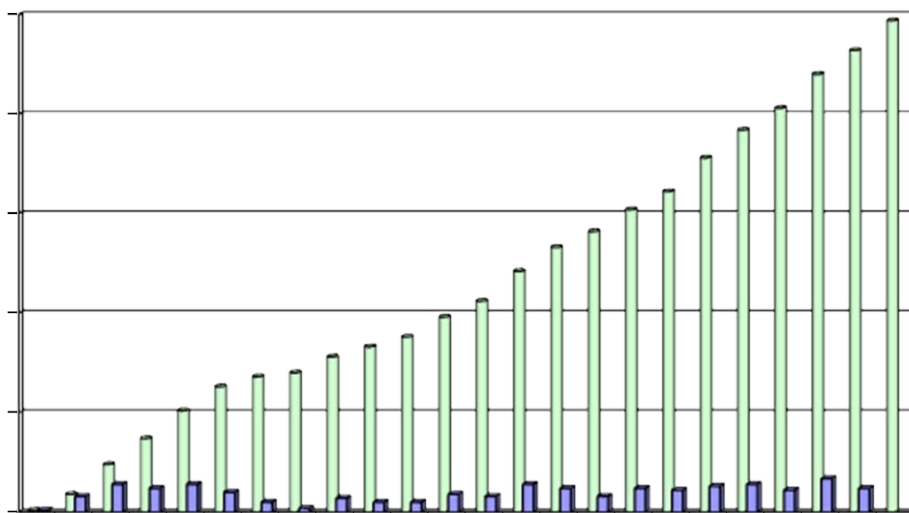


Figure 13. Discovery of water bodies in Minnesota with Eurasian watermilfoil; annual and cumulative numbers.

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 2010, 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

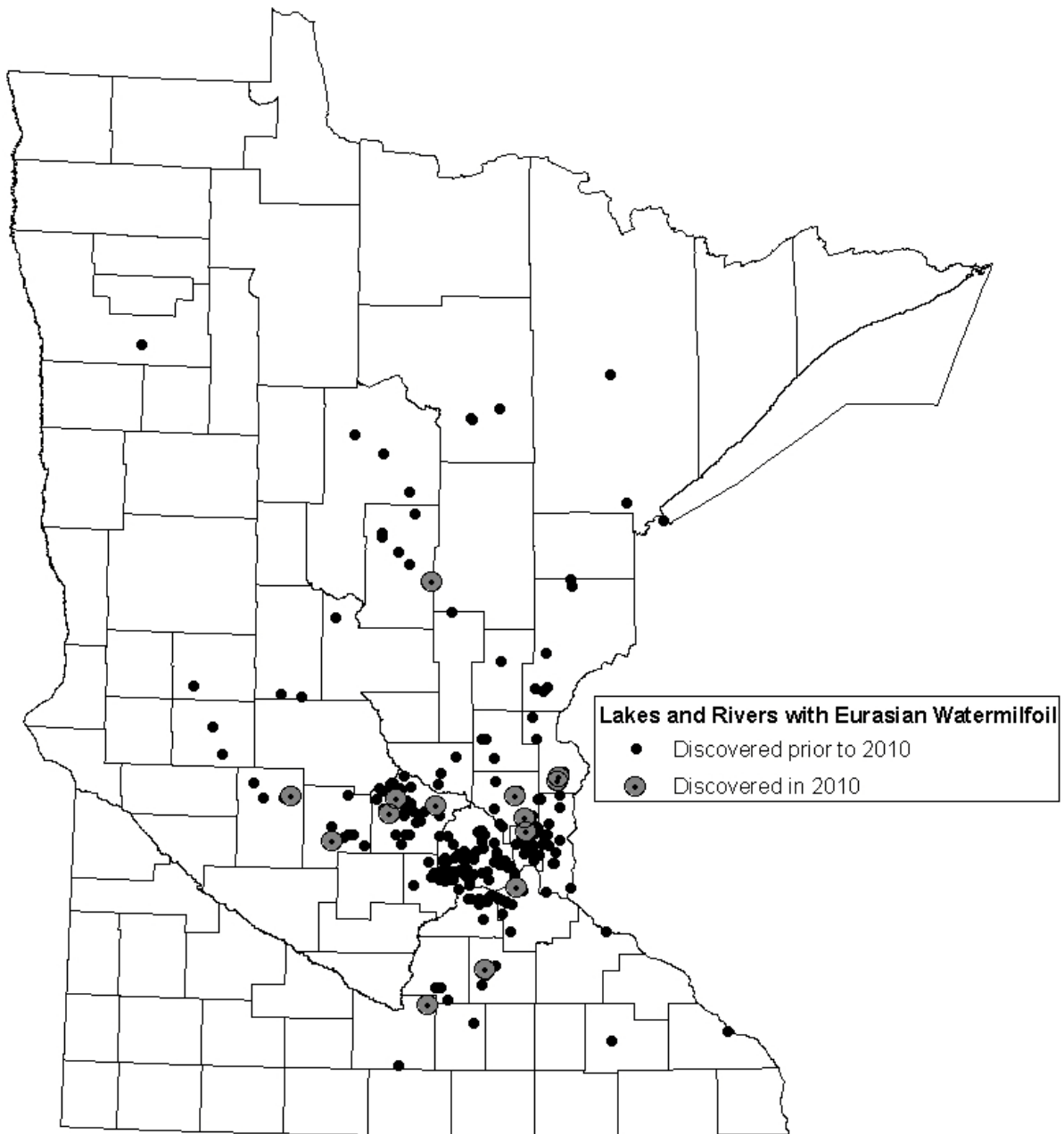


Figure 14. Distribution of water bodies with Eurasian watermilfoil in Minnesota as of November 2010.

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 - 2010

Classification of water bodies for management of Eurasian watermilfoil

In the spring of 2010, the Invasive Species Program classified the 232 bodies of water known to have milfoil (Table 13). One hundred fifty-eight 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.

Ten of the 14 water bodies that were discovered to have milfoil during 2010 were eligible for management with state funds because they have public water accesses. Five lakes found to have milfoil in 2010 have no public water access and, consequently, are ineligible for management with state funds.

Lake-wide or bay-wide control of Eurasian watermilfoil

In 2010, the DNR provided grants to support lake-wide or bay-wide control of Eurasian watermilfoil or Eurasian watermilfoil and curly-leaf pondweed on three bays in one lake and a second lake (Table 14). Control involved the application of two herbicides, endothall and triclopyr.

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

Table 13. Classification of water bodies in Minnesota with Eurasian watermilfoil during 2010.

| Classification | Spring 2009 | New in Summer | Fall 2009 | New in Summer 2010 | Spring 2011 |
|--|-------------|---------------|-----------|--------------------|-------------|
| Lakes eligible for management with state funds | 152 | 6 | 158 | 10 | 168 |
| Lakes ineligible for management with state funds [lack of public access] | 60 | 6 | 66 | 4 | 70 |
| Rivers or streams | 8 | 0 | 8 | 0 | 8 |
| Total | 220 | 12 | 232 | 14 | 246 |

Table 14. Pilot program - projects granted funding in 2010 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)

| Region | County | Lake or Bay Name | DOW | Grant (\$\$\$) | Cost (\$\$\$) | Grant as % of cost | Herbicide | Year of treatment | Target plant(s) | |
|--------|---------|------------------|---------------------------|----------------|---------------|--------------------|-----------|-------------------|-----------------|-----------|
| 1 | Central | Hennepin | Minnetonka – Gray's Bay | 27.013301 | 4,300 | | Endothall | 3 | CLP | |
| 2 | Central | Hennepin | Minnetonka – Carman's Bay | 27.0133XX | 40,800 | | triclopyr | 2 | EWM | |
| 3 | Central | Hennepin | Minnetonka – Phelps's Bay | 27.013305 | 28,300 | | endo/tric | 3 | CLP & EWM | |
| | | Minnetonka | [subtotal] | 25,000 | 73,400 | 34 | | | | |
| 4 | Central | Sherburne | Big & Mitchell | 71.0081 | 15,000 | 15,700 | 96 | endo/tric | 2 | CLP & EWM |
| | | | | 40,000 | 89,100 | 45 | | | | |

* Insufficient Eurasian watermilfoil found to treat in spring.

Skogerboe and Poovey (2010) reported that treatments on Minnetonka reduced the target invasive species in 2010 in Gray's and Phelp's bays. In Carman's Bay, the percent frequency of Eurasian watermilfoil increased in 2010 during June and remained high during September. Results in the draft report indicated that the native vegetation was not reduced overall; average numbers of native species per sample point during 2010 were equal to or greater than levels observed in 2007, the year before the current series of bay-wide treatments began. The DNR is encouraged to see the average number of native species per sample point return to near pre-treatment levels.

Silver Lake was treated in 2008 with endothall and triclopyr to control both milfoil and curly-leaf pondweed. Observations from 2008 showed that the frequencies of native plants and water clarity were low by comparison with pre-treatment conditions. In addition, the frequencies of Eurasian watermilfoil were lower than that of curly-leaf pondweed. As a result, it was decided that treatment in 2009 would be done to control curly-leaf, but not milfoil. The lack of increases in native submersed plants in Silver Lake during 2009 led the DNR to disallow lake-wide treatment of invasive species in 2010.

Results of pilot projects to control Eurasian watermilfoil or both Eurasian watermilfoil and curly-leaf pondweed

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

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

Lake-wide treatments with all herbicides used (endothall and fluridone) reduced the frequency and biomass of Eurasian watermilfoil during in the year of treatment (Newman et al. 2010, Skogerboe and Poovey. 2010).

Goal B. To provide long-term reduction in Eurasian watermilfoil or both in the lake

In some cases, lake-wide treatments with the herbicides used reduced the amount of area occupied by Eurasian watermilfoil in the year following treatment. The duration or longevity of these reductions varies. Whole-lake treatments done with fluridone herbicide to control milfoil appear to significantly reduce the amount of the invasive plant in a lake for three or four years. Such treatments have significant potential to do more harm than good, especially in lakes with low water clarity. Consequently, proposed whole-lake treatments with fluridone to control milfoil are carefully reviewed and often lead to recommendations of alternative approaches.

Goal C. To increase native submersed plants

In one of four lakes or bays treated to control both Eurasian watermilfoil and curly-leaf pondweed, large decreases in native submersed plants and water clarity were observed following the second year of treatment. In the other three lakes or bays, both decreases in some native submersed plants and increases in others were observed. It has been our observation that in mesotrophic lakes treated with fluridone to control Eurasian watermilfoil, some native submersed plants usually increase after the year of treatment.

Partial-lake treatments of Eurasian watermilfoil to manage nuisances

During 2010, 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 2010) 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 24 lakes (Table 15). Applications were reviewed by the Invasive Species Program in relation to the standards described in the announcement that is available to potential cooperators (DNR 2010). In most cases, the areas with milfoil where control was proposed in these lakes were inspected by staff of the Invasive Species Program. The results of these inspections and recommended modifications of proposed control projects were reported to the potential cooperators and staff in the Aquatic Plant Management Program who issue permits for control. On some lakes, proposals were modified by reducing the size of the area to be treated, and subsequently approved. Twenty-three of the applications were approved for funding. To date, most applicants have been reimbursed for control done in 2010. These reimbursements are expected to comprise a total of \$124,000 once reimbursements are completed. On the lake where an application for a grant was not approved, inspection revealed that sites proposed for treatment with herbicide did not have dense and matted milfoil that created a nuisance for users of the lake.

Table 15. Number of Minnesota lakes where management of nuisances caused by Eurasian watermilfoil was supported with state funds in 2006-2010.

| | Applications received | Applications approved and reimbursed | Applications denied or not pursued |
|------|-----------------------|--------------------------------------|------------------------------------|
| 2006 | 27 | 23 | 4 |
| 2007 | 30 | 28 | 2 |
| 2008 | 29 | 22 | 7 |
| 2009 | 26 | 23 | 3 |
| 2010 | 25 | 24 | 1 |

Early detection and rapid response for Eurasian watermilfoil

In 2010, 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 2010, applications for grants to support EDRR were received from groups on three lakes. In one of these cases, the distribution of milfoil was sufficiently limited to justify a grant for EDRR. The value of the reimbursement for this lake was \$2,300. In the second case, no milfoil was found in the lake. In the third case, the applicant did not complete the process of establishing a grant agreement between the lake association and the DNR. Consequently, it was not possible to reimburse this group for any costs of control.

Effectiveness of management of Eurasian watermilfoil in Minnesota lakes

Though the number of Minnesota lakes known to have milfoil increased in 2010, the number of lakes from which applications for DNR funding for control were received remained much lower than the number of lakes eligible to apply (Tables 14). The number of lakes where cooperators received funding from the DNR for control of milfoil during 2010 was essentially unchanged by comparison with the previous year (Table 15).

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 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 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.

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. Current results of recent efforts are described above.

Future plans and needs for management of Eurasian watermilfoil

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

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Management of Flowering Rush

2010 Highlights

- A meeting was organized and held in January 2010 to discuss the potential to improve the management of flowering rush, particularly the use of herbicides on flowering rush. The meeting identified research priorities and projects which were initiated and funded by Pelican River Watershed District, Detroit Lake, MN.
- The Invasive Species Program continued to provide technical assistance and field support to partners who managed flowering rush including the Detroit Lakes chain, Lake Minnetonka, and North Twin.

Introduction

Issue

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

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

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

In the Detroit Lakes area, there are large areas occupied by flowering rush, which 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.

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

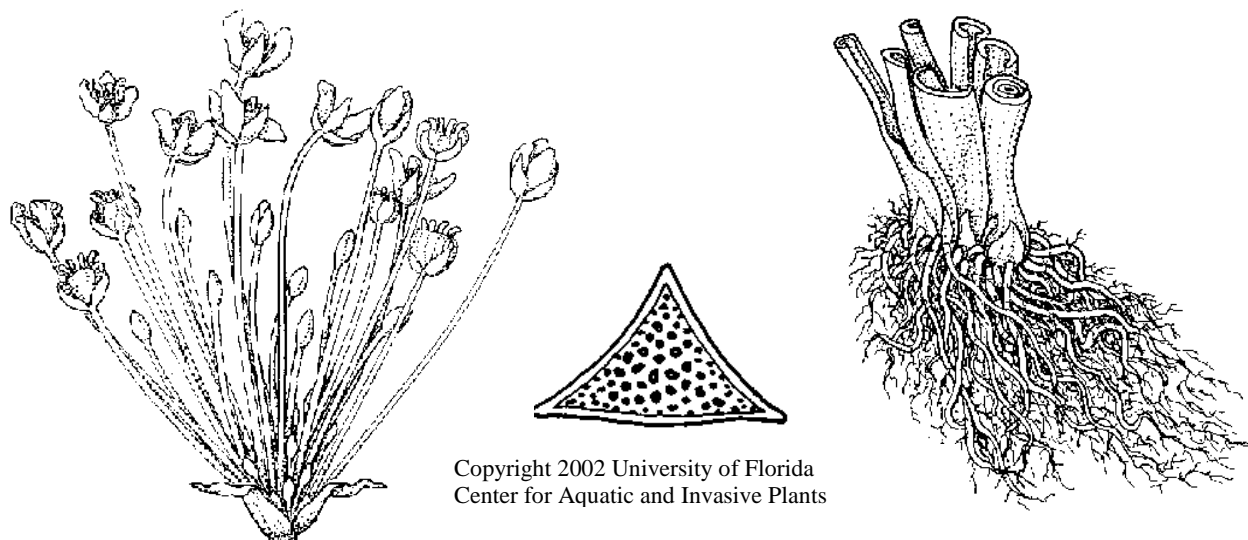


Figure 15. Flowering rush umbel, cross-section of a leaf, and rhizomes.

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

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

Management of flowering rush

Mechanical control

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

Treatment with herbicides

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

Since the early 1990s, the Pelican River Watershed District (PRWD) has evaluated a number of approaches to control of flowering rush (for example, see Olson (2004)). In recent years, PRWD has applied either imazapyr or imazmox to emergent portions of flowering rush. In 2010, emergent herbicide treatments were limited as PRWD focused on research to better understand the biology of flowering rush and in-lake and laboratory herbicide efficacy studies.

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

Distribution

Flowering rush was first recorded in Anoka County in 1968 (Moyle 1968) and has since been located in 27 bodies of water in ten counties. Despite its 30-plus year presence in the state, the distribution of flowering rush is widely scattered and uncommon (Figure 16).

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).

Goals

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

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

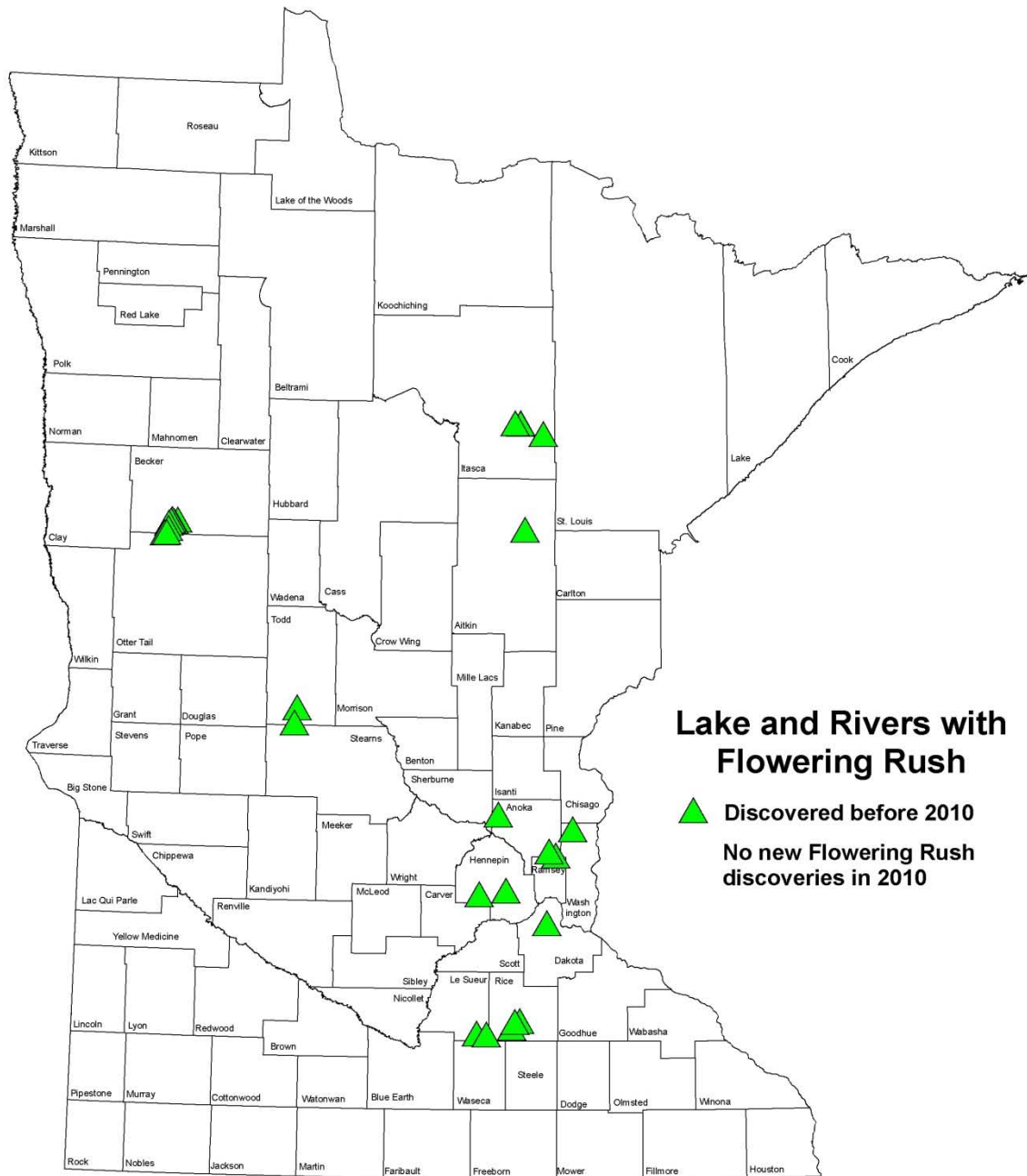


Figure 16. Flowering rush locations as of December 2010.

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.

Progress in Management of Flowering Rush - 2010

The PRWD, City of Detroit Lakes, Lake Detroiters, and Sallie / Melissa Lakes Association invested significant time and effort in working with the DNR to organize a meeting held in St. Paul on January 27 and 28 to discuss the potential to improve management of flowering rush. In addition to traveling to St. Paul for the meeting, representatives of these organizations also brought to the meeting two researchers from beyond Minnesota. These were Dr. Peter Rice, University of Montana, and Dr. John Madsen, Mississippi State University. In addition, Dr. Michelle Marko, Concordia College, Moorhead, participated in the meeting. Discussions of the extensive efforts of the PRWD and others on the Detroit Lakes chain over the past 15 to 20 years to identify effective approaches to management, plus work in other states led to the development of a list of possible research projects. Following the meeting, the PRWD and the City of Detroit Lakes worked with researchers in consultation with the DNR to develop proposals for several research projects, which were funded by the PRWD. In the spring of 2010, researchers from the University of Mississippi and Concordia College initiated 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. PRWD approved and spent \$120,000 in year one of the research projects.

Three research projects undertaken by PRWD and the researchers;

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*

At the Minnesota-Wisconsin Invasive Species Conference in St. Paul in November, Dr. John Madsen gave a presentation on the initial progress of research by Mississippi State University on flowering rush in Detroit Lake. In addition, researchers from Concordia College and Mississippi State University gave a poster at the conference on early results of work on flowering rush on Detroit Lake. The DNR is very appreciative of the initiative taken by organizations and individuals in the Detroit Lakes area to improve management of this invasive plant. Lastly, it should be noted that the residents of the City of Detroit Lakes voted to tax themselves to generate revenue to fund, among other activities, continued research on flowering rush.

The Invasive Species Program also offered grants to support the control of flowering rush. The first of two partners to receive a grant for this purpose was the city of Detroit Lakes. The city and PRWD have been managing flowering rush since the late 1980s and in 2010 the city was awarded \$2,000 from the DNR to treat 4 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 also permitted for the first time. This effort allowed individuals to sign up for a permit to selectively remove flowering rush along the full frontage of their shoreline. An effort to manage around 60 acres of dense emergent flowering rush on Detroit Lake and other connected lakes using imazapyr was also granted but due to high water level, the treatment was not completed.

Downstream of the PRWD is Buck Lake, another flowering rush infested water at the downstream end of the district but in the Pelican Group of Lakes Improvement District (PGOLID). In Buck Lake, small clusters of flowering rush were found and removed during two of three inspection trips in 2010, as was done in 2008 and 2009. Searches have not discovered flowering rush farther downstream of Buck Lake. The PGOLID continues to monitor for new infestations of flowering rush.

The second of two lakes to receive a grant for control of flowering rush was North Twin Lake in Itasca County. The DNR delineated two areas comprising 0.8 acres with the invasive plant near the public access and swimming beach. The Greenway Township then applied herbicides to control flowering rush in these areas in June and late August. This treatment was supported with a grant for \$1,000 from the DNR.

In May, 2010, the DNR was contacted by Three Rivers Park District, who reported an observation of flowering rush in Maxwell Bay, Lake Minnetonka 34 years ago. In 1976, the plants were in flower and growing as scattered individuals among other aquatic plants. The observer speculated that the flowering rush might have escaped from gardens at one of the nearby lakeshore properties. This report confirms the DNR's suspicion that the non-native plant first became established in the lake some number of years ago since flowering rush was found to be widespread in Minnetonka during 2009.

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

DNR staff including representatives from the Invasive Species Program meets regularly with the PRWD, PGOLID, the city of Detroit Lakes, and others to discuss concerns regarding the expansion of flowering rush in the Detroit Lakes area. In 2010, the PRWD invested \$120,000 in flowering rush biology and herbicide efficacy research to aid in better understanding this plant and herbicide effects upon it. The city of Detroit Lakes continues to manually, mechanically, and chemically treat the mile-long stretch of city beach. Support of this project, including technical and research assistance, will continue.

Participation of other groups

Participation by local units of government and interested groups in management of flowering rush - 2010

Cooperation between the Invasive Species Program and organizations outside the DNR such as lake associations and various local units of government was critical to the success achieved in management of flowering rush in Minnesota in recent years. A major effort to manage this plant in Detroit Lake and connected water bodies continued in 2010 with research meetings and projects initiated by the PRWD and the city of Detroit Lakes. Others involved in flowering rush management include: PGOLID, Lake Minnetonka Conservation District, Lake Minnetonka Property Owners Association, and the township of Greenway in Itasca County. 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.

Research on flowering rush and potential approaches to management in Minnesota

The DNR continues to work with researchers from the U.S. Army Engineer Research and Development Center (ERDC), Mississippi State University, Concordia College, Montana State University, and others to determine the efficacy of herbicides on flowering rush growing under controlled conditions. The PRWD worked with researchers in consultation with the DNR to develop proposals for several research projects, which were funded by the PRWD.

Three research projects were undertaken by PRWD and the researchers;

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*

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.

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 encourage research on the distribution, reproductive biology, and potential impacts of flowering rush in Minnesota.
- Continue to investigate new methods of controlling flowering rush and to evaluate the results of continuing flowering rush management within the state.

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Management of Purple Loosestrife

Background

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

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

Statewide Inventory of Purple Loosestrife

In 1987, the DNR began to inventory sites in Minnesota where purple loosestrife was established. DNR area wildlife managers, county agricultural inspectors, local weed inspectors, personnel of the Minnesota Department of Transportation, and the general public report purple loosestrife sites to the DNR. The DNR maintains a computerized list or database of sites that includes the location, type of site, and number of loosestrife plants present (see Figure 17). In 2010, 12 new purple loosestrife infestations were identified in Minnesota. There are now 2,406 purple loosestrife infestations recorded statewide (Table 16). 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 - 2010

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

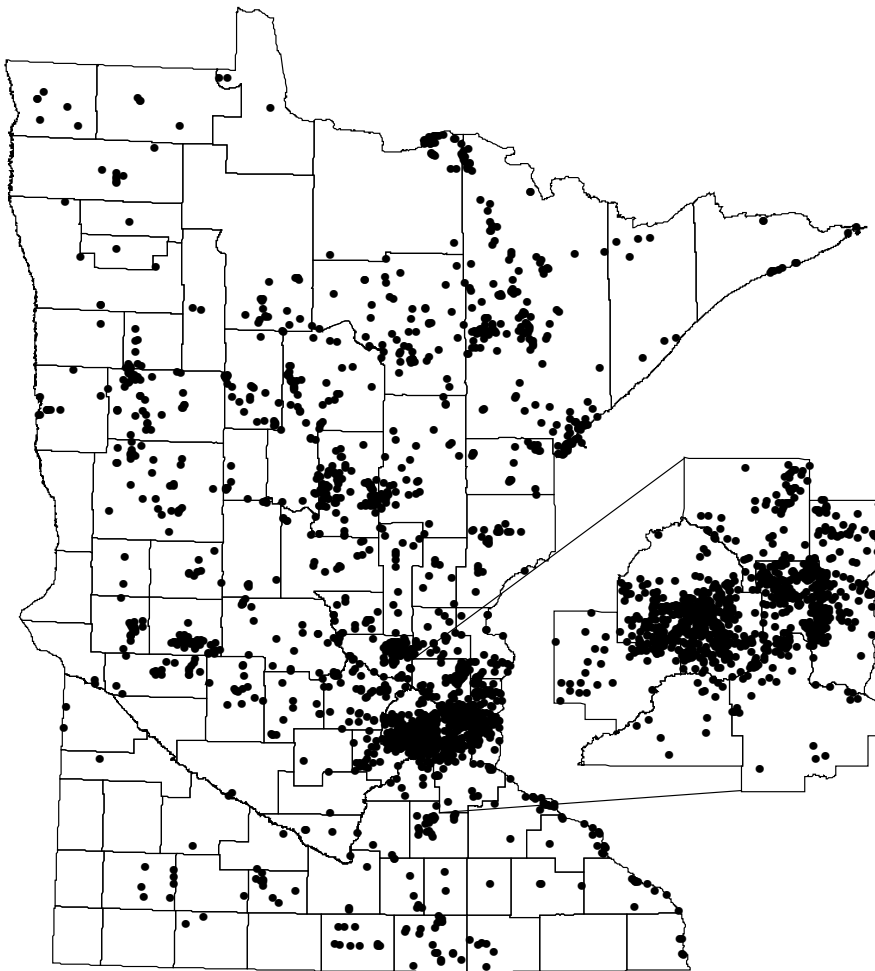


Figure 17. Purple loosestrife infestations in Minnesota as of December 2010.

Table 16. Purple loosestrife infestations in Minnesota recorded by the DNR in 2009 and 2010.

| Site Type | Total sites 2009 | New sites 2010 | Total sites 2010 |
|-----------------------|------------------|----------------|------------------|
| Lake | 731 | 4 | 735 |
| River | 225 | 2 | 227 |
| Wetland | 763 | 6 | 769 |
| Roadsides and ditches | 510 | 0 | 510 |
| Other ¹ | 165 | 0 | 165 |
| Total | 2,394 | 12 | 2,406 |

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 2010, the number of sites, number of plants, and total cost of treating purple loosestrife with herbicide, have generally decreased (Table 17). 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 2010, only DNR staff was used to treat purple loosestrife stands statewide. DNR staff visited 74 purple loosestrife stands for herbicide control work (Table 17). A total of 74 sites were treated with herbicides. Most of the sites were very small: 82% (61 sites) had fewer than 100 plants. Seven purple loosestrife plants were hand-pulled from four locations. This work took a total of 403 worker hours, and only 0.38 gallons of Rodeo concentrate. The total cost for this effort was \$11,400.

Effectiveness of chemical control

Effectiveness of control efforts will be based on short-term and long-term objectives. Control or eradication of small infestations statewide with herbicides is the primary short-term objective. Each year, a small number of purple loosestrife infestations (three in 2010) are controlled for at least one year beyond the year of treatment with herbicides. This is critical because these infestations are in watersheds that have very few infestations of loosestrife. This effort helps prevent the spread of purple loosestrife into uninfested wetlands and lakeshores.

Table 17. Historical herbicide applications performed by DNR and applicators contracted by DNR in Minnesota (1989-2010).

| 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 |

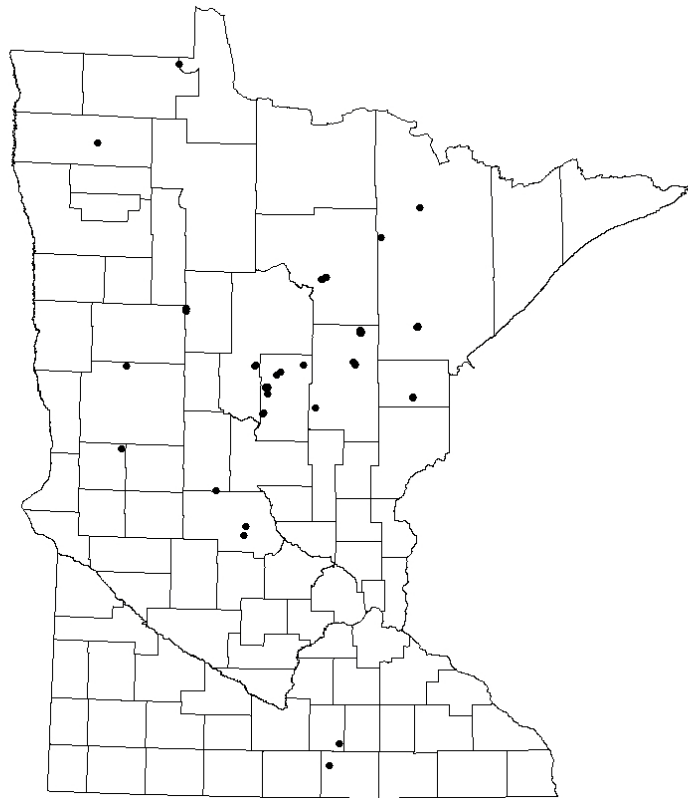


Figure 18. Locations where DNR staff used herbicides to control purple loosestrife in 2010.

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 2010, this cooperative effort has had a significant effect on total number of insects released (Figure 19).

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 2010, an estimated 14,025 leaf-eating beetles were collected and released on 14 sites. To date, the leaf-eating beetles have been released on 863 sites statewide (see Figure 20, Table 18).

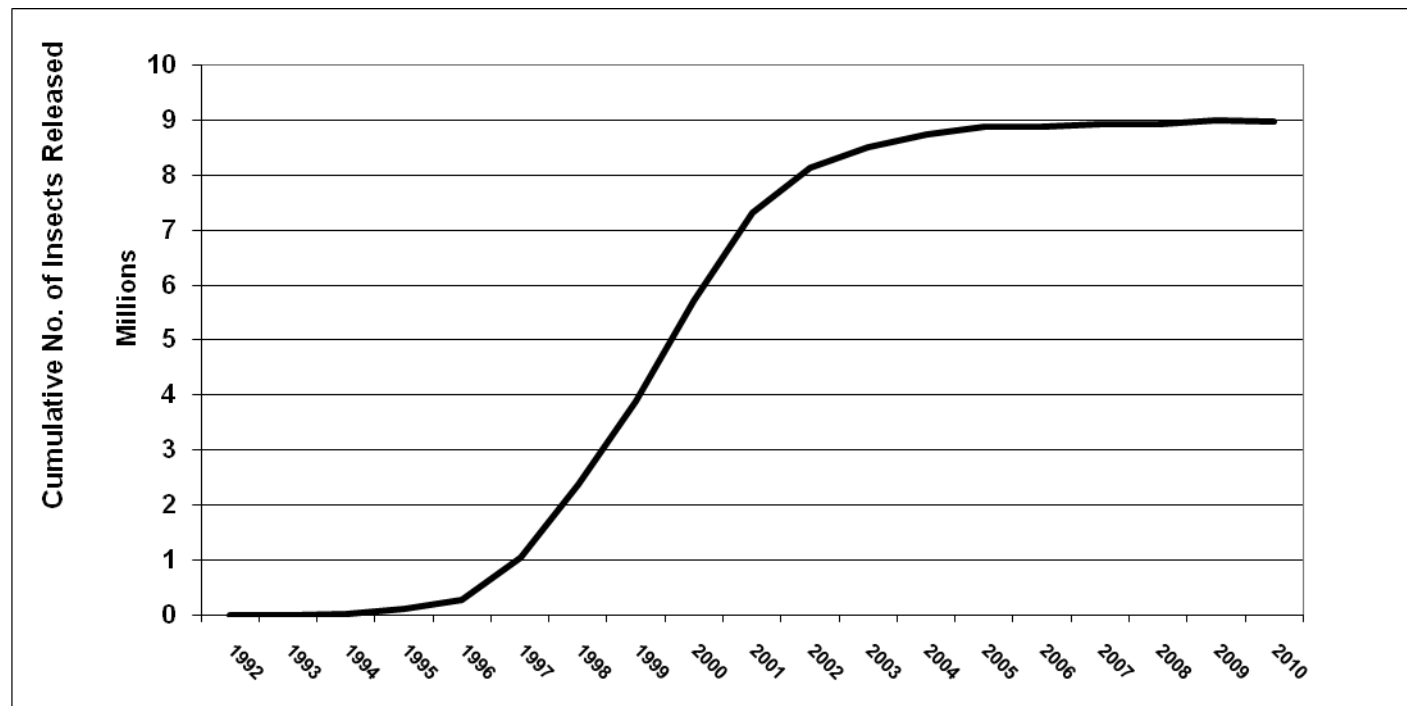


Figure 19. Cumulative number of insects released to control purple loosestrife by year.

Table 18. Summary of number of insects released in each region to control purple loosestrife (1992-2010).

| Minnesota DNR Regions | Number of Release Sites | Number of Insects Released |
|-----------------------|-------------------------|----------------------------|
| 1 – Northwest | 142 | 1,370,116 |
| 2 – Northeast | 229 | 1,640,403 |
| 3 – Central | 427 | 5,254,227 |
| 4 – South | 65 | 705,304 |
| Totals | 863 | 8,970,050 |

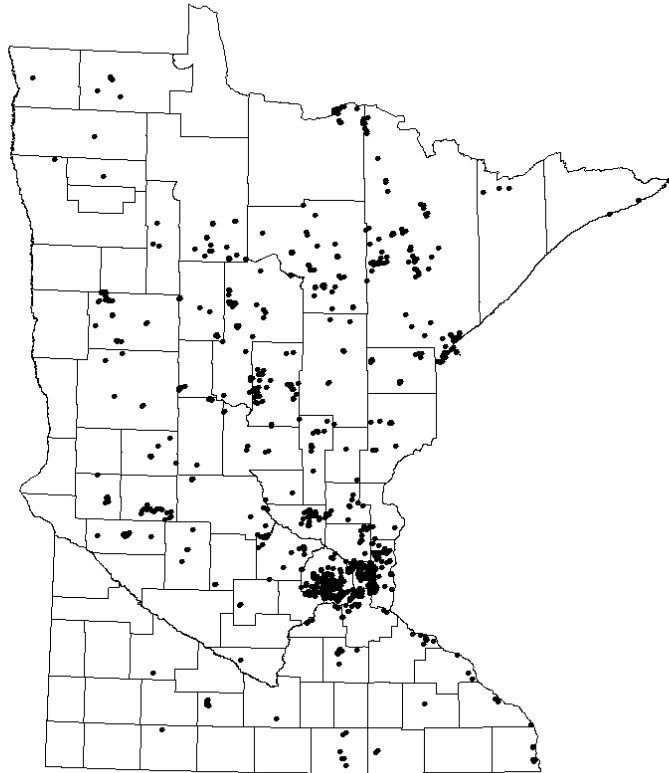
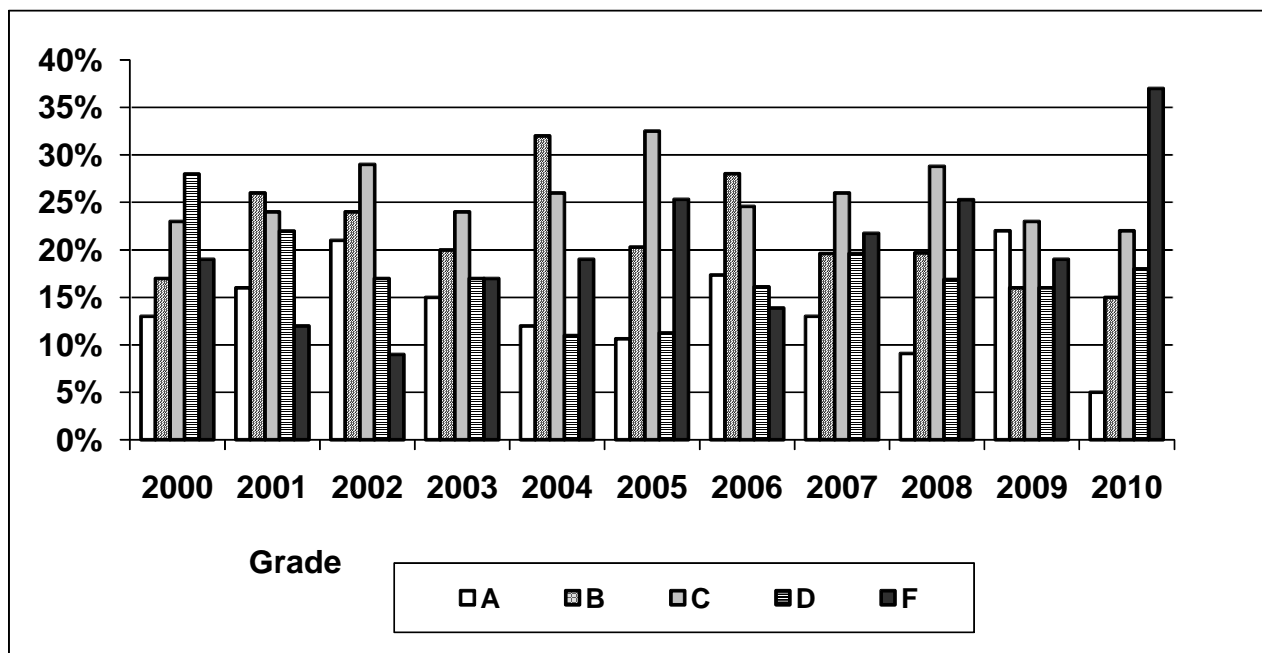


Figure 20. Locations of insects released to control purple loosestrife in Minnesota through 2010.

Biological control insects released between 1992 and 2010 have established reproducing populations at more than 75% of the sites visited. Insect populations increased significantly at many locations with pronounced damage to loosestrife plants. In the summer of 2010, 130 insect release sites were assessed for insect establishment and level of control achieved. At 43% (39 sites) of the sites surveyed, insect populations were increasing and causing damage to the loosestrife infestations. At 5% (five sites) of all visited sites, the loosestrife was severely defoliated (90-100%) (Figure 21).

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 2010 demonstrated that *Galerucella* introductions have caused moderate to severe defoliation of loosestrife populations on 21% (19 sites) of 130 sites assessed in 2010 (Figure 20).



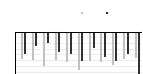
A = 90-100% defoliation, B = 50-89% defoliation, C = damage near release point with insects visible, D = no damage, few insects visible, F = no insects or damage present.

Figure 21. Sites graded for insect establishment and control.

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

Research on Insects as Biological Control Agents

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



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

Future needs for management of purple loosestrife

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

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Other Aquatic Invasive Plant Species in Minnesota

Introduction

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

Brazilian waterweed (*Egeria densa*)

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

As in 2008 and 2009, inspection of Powderhorn Lake during 2010, did not result in the observation of Brazilian waterweed in the lake. The DNR plans to continue to monitor the lake in future years to determine whether Brazilian waterweed is in the lake.

Brittle naiad (*Najas minor*)

In July, 2010, Steve McComas of Blue Water Science reported the discovery of brittle naiad in Round Lake, Hennepin County. This lake is adjacent to the storm-water pond in Eden Prairie where the invasive plant was observed in 2009. The DNR subsequently inspected the lake and found the plant. Brittle naiad is classified as a prohibited invasive species in Minnesota.

Non-native waterlilies (*Nymphaeaceae* sp.).

During the summer of 2010, the DNR Invasive Species Program received two reports of the presence of non-native waterlilies (*Nymphaeaceae* sp.). The first case was discovered in Douglas County in Aaron Lake on June 29, 2010. The waterlilies occupied an area of approximately 180 ft² (Figure 22). The owner of the property where the waterlilies were found was contacted by enforcement. It was discovered that the waterlilies had been purchased from a local department store and planted over the last several years. The second case was discovered in Otter Tail County in Tamarac Lake on August 9, 2010. The area occupied by the waterlilies was approximately 25 ft² (Figure 23). The owner of the property nearest to the waterlilies was contacted by enforcement. The owners acknowledged that they had planted the waterlilies over the last couple of years. In both cases, the waterlilies were found by other DNR staff conducting fieldwork and were removed by DNR staff in order to ensure the waterlilies were properly removed and disposed of.



Figure 22. Non-native waterlilies growing on the northeast shore of Aaron Lake, Douglas County, July 21, 2010.



Figure 23. Non-native waterlilies growing on the north shore of Tamarac Lake, Otter Tail County, August 30, 2010.

Table 19. Other Aquatic Invasive Plant Species in Minnesota.

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

Terrestrial Invasive Plant Management

Overview

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

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

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

Management

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 20). Funds totaling \$606,777 were awarded to DNR land managers from July 1, 2009 - June 30, 2010. Funds of \$438,000 were awarded to land managers for July 1, 2010 - June 30, 2011. 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 160,000 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, and hardwood forest and wetland habitats. Minnesota’s Comprehensive Wildlife Conservation Strategy lists management of invasive species as a Priority Conservation Action for all ecological subsections in the state.

The 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 20. History of terrestrial invasive plants funding program:

| Fiscal Year | \$ spent | 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 | Currently underway | 33 |

Outcome Report: 2010 Funding Cycle

Four divisions and one region completed 42 terrestrial invasives projects in FY10 (Table 21). The projects implemented treatment or inventory for more than 30 different invasive plant species (Table 22). Many of the proposals targeted the control of woody invasive species such as buckthorn, non-native bush honeysuckles, Siberian elm, Amur maple, Japanese barberry, and multiflora rose. Other projects targeted species that typically grow in open areas such as common tansy, leafy spurge, spotted knapweed, and Canada thistle. However, these species also pose a threat to forestry because of their effect on tree regeneration in harvested areas. The Division of Forestry implemented a large inventory project on gravel pits. Gravel pits can be a source of invasive species which are then spread to new areas. This information is being used to prioritize areas for treatment in the coming years.

Table 21. Types of funded terrestrial invasive plant inventory/management projects for FY10.

| Division/Section | # of Projects | Project Type (# of projects) | Subtotal |
|--------------------------------|----------------------|--|-------------------|
| Ecological and Water Resources | 2 | - Inventory (all or part of 2) - Management of invasives (1) | \$ 120,000 |
| Forestry | 13 | - Inventory (3) - Management of invasives (8) - Op Order 113 equipment (2) | \$ 153,767 |
| Parks and Trails | 17 | - Inventory (all or part of 5) - Management of invasives (14) | \$ 154,900 |
| Region 3 | 1 | - Management of invasives | \$ 27,000 |
| Wildlife | 9 | - Inventory (all or part of 6) - Management of invasives (6) | \$ 151,110 |
| TOTAL | 42 | | \$ 606,777 |

Table 22. Results of funded terrestrial invasive plant inventory/management projects for FY10.

*Inventories in all divisions included: buckthorn, common tansy, honeysuckle, leafy spurge, Siberian elm, Siberian peashrub, spotted knapweed, non-native thistles (e.g. Canada thistle), and wild parsnip. Additional species are listed below.

| Division/ Section | Acres Inventoried | Targeted Species: Inventory* | Acres Managed | Targeted Species: Management | Equipment Purchased |
|---------------------------------------|---|--|------------------|--|--|
| Ecological and Water Resources | 7,033 | butter and eggs, creeping Charlie, garlic mustard, orange hawkweed, Queen Anne's lace, St. Johnswort, reed canary grass, smooth brome, sweetclover, tansy | 366 | Bird's foot trefoil, buckthorn, Canada thistle, cow vetch, crown vetch, dame's rocket, garlic mustard, leafy spurge, spotted knapweed, tansy | -5 Juno SB gps handheld data collectors |
| Forestry | 600 on land, 40,000 aerial survey for buckthorn | Amur maple, black locust, garlic mustard, Grecian foxglove, Japanese barberry, Japanese & giant knotweed, multiflora rose, Norway maple, reed canary grass, Russian olive, sowthistle, St. Johnswort | 377 | buckthorn, honeysuckle, multiflora rose, Amur maple, Japanese barberry | -4 Under carriage cleaner nozzles -1 Poly water tank -1 Poly foam tank -1 Bambi bucket -1 small power washer |
| Parks and Trails | 2,550 | Amur maple, bird's foot trefoil, crown vetch, garlic mustard, reed canary grass | 1,866 | Buckthorn, bird's foot trefoil, burdock, Canada thistle, garlic mustard, Grecian foxglove, honeysuckles, leafy spurge, Siberian elm, spotted knapweed, tansy, thistles, wild parsnip | -3 Juno SB gps handheld data collectors |
| Region 3 | 0 | NA | 20 | Buckthorn | |
| Wildlife | 14,411 | bird's foot trefoil, chicory, crown vetch, hoary alyssum, lilac, orange hawkweed, oxeye daisy, Queen Anne's lace, Russian olive | 733 | Common tansy, crown vetch, buckthorn, Siberian elm, thistles, + species from inventory for some projects | -5 Juno SB gps handheld data collectors, + licenses |
| TOTAL | 64,594 | | 3,362 | | |

Current Terrestrial Invasives Funding Proposals ending June 2011

In response to the FY request for proposals for terrestrial invasive plant management, we received proposals for 54 projects totaling \$1,009,323. It was possible to fund 33 of the proposals for a total of \$438,000 (Table 24). The funded proposals included 22 proposals for controlling invasive plants, four proposals for invasive plant inventories, six proposals to do both inventories and control, one proposal to improve education surrounding spread of terrestrial invasives, and several that included purchasing equipment to limit the spread of invasive species (Op Order 113 equipment). 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 three DNR offices.

Table 23. Funded terrestrial invasive plant inventory/management projects for FY11.

| Division/ Section | # of Projects Funded FY11 | Project Type (Number of projects) | Subtotal |
|--------------------------------|--------------------------------------|--|-------------------|
| Ecological and Water Resources | 2 | - SNA invasives inventory, control and Op Order 113 implementation - Monitoring spread in Manitou project | \$ 97,700 |
| Fisheries | 2 | - Terrestrial invasives inventories on Aquatic Management Areas, includes GPS equipment | \$17,800 |
| Forestry | 7 | - Inventory (part of 1) - Management of invasives (6) - Stop the spread of terrestrial invasives (1) | \$ 97,700 |
| Parks and Trails | 9 | - Inventory (part of 1) - Management of invasives (8) - Op Order 113 – boot brushes and signs (1) | \$ 99,000 |
| Region 2 | 1 | - Region 2 Headquarters invasives control | \$ 3,400 |
| Region 3 | 1 | - Region 3 Headquarters invasives control | \$ 23,000 |
| Region 4 | 1 | - Region 4 co-located offices invasives control | \$ 3,000 |
| Wildlife | 10 | - Inventory, includes equipment (part of 3) - Management of invasives (10) | \$ 96,400 |
| TOTAL | 33 | | \$ 438,000 |

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

Due to the growing threat of invasive species (both terrestrial and aquatic), and the Forest Stewardship Council’s Corrective Action Request to “implement strategy to identify areas of greatest concern with respect to invasive species and implementation to control,” there is a need to address the spread and impact of invasive species by DNR resource management activities from a department-wide perspective. Therefore,

the Invasive Species Operational Order 113 identified the need for each DNR Division to develop Invasive Species Divisional Guidelines for their work activities. These were finalized in the spring of 2008 and are currently being implemented at the field level. 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 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. A survey of DNR employees was conducted to determine what is needed to increase implementation of Op Order 113.

Inventory

Using standardized protocols developed by the DNR, 89,000 locations of invasive plant species on state-managed lands have already 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 all-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. DNR coordinated with MDA and MnDOT to work on addressing these species while populations are small.

Information and Education

The buckthorn brochure was updated and reprinted in fall of 2009. 50,000 copies were purchased and are being disseminated statewide.

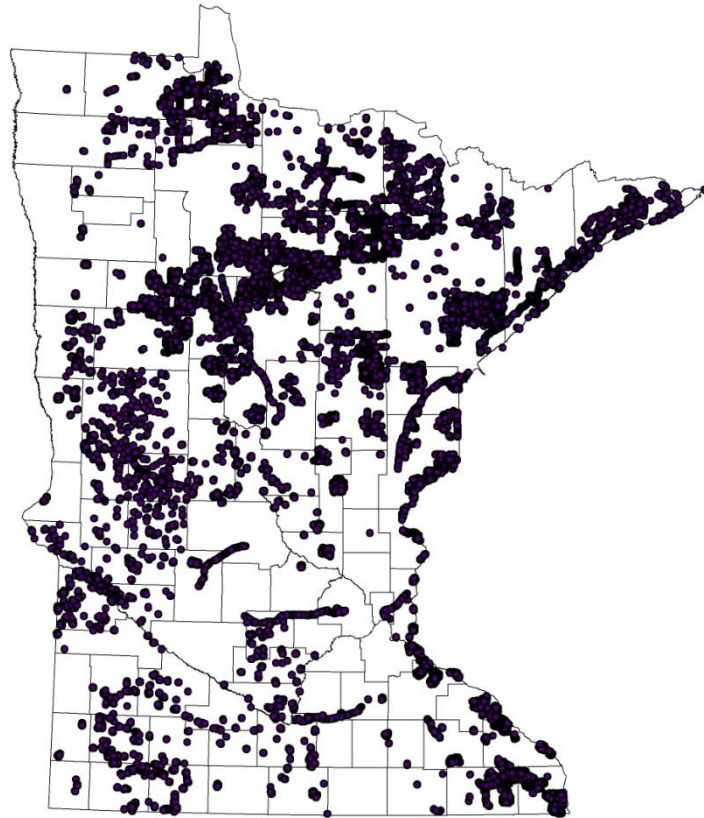


Figure 24. Terrestrial invasive plant inventories (all species), 2010.

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 Environmental 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*. Species identified as priority species for further work include the sap-sucking psyllid *Trichoermes walkeri* (Hom., Triozidae), and the seed-feeding midge *Wachtliella krumbholzi* (Dipt., Cecidomyiidae).

Further funding was secured for FY11-13 which will help to complete the work on these potential biocontrol agents for *R. cathartica*. In future years, host-specificity testing will continue for *T. walkeri* and *W. krumbholzi* and further research will be carried out on a phytoplasma recently detected in *T. walkeri*. Research will also be 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 were also attacked in tests, these species are not recorded as field hosts of the weevils. The implementation of safe garlic mustard biocontrol appears within close reach.

Host specificity testing of the final set of native plant species was completed for *C. scrobicollis*. This included additional native species in several genera now considered closely related to garlic mustard. With testing complete, a petition was submitted in April 2008, to USDA-APHIS to allow state agencies to field release *C. scrobicollis* in the United States. After review of the petition, additional plant species were recommended for host specificity testing. This work is ongoing and should be completed in early 2011. We expect approval for release of this control agent in 2011-12.

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

Garlic mustard biological control implementation in Minnesota. A garlic mustard project was initiated in 2005 to establish permanent plots to monitor garlic mustard populations in anticipation of biological control insect release. To find potential sites, it was necessary to locate garlic mustard populations of the appropriate size in areas where management would not be applied. Garlic mustard monitoring plots were established in 12 sites in central and southeastern Minnesota. The established plots then had their species composition and garlic mustard abundance recorded in 2005-2010.

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 2010, 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 Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources.

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Management of Mute Swans

Introduction

Issue

Mute swans (*Cygnus olor*) are native to Europe and Asia and were brought to the United States from the mid-1800s through the early 1900s. Populations of mute swans have established in numerous states. These populations have originated from release or escape of individuals from captive flocks. The current population growth in the Great Lakes states is estimated at 10-20% or higher per year (Scott Petrie, Bird Studies Canada, Port Rowan Ontario, presentation to Mississippi River Basin Panel, 8 September 2005). The birds can consume 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 that has previously occurred on those lakes. Individuals have also reported seeing the mute swans harassing trumpeter swans. Individuals and lake associations have requested that the DNR remove mute swans from lakes and wetlands where there were birds in the wild.

Goal

The 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 2010. Monitoring mute swans in the wild is a strategy necessary to help DNR respond to birds that may establish naturalized populations. During 2010, the DNR recorded reports of wild or escaped mute swans at locations in the state. A total of four birds were reported in the wild in three counties (Table 24). DNR conservation officers removed all four birds from the wild.

Progress in Management of Mute Swans - 2010

Table 24. Unconfined mute swans removed from Minnesota counties during 2010.

| County | Number of Mute Swans Reported |
|-------------------------------|---|
| Hennepin | 1 - at Lake Rebecca (Three Rivers Park) |
| Scott | 1 - at Rapids Lake |
| Wadena | 2 - at Menahga Golf Course |
| Total for all counties | 4 |

Future needs for management of mute swans

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

Management of Zebra Mussels

Background

The zebra mussel (*Dreissena polymorpha*) is a small striped invasive mussel that was brought to North America in the ballast waters of trans-Atlantic freighters in the late 1980s. Unlike our native mussels, zebra mussels secrete sticky threads that are used to firmly attach to 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 - 2010

New Infestations: New infestations were reported from three waters during 2010: Lake Minnetonka (Hennepin County), Gull Lake (Cass/Crow Wing County) and Victoria Lake (Douglas County) (Figure 25). The infestation in Victoria Lake is not surprising, given the connections between this lake and the other infested waters in the chain of lakes by Alexandria (Le Homme Dieu, Geneva, Carlos and Darling). However, the infestation of the other two lakes presents challenges in spread prevention, due to size and use levels in both of these waters.

Lake Minnetonka: In late July, a swimmer reported finding what was suspected to be a zebra mussel attached to litter picked off the bottom of the lake near the channel between Gray's and Wayzata Bay's. Upon confirmation of the find, Invasive Species Program staff conducted a rapid shoreline search in the immediate vicinity of the reported find and discovered tiny zebra mussels attached to scattered bottom substrate in the lake. These findings resulted in the listing of Lake Minnetonka as infested with zebra mussels. Subsequent surveys documented widespread settlement in the lower part of the lake. Surveys also documented mussels attached to rocks below the dam at the outlet of the lake, leading to listing of Minnehaha Creek and attached downstream waters as infested until the confluence with the Mississippi River.

Partnerships already existed between the Invasive Species Program and other groups on the lake, particularly the Lake Minnetonka Conservation District (LMCD) and the Minnehaha Creek Watershed District (MCWD) relating to Eurasian watermilfoil and other invasive species efforts. The partners met very early in the zebra mussel infestation discovery and determined that information could best be provided to the public by establishing one major source for all to use. In light of these discussions, the DNR Invasive Species Program established a separate webpage linked from the DNR zebra mussel webpage devoted solely to the issue of zebra mussels in Lake

Minnetonka. Information was shared between the partners and posted on this website (such as maps detailing findings in the lake) to make it easier for the public to access. A number of meetings were held in the area on this new infestation. Shortly after the discovery, Invasive Species Program and other research staff met and presented information to the LMCD Board of Directors to update them on the findings, educate them on basic zebra mussel biology and ecology, and answer questions. This meeting was followed by two emergency meetings of the LMCD Aquatic Invasive Species (LMCD-AIS) Task Force, where Invasive Program and other research staff attended and provided technical and programmatic input. Two public information open house meetings were held in the Lake Minnetonka area, where a presentation on zebra mussels was made and staff from the partner organizations as well as DNR Enforcement and Invasive species staff were available at various tables to answer questions. The efforts at coordinating with existing partners provided consistent timely information and reduced overlap and duplication of effort.

Media coverage of this infestation was extensive, providing opportunities for getting out the messages of actions people should take to prevent spread. Signs at public access sites were updated, and in response to inquiries, two training meetings were held with lake service providers (such as dock installers) to help them understand what new laws and regulations applied and how they could help prevent problems in their work. In response to needs expressed by some providers, a new permit process was developed to allow boat servicers to transport boats which might have attached zebra mussels to their facilities for cleaning and storage, rather than mandatorily cleaning at the access site. A similar program was developed for lake residents who might remove their watercraft in the fall, allowing them to move a boat with zebra mussels to their residence for cleaning and overwinter storage.

In an effort to engage lakeshore residents to help determine spread of zebra mussels within the lake, the MCWD used material from the DNR Zebra Mussel Volunteer Monitoring program in a newsletter mailing. Reports from residents who are removing their boats and docks will help clarify the overall lake-wide distribution.

Gull Lake: In late fall, a lake service provider reported finding a few zebra mussels attached to a boat lift removed from Gull Lake. After confirmation, regional Invasive Species Program specialists conducted a rapid shoreline survey in the area, looking at aquatic vegetation, substrate and other boat lifts and docks. More zebra mussels were found attached to other boat lifts as well as aquatic vegetation from the lake. Gull Lake was listed as infested with zebra mussels. Invasive Species Program staff answered questions from local and state media which resulted from this announcement. Additionally, access sites on the lake were immediately posted due to quick response by area DNR Parks and Trails staff. Enforcement staff spent extra time at this lake in response to the report.

These two large lakes (Minnetonka and Gull) present an increased risk for further spread of zebra mussels. Boating use on Lake Minnetonka is extremely high, and Gull Lake provides a new infestation on a large popular recreational water body in central Minnesota. The potential for movement to other waters increases with the occurrence of zebra mussels in waters such as these. Increased inspection and public awareness efforts will need to be focused on Gull Lake to attempt to contact boaters who may not

have encountered this invasive species prior to this infestation. The level of inspection effort on Lake Minnetonka was very high already, with cooperative agreements between the DNR Invasive Species Program and local partners such as the LMCD (see Watercraft Inspections and Awareness Events).

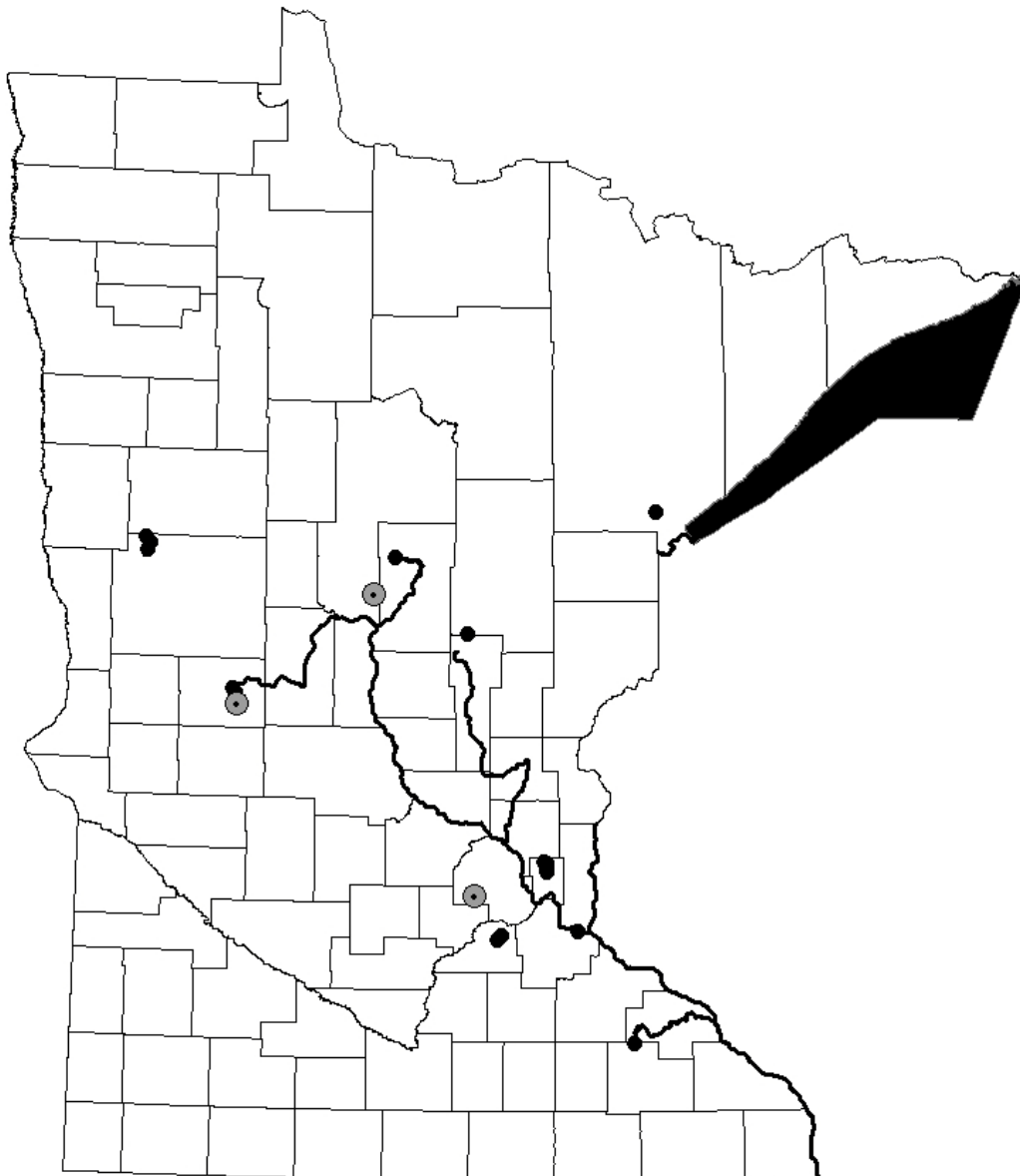


Figure 25. Zebra mussel infestations in Minnesota confirmed by the DNR. Gray circles indicate new infestations in 2010. Black dots and bold black lines indicate infested river areas and Lake Superior.

Existing populations and efforts: Dive surveys in Mille Lacs Lake by DNR Fisheries and Ecological and Water Resources staff found approximately a 3.5x increase in zebra mussels over numbers from 2009. Calculated densities were estimated at about 14 zebra mussels per square foot. Reports from the public showed an increase in zebra mussel density and settlement, with a number of calls ranging from attachment on boats to mussels found on water pump intake lines used for watering lawns and gardens. Water tow samples collected over the summer season found extremely high numbers of veligers (larval zebra mussels) over a longer time period than previous seasons. Aquatic plant surveys conducted by DNR field staff also found high numbers of tiny zebra mussels attached to aquatic vegetation in the lake.

Similar dramatic increases in zebra mussel reproduction and settlement were seen in other lakes in the state. In Lake Le Homme Dieu, water samples showed very high densities in veliger counts. Late season shoreline surveys also found high numbers of tiny settled mussels. Carlos Lake had moderate numbers of veligers in water samples, and plant surveys found many tiny zebra mussels attached to vegetation. 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. One boat owner had engine problems with a little used watercraft from the lake. Across the state, infested waters all seemed to have a much more productive reproduction success. It is possible that the earlier warm sustained temperatures allowed the water to warm sooner, and maintained it at warmer temperatures than normally found throughout the season. This may have enhanced zebra mussel production, as reproduction is keyed to water temperatures. These higher veliger and young of year densities could enhance the possibility of spread from infested waters, or cause more recreational impacts or even ecological impacts.

Sucker Lake water appropriation: Sucker Lake is part of the chain of lakes used for water supply by St. Paul and surrounding suburbs. It was infested with zebra mussels a few years back. Sucker Lake is connected to nearby Snail Lake by a pipeline, which was used to transfer water to Snail Lake to artificially maintain its water levels. Due to the infested status of Sucker Lake, this water transfer could not be permitted without measures to prevent movement of any life stages of zebra mussels. City officials contracted to have a filtration system designed and installed, with filtration finer than needed to prevent veliger movement. The city was issued a permit to allow water transfer from Sucker Lake to Snail Lake.

Colonization and water chemistry: A short summary of selected water chemistry and the influence on possible zebra mussel population for lakes was done using MPCA data on reference lakes over ecoregions in the state. Selected parameters were assessed using published data on zebra mussel tolerances. Overall, most of the waters across the state do not appear to have limitations based on water chemistry. However, the summary suggested that some lakes in the northern region may have lower levels in some of the parameters that might prevent zebra mussel survival or limit population densities. Water chemistry data from specific lakes in the north and northeastern parts of the state were examined in more detail. A larger number of lakes in this region may be less suitable for zebra mussel survival. Mapping the lakes with unsuitable water

chemistry may help delineate areas that this invasive might be less of an issue than other parts of the state.

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. The importance of volunteer monitoring is emphasized by the fact that the new infestation in Lake Minnetonka was reported by a lake user and the Gull Lake infestation was first found by a lake service provider.

Other Invasive Animal Species in Minnesota

Introduction

Numerous invasive wild animals exist in the state. The previous chapters described species for which there were ongoing efforts. The species described in this chapter exist in the state, but there are no ongoing efforts by the DNR to manage them in the wild. They are included because they are or have been of interest within the state. In addition to the information presented on Eurasian collard-dove, faucet snail, New Zealand mudsnail, rusty crayfish, and spiny waterflea in this chapter, Table 25 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 60 Minnesota counties from 1999 to 2010: Big Stone, Blue Earth, Brown, Carver, Chippewa, Clay, Cottonwood, Dakota, Dodge, Faribault, Fillmore, Freeborn, Goodhue, Grant, Hennepin, Houston, Itasca, Jackson, Kandiyohi, Kittson, Koochiching, Lac qui Parle, Lincoln, Lyon, Martin, McLeod, Meeker, Mower, 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, Waseca, Washington, Watonwan, Wilkin, Winona, Wright and Yellow Medicine.

In 2010, there were a total of 49 sightings across 26 counties. No new sightings were reported in counties where collared doves have not been previously seen, but the birds 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 (*Sphaeriodotrema 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 Lacrosse, 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 - Known faucet snail populations in Minnesota waters are at Lake Winnibigoshish and connected waters, the Mississippi River downstream of Lake Winnibigoshish, Little Winnibigoshish Lake, Upper Twin (Hubbard County) and Lower Twin Lakes (Wadena County), the Shell River downstream of Lower Twin, the Crow Wing River downstream of First Crow Wing Lake, and in border waters of the Mississippi River near LaCrosse, Wisconsin (Figure 25). They can live in rivers and streams, lakes, ponds, ditches, marshes and canals and may be found on variety of substrates, including gravel, sand, clay, mud, and the exposed undersides of rocks.

Surveys for the faucet snail in Lake Winnibigoshish, its connected waters, Bowstring Lake in Itasca County, and Upper and Lower Twin lakes, and suspect infested waters continue in cooperation with Leech Lake Band of Ojibwe natural resource staff and the DNR. Densities ranged widely from dense to almost absent throughout Winnibigoshish and its connected waters and again in 2010, no faucet snails were found in Bowstring Lake.

A report of the faucet snail was investigated in the spring of 2010 in the Crow Wing River which resulted in the verification of the presence of the faucet snail there. The river was designated as infested and due to the heavy use of commercial bait harvest two trainings were done to train permit applicants on infested water bait harvest rules and regulations.

Other reports where the faucet snail was verified included the Mississippi River downstream of Lake Winnibigoshish and Little Winnibigoshish Lake.

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

Actions that have been taken in 2010 to help prevent the spread of faucet snails include:

- Designating Little Winnibigoshish Lake, the Mississippi downstream of Lake Winnibigoshish to White Oak Lake, the Leech Lake River from Mud Lake dam to the confluence with the Mississippi River, and the Crow Wing River downstream of First Crow Wing Lake as *infested waters* and posted Invasive Species Alert signs and Help Stop Aquatic Hitchhikers! signs at water accesses and all campgrounds on those waters;

- Monitoring current distribution and assess changes;
- Working with the Leech Lake Band of Ojibwe-Division of Resource Management and the U.S. Forest Service in Chippewa National Forest on containment options;
- Supporting research about the snail by cooperatively working within the DNR and with other outside agencies including the United States Geologic Survey, the U.S. Fish and Wildlife Service, and the Leech Lake Band of Ojibwe.
- Disseminating fact sheets, Web information, and a regulations card with information about preventing its spread and regulations that apply.
- Presenting faucet snail presentations at professional and public workshops and conferences.

In 2011, the DNR is planning to designate the faucet snail as a *prohibited invasive species* in Minnesota. When it is designated it will be illegal to import, possess, transport, and introduce.

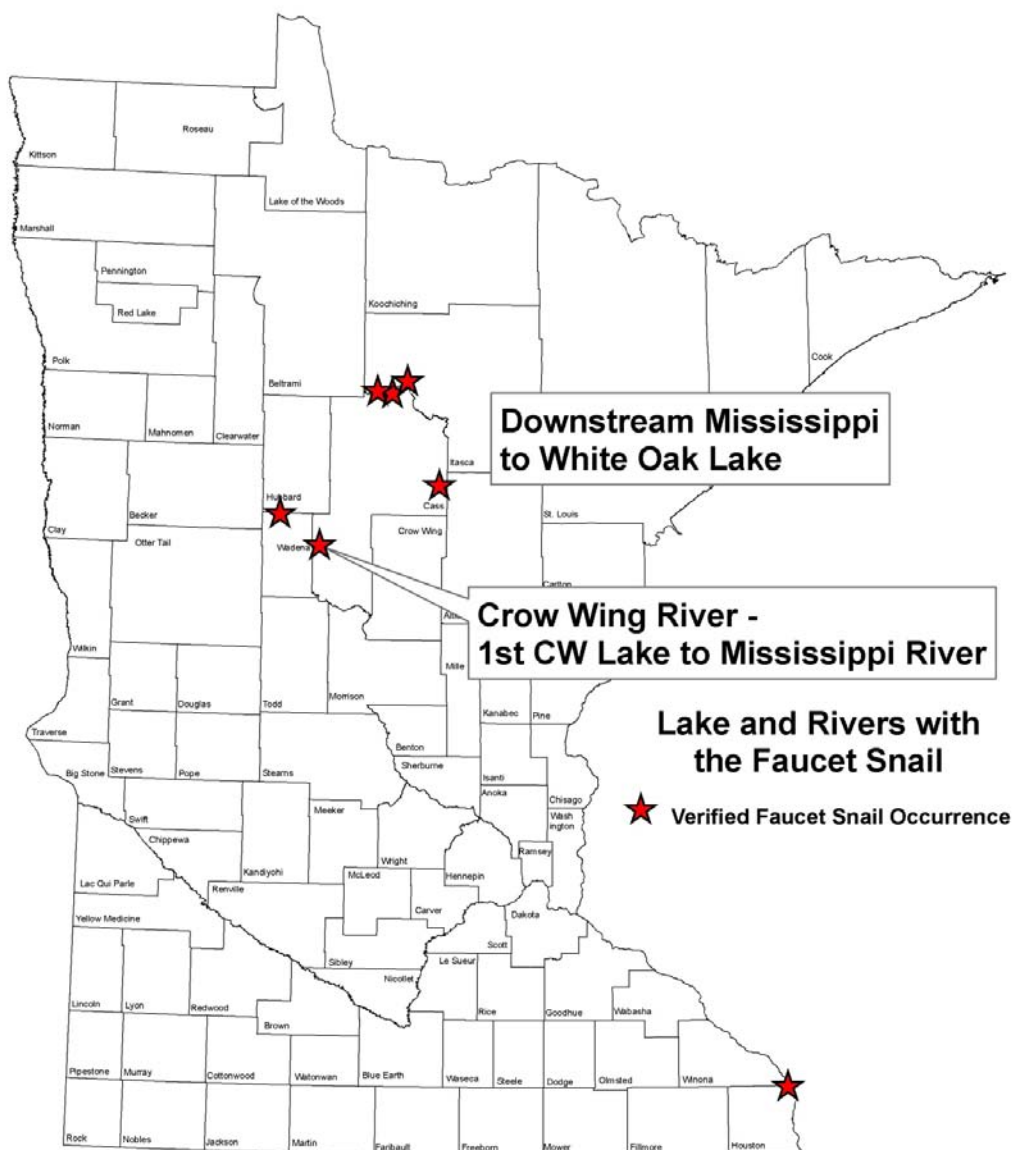


Figure 26. Distribution map of where faucet snails (*Bithynia tentaculata*) have been found as of December 2010.

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 - The distribution of these snails appear to be increasing in Minnesota. New reports are confirmed with specimens and added to distributional lists. Recent surveys in lakes have documented a number of new occurrences. The increase in waters reported with these taxa may be an indication of heightened awareness of the species, rather than an indication of recent movement.

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

Spiny Waterflea

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

Bythotrephes sp. - 2010: Spiny waterflea were reported from several waters in 2010. Reports from the USFS confirmed the occurrence in the following waters: Royal River between Little John and North Fowl Lakes, Royal Lake, North Fowl Lake, South Fowl Lake, Pigeon River. These new infestations are not surprising, due to connections with previously infested waters. Additionally, Burntside Lake in northern Minnesota was found to be infested with *Bythotrephes* sp. With the interconnections between many of the 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 processing zooplankton samples collected in the Rainy Lake system as part of a large federal study to assess potential impacts of *Bythotrephes*. Zooplankton samples from Lake of the Woods collected over the summer by Baudette area Fisheries 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 lakes used for aerial stocking operations to check if these lakes are infested, with negative results to date.

Recent reports from a long-term Fisheries study on Island Lake have documented high levels of predation by perch and walleye on the *Bythotrephes* that are abundant in the lake. Researchers also suggested that the abundance of the spiny waterflea does not appear to have impacted the fisheries in the lake. However, they have eliminated *Leptadora* sp. (a similar native zooplankton) from the lake and have reduced zooplankton biomass.

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 lake was confirmed as infested in 2009, and was already being sampled as part of a research study to look at potential impacts from zebra mussels. Last year, only one sample from late fall contained spiny waterflea. This season, this invasive was present throughout most 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.

Efforts continue to educate lake recreationists on actions that can be taken to prevent further spread. Billboards, signs, watercraft inspections, literature, media and enforcement work continue to try to keep *Bythotrephes* from being moved to unconnected waters. Information from University of Minnesota-Duluth research suggests that complete drying for 12 hours is sufficient to kill the resting eggs, however, researchers also warn that partial desiccation is not enough. While this drying is an easy prevention step, it may also be difficult if recreational gear is exposed to precipitation delaying the drying period, or stored in a damp condition that may prevent desiccation.

Table 25. 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 | | 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 germinata</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 25. (Continued)

| | | | |
|---|--|------------|------|
| 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 water bodies in 2010. | Prohibited | 2005 |
| Ruffe (<i>Gymnocephalus cernua</i>) | No new water bodies 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 efforts that address specific invasive species

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

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

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

Appendix B - Invasive Species Program Staff

| Title / Area of Responsibility | Name | Phone | E-mail |
|---|-------------------|--------------------------|--|
| Invasive Species Program Staff (Central Office) | | | |
| Invasive Species Program Supervisor - supervision of overall program, policy and direction, legislative issues | Luke Skinner | 651-259-5140 | luke.skinner@state.mn.us |
| Invasive Species Prevention Coordinator - education and public awareness, permits, regulations and prevention grants | Jay Rendall | 651-259-5131 | jay.rendall@state.mn.us |
| Aquatic Invasive Species Management Coordinator - technical and financial assistance for aquatic invasive plant management | Chip Welling | 651-259-5149 | chip.welling@state.mn.us |
| Terrestrial Invasive Species Management Coordinator - technical assistance and biological control programs | 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) | Brittany Hummel | 651-259-5828 | brittany.hummel@state.mn.us |
| Southern MN (New Ulm) | Joe Eisterhold | 507-359-6079 | joe.eisterhold@state.mn.us |
| Watercraft Inspection Program Assistants (Field Staff) - Supervise local watercraft inspectors and provide outreach for awareness events at water accesses | | | |
| Northern MN (Park Rapids - seasonal) | Bruce Anspach | 218-699-7295 | bruce.anspach@state.mn.us |
| West-Central MN (Fergus Falls - seasonal) | Anna Ness | 218-739-7576 ext. 247 | anna.ness@state.mn.us |
| Central MN (Brainerd - seasonal) | Keri Hull | 218-833-8737 | keri.hull@state.mn.us |
| Central and Southeast MN (St. Paul) | Maureen Ziskovsky | 651-259-5146 | maureen.ziskovsky@state.mn.us |
| General Information | | 651-259-5100 | |

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

Department of Natural Resources - Forest Pest Program

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

Forestry Division Contacts

| | | |
|---|----------------|--------------|
| Metro/Southern Forest Health Specialist | Ed Hayes | 507-206-2834 |
| Northeast Forest Health Specialist | Mike Albers | 218-327-4115 |
| Northwest Forest Health Specialist | Jana Albers | 218-327-4234 |
| Forest Health Program Coordinator | Val Cervenka | 651-259-5296 |
| Silviculture Lands and Roads Supervisor | 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 |
|-----------------------------|-------------|--------------|

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 Gypsy Moth 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 |
| Gypsy Moth Unit | Lucia Hunt | 651-201-6329 |

Seed Inspection and Noxious Weed Unit Contacts

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

Interagency Invasive Species Groups

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

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

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

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

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