DEPARTMENT OF NATURAL RESOURCES

INVASIVE SPECIES
2023 ANNUAL REPORT

Photo on cover: *An angler properly disposes of unwanted bait.*

DEPARTMENT OF NATURAL RESOURCES

ECOLOGICAL AND WATER RESOURCES

500 Lafayette Road, St. Paul, MN 55155-4025 888-646-6367 or 651-296-6157
mndnr.gov

For current invasive species regulations, a list of infested waters, species information, and local DNR contacts, visit mndnr.gov/ais.

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Note from the Program

The Minnesota Department of Natural Resources (DNR) is pleased to submit the 2023 Invasive Species Annual Report to the governor, legislature and people of Minnesota. This report summarizes our efforts to prevent the introduction and spread of invasive species of aquatic plants and animals in Minnesota.

The report provides an overview of program activities, finances, prevention and management efforts, goals, highlights, partnerships, and future needs and plans for individual program areas.

Contents

A Letter from the Invasive Species Program

Welcome to the 2023 Minnesota Department of Natural Resources (DNR) Invasive Species Program annual report.

This report highlights the accomplishments of the Invasive Species Program and keeps you up to date with new issues facing the program as we work with partners around the state to reduce the impacts of invasive species on Minnesota's outdoor traditions.

Our work in 2023 included:

Invasive Species Program staff issued 402 permits to manage invasive aquatic plants and the DNR Aquatic Invasive Species (AIS) Management Grant Program funded 141 invasive aquatic plant treatments through 102 grants, totaling $400,000.

DNR and local government watercraft inspectors together completed 469,038 incoming and outgoing watercraft inspections.

Staff provided technical support to counties that received AIS Prevention Aid and worked with the public at lake association meetings, conferences and outdoor events.

The DNR installed the first state-owned, on-demand decontamination station at Big Bog State Recreation Area as part of a project with Red Lake Nation, to respond to the discovery of larval zebra mussels, or veligers, in Red Lake.

The DNR financially supported the inventory and management of terrestrial invasive species on 4,046 acres of state and adjacent land.

Conservation officers completed 13,121 hours of invasive species education and enforcement.

After a report from a commercial harvester, we worked with experts to confirm the first known occurrence of signal crayfish in the state, in Lake Winona (Douglas County). DNR and others followed up with trapping this year and will continue the response in 2024.

Two new specially trained zebra mussel detection canine officer teams were added to the DNR Enforcement Division.

The DNR continued to build partnerships with the U.S. Geological Survey (USGS), the U.S. Fish and Wildlife Service (USFWS), Wisconsin DNR, the National Park Service (NPS), and Wild Rivers Conservancy to test new technologies for invasive carp capture. In October of 2023, multiple sites were sampled in Mississippi River Pools 6 and 8 and three new technologies developed by USGS were successfully deployed.

The DNR tags, releases, and tracks small numbers of invasive carp to better understand patterns of movement and find additional invasive carp. Seventeen carp captured between April and October were tagged and released. Tracking tagged invasive carp led to the successful removal of 408 invasive carp in Pool 6 of the Mississippi River in late November and early December of 2023.

Thank you for partnering with the Invasive Species Program this year. We look forward to working with you in 2024 as we search for new technologies, create new partnerships, strengthen current partnerships, and continue our work to prevent and manage invasive species to benefit Minnesota's natural resources.

Thank you,

/s/ Kelly Pennington, Invasive Species Unit Supervisor

Invasive Species Unit Supervisor

Minnesota Department of Natural Resources

Program Overview

Invasive species have serious economic, environmental and recreational impacts in Minnesota. In 1991, the Minnesota Legislature directed the DNR to establish an Invasive Species Program. The program is tasked with preventing the spread of invasive species and managing invasive aquatic plants and wild animals (Minnesota Statutes, chapter 84D).

In 2023, the Invasive Species Program included 24 full-time positions, plus affiliated staff in DNR offices across Minnesota whose work is primarily or partly focused on invasive species. In the summer, the DNR employed 68 watercraft inspection staff.

Program staff work with many partners, including:

- Local government units (LGU).
- Tribes, states, provinces, federal agencies, multi-jurisdictional, and national groups.
- Researchers, including the Minnesota Aquatic Invasive Species Research Center (MAISRC) and the Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC) at the University of Minnesota.
- The DNR Statewide AIS Advisory Committee.

The DNR Operational Order 113, which applies to DNR staff and contractors, provides policies and guidance for including invasive species prevention measures in their work.

The program tracks invasive species in other areas of North America and the world, works with partners to understand and manage pathways of spread, and works to reduce the potential for their introduction and spread in Minnesota.

Examples of key invasive species of concern that we are tracking outside of Minnesota include:

- Hydrilla, an invasive aquatic plant.
- Water chestnut, an invasive aquatic plant.
- Northern snakehead, an invasive fish.

The program addresses aquatic invasive species in Minnesota, such as Eurasian watermilfoil, purple loosestrife, zebra mussel, spiny waterflea, starry stonewort, and invasive carp. Efforts in this area include working to prevent further spread and to manage impacts from invasive populations.

DNR invasive species prevention and management activities depend on collaboration with: Tribes; other states; regional task force panels, local governments including counties, cities and townships; agencies and other partners with similar concerns. Coordinated prevention efforts reduce the spread of invasive species and provide time needed for research and management that may provide long-term reduction in impacts.

The program also addresses terrestrial invasive species on DNR-managed lands and provides information for private landowners. The program works to enhance the ability of DNR field staff to prevent and manage terrestrial invasive species effectively.

GOALS

- Prevent the introduction of new invasive species into Minnesota.
- Prevent the spread of invasive species within Minnesota.
- Reduce the impacts caused by invasive species to Minnesota's ecology, society and economy.

KEY STRATEGIES

1. Creating and maintaining effective invasive species regulations across the state and working with enforcement to ensure compliance.

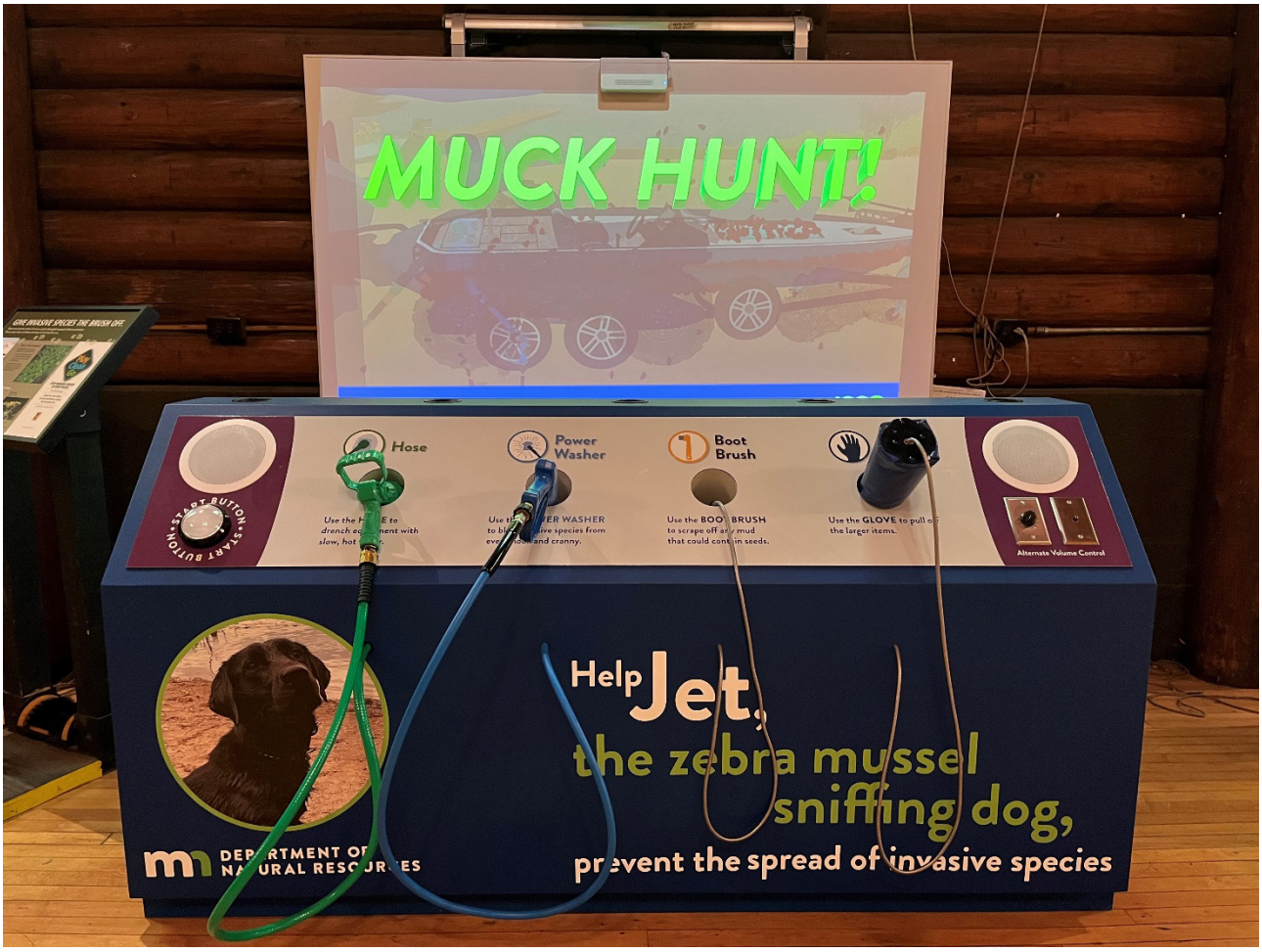
2. Deepening partnerships with local governments, research institutions, interest groups, lake associations, related businesses and others.

3. Coordinating watercraft inspection and decontamination with counties, tribal governments, lake associations, resort owners and DNR Enforcement.

4. Verifying and responding to all new reports of possible invasive species as soon as possible.

5. Coordinating invasive species management efforts and inventories.

6. Using innovative outreach and communications tools to share knowledge of aquatic and terrestrial invasive species and inspire behaviors that help prevent the spread of invasive species in Minnesota.



Muck Hunt! game in the DNR building at the Minnesota State Fair. Players clean muck off equipment to help prevent the spread of invasive species.

HIGHLIGHTS

- Watercraft inspectors hired by the DNR, and by 66 local units of government with delegated authority from the DNR, inspected 469,038 watercraft in 2023, which makes Minnesota's watercraft inspection program one of the largest in the nation.

- The DNR partnered with MAISRC, University of Minnesota Extension and many counties and local partners on an annual statewide search for new populations of starry stonewort, called "Starry Trek". In 2023, 187 volunteers searched 215 Minnesota waterbodies. No new starry stonewort populations were found during the 2023 Starry Trek.

- The Invasive Species Program co-hosted an Aquatic Plant Identification Training with University of Minnesota Extension and MAISRC. Staff and researchers throughout the state collected, sorted and identified over 60 plant species to be used in the training. Attendees included seven consultants, 13 local government staff that conduct aquatic plant surveys and 24 volunteers interested in building identification skills.

- A new interactive video game, "Muck Hunt" debuted at the 2023 Minnesota State Fair. In this game visitors could use four cleaning tools to virtually clean aquatic and terrestrial invasive species off equipment.

- The DNR installed the first state-owned, on-demand decontamination station at Big Bog State Recreation Area as part of a project with Red Lake Nation, to respond to the discovery of larval zebra mussels, or veligers, in Red Lake. This on-demand system gives watercraft inspectors greater control of water temperatures when decontaminating watercraft, providing better service to boaters at Red Lake and helping to reduce the risks of spreading invasive species.

- DNR trainers trained 301 inspectors in 27 in-person trainings before the fishing opener. An additional 68 inspectors attended in-person training before Memorial Day.

- DNR AIS prevention planners continued to build a network of support with local AIS program managers who oversee the use of their counties' AIS prevention aid funds. In February and March 2023, the Invasive Species Program facilitated a series of five, two-hour online workshops designed to help local AIS program managers and their partners be more successful in their AIS prevention work through peer-to-peer sharing and collaboration. The online workshops were well-attended, with over 60 attendees at each one.

- The DNR worked with the U.S. Geological Survey to lead a comprehensive series of discussions with stakeholders to evaluate additional options for active invasive carp management in the Mississippi River. The process incorporated public stakeholders and invasive carp experts to evaluate options and the outcomes will be used to inform an update to the statewide Minnesota Invasive Carp Action Plan.

- The DNR continued to work with partners to implement a coordinated response to nonnative *Phragmites* (*Phragmites australis* subsp. *australis*) in Minnesota. In 2023, DNR contractors visited 420 nonnative *Phragmites* sites in 38 counties. At 95 of the sites no nonnative *Phragmites* was found, largely due to previous years' effective treatment. Most of the treated sites were very small. Of the 292 sites where treatment occurred, 210 of them were less than one tenth of an acre.

- The Invasive Species Program continued to foster key partnerships with organizations and agencies in other jurisdictions to help Minnesotans stay aware of threats coming from watersheds shared with other states, like the Mississippi River and the Great Lakes Basin. The DNR participates in regional groups to provide mutual support of interjurisdictional AIS prevention and management efforts, share information and experiences, and contribute to regional AIS efforts.

Program Finances

TIME FRAME

The other chapters in this report mostly include activities from calendar year 2023. However, to provide a comprehensive review of expenditures and to coordinate with the state funding cycle, this chapter refers to expenditures incurred in fiscal year 2023: July 1, 2022, to June 30, 2023.

FUNDING SOURCES

The Invasive Species Program was mostly supported by state funds in fiscal year 2023, with additional funding from federal grants administered by the USFWS and U.S. Environmental Protection Agency (EPA).

State Funds

$2,831,000 from a general fund appropriation, of which $2,519,420 supported the Aquatic Invasive Species Program and $311,580 supported the Terrestrial Invasive Species Program.

$3,926,202 from the invasive species account, which included the following funding:

- $2,752,682 from a $10.60 surcharge on watercraft registration (valid for three years) in Minnesota.
- $1,173,520 from a $5 fee on non-resident fishing licenses.

Federal Funds

Federal funds, including from the Great Lakes Restoration Initiative (GLRI), supported the implementation of the Minnesota State Management Plan for Invasive Species. Federal funds helped support public awareness efforts, enforcement (including the zebra mussel K9 program), watercraft inspections, invasive carp management and nonnative *Phragmites* management. In fiscal year 2023 the program received $1,337,046 in federal grants.

An Invasive Species Unit summer intern uses the rake on a rope method to sample submersed plants during an aquatic plant survey.

FISCAL YEAR 2023 EXPENDITURES

Invasive Species Program expenditures on invasive species activities during fiscal year 2023 (July 1, 2022–June 30, 2023) totaled $8.3 million.

The funds are focused on the prevention and management of invasive species, with inspection/enforcement and management.

Funding for management was spent on the inventory and management of Eurasian watermilfoil, starry stonewort, zebra mussels, flowering rush, invasive carp, invasive phragmites and curly-leaf pondweed.

The pie chart below provides a broad look at how invasive species funding was spent in fiscal year 2023 and includes $2.2 million expended for invasive species work by the DNR Enforcement Division.

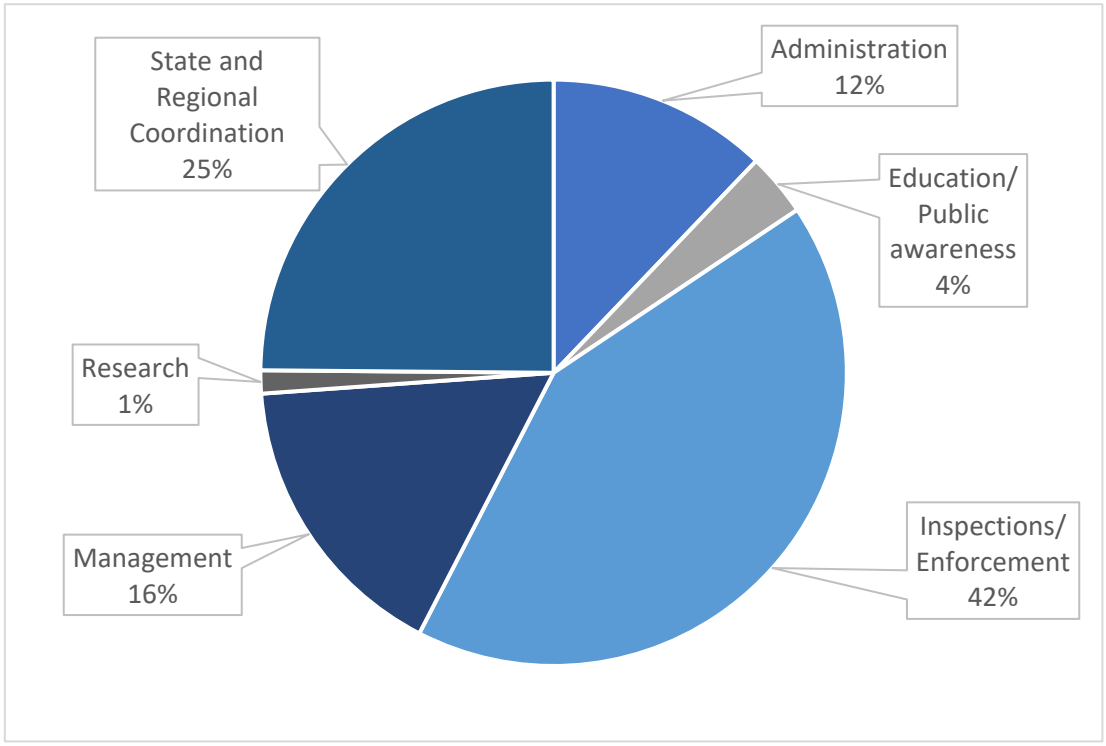
The table on the following page lists expenditures from the Invasive Species account and the General Fund account, along with spending from other accounts, including grants received from various state or federal funding sources.

The DNR spent $4,336,422 from the Invasive Species account in fiscal year 2023. The unspent funds from the Invasive Species account appropriation will go back to the invasive species fund. General Fund expenditures were $2,977,319.

The program also spent $1,279,058 in federal funds in fiscal year 2023, with most of those funds supporting watercraft inspections and enforcement, management of aquatic invasive species and state and regional coordination.

These expenditures include a one-time appropriation for $300,000 in the fiscal year 2022-2023 biennium to address aquatic invasive species in and around Upper and Lower Red Lake. These funds, administered in partnership with the Red Lake Nation, supported the installation of the first state-owned, on-demand decontamination station at Big Bog State Recreation Area and production of new AIS prevention outreach materials.

INVASIVE SPECIES PROGRAM SPENDING



FISCAL YEAR 2023 EXPENDITURES

	Invasive Species Account	General Fund	Federal/Other	Total Expenditures
Administration	$664,306	$605,552	$7,776	$1,277,634
State/Regional Coordination	$1,255,104	$1,298,015	$62,786	$2,615,905
Education/Public Awareness	$101,242	$197,216	$67,391	$365,876
Management: Aquatic	$415,507	$640,426	$474,179	$1,530,112
Management: Terrestrial		$184,101		$184,101
Inspections/Enforcement	$1,892,434	$1,972,874	$548,944	$4,414,270
Research	$7,829	$8,171	$118,081	$134,080
Total Expenditures	$4,336,422	$4,906,355	$1,279,202	$10,521,979

COST ACCOUNTING

Minnesota Statutes, section 84D.02, subdivision 6 identifies five expenditure categories that must be reported annually: Administration, Education/Public Awareness, Management, Inspections/Enforcement, and Research. A sixth category, State and Regional Coordination, covers a variety of program-wide activities that do not fit easily into the five reporting categories required by statute.

ADMINISTRATION includes general office supplies, office rent, telephones, workers' compensation fees, computer support fees, the state accounting system fees, departmental operational support costs, as well as clerical and administrative support costs.

EDUCATION/PUBLIC AWARENESS includes staff time, in-state travel expenses, fleet charges, mailings, supplies, printing and advertising costs, and radio and TV time to increase public awareness of AIS. 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 website.

MANAGEMENT includes staff time, in-state travel expenses, fleet charges, commercial applicator contracts, and supplies to survey the distribution of AIS in Minnesota and to prepare for, conduct, supervise, and evaluate management activities. Funds provided to local government units and organizations to offset the cost of Eurasian watermilfoil, flowering rush and/or curly-leaf pondweed management efforts also are included.

INSPECTIONS / ENFORCEMENT includes 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 invasive species prevention efforts.

RESEARCH includes staff time, travel expenses, fleet charges, supplies, and contracts with the University of Minnesota and other research organizations to conduct research. These include efforts to develop new or to improve existing management methods, better understand the ecology of invasive species, improve risk assessment tools, and evaluate program success.

STATE AND REGIONAL COORDINATION includes general program planning, preparation of state plans and reports, and general invasive species coordination with a wide variety of groups. This category also includes the work of program staff as well as various managers in the Ecological and Water Resources Division who periodically work on invasive species issues. Expenditures primarily represent staff time spent on these activities, as well as staff time and out-of-state travel expenses to work with regional and federal partners on AIS issues; work activities that staff participate in to improve their knowledge and skills, direct staff, or help on other projects; and fleet costs and the cost to purchase and repair boats, trailers, computers, and similar items.

Prevention

GOALS

- Prevent the introduction of new invasive species to the state.
- Prevent the spread of AIS within Minnesota.

HIGHLIGHTS

- Invasive species staff worked to prevent the introduction and spread of new AIS in Minnesota by working with partners locally, statewide, regionally, nationally and internationally. DNR invasive species prevention work includes outreach, enforcement, regulations, permitting, collaboration and coordination.

Prevention Activities

In 2023, invasive species program conducted the following activities to prevent the introduction and spread of AIS.

- Continued focus on trade and commerce pathways for invasive species introduction, hiring a position funded with a federal grant to build on our outreach to businesses and consumers regarding invasive species in trade and to collaborate with DNR Enforcement.
- Surveyed lakes for AIS and reviewed reports from lake users about potential AIS.
- Searched for zebra mussels and other AIS on water-related equipment on lakes and at public water accesses. Staff occasionally worked with a DNR Enforcement officer and zebra mussel K9 detection dog.
- Provided technical guidance on AIS prevention and management activities.
- Water Resources Enforcement Officers spoke with lake service providers to ensure AIS weren't moved when docks, boat lifts and other water-related equipment was removed from lakes.
- Increased public awareness of AIS via interviews with radio, newspaper and television outlets.
- Investigated pathways for spreading AIS such as equipment and watercraft, food markets, bait dealers and aquatic plant dealers.
- Staffed events with community partners to promote public awareness and preventative actions.

A native mussel with attached zebra mussels found in Big Lake, Minnesota.

Permits

The DNR has authority to issue permits to allow the public to conduct certain activities with invasive species or in listed infested waters that would otherwise be prohibited under state regulations.

The DNR provides information or training to permittees on how to reduce the risk of spreading AIS. Permit conditions require permittees to take actions to prevent the spread of AIS.

DNR permits related to AIS include:

- Lake service provider permits
- Infested waters permits
- Prohibited invasive species permits
- Bait harvest permits

LAKE SERVICE PROVIDER PERMITS

Legislation authorizing a permit program for lake service providers (LSPs) to help prevent the spread of AIS in the state took effect in 2012. A LSP includes anyone who is paid to decontaminate, rent/lease, install or remove water-related equipment in or from Minnesota waters. Common LSP businesses include marinas, dock and lift installers, resorts and outfitters, local parks departments and lawn irrigation companies.

Lake service provider business owners are required to complete AIS prevention training and receive a Lake Service Provider Permit before conducting work that involves decontaminating, installing, removing, or renting water-related equipment from or in state waters. Employees who work for a LSP must also successfully complete a free online training course and receive a training certificate. Permits and certificates are valid for three calendar years.

TOTAL STATEWIDE CERTIFICATIONS AND LSP PERMITS

2,720
Certified LSP employees

990
Permitted LSPs

Photo above:
Boater drains water from kayak before leaving the public access.

2023 ACTIVITIES

- The DNR completed permit training for 239 LSP business owners and managers, issuing 231 permits.
- 814 LSP employees completed online employee certificate training.
- 990 businesses were permitted LSPs at the end of 2023. The current list of businesses is on the DNR website.

Future Plans

Assess ways to improve the LSP course delivery, outreach and compliance.

INVASIVE SPECIES AND INFESTED WATERS PERMITS

People need a permit to divert or transport water from listed infested waters (Minnesota Rules, part 6216.0500). In 2023, the Invasive Species Program issued eight individual infested waters permits. Permits for water appropriation and work in public waters issued through the DNR Permitting and Reporting System (MPARS) also include invasive species conditions.

People need a permit to possess, transport, sell, purchase, or import prohibited invasive species. The Invasive Species Program issued 33 prohibited invasive species permits in 2023 for species other than red swamp crayfish. In 2023, 84 people were permitted to import and/or possess frozen dead red swamp crayfish for consumption.

Individuals can access several general permits on the DNR website, for example: to possess certain preserved specimens of prohibited invasive species for educational purposes; for fire departments using infested waters for training purposes; to transport water for water quality sampling; and to transport certain equipment away from a water body to a cleaning or storage location.

PERMITS TO HARVEST BAIT FROM INFESTED WATERS

In Minnesota, commercial bait harvesters need a permit to work in listed infested waters. DNR Fisheries issues permits to licensed minnow dealers who work in infested waters. Permittees must successfully complete AIS training and comply with permit conditions to prevent the spread of AIS from infested waters. For example, permitted commercial bait harvesters must attach tags to equipment used in infested waters and they may not use that gear in waters other than those identified by the tag.

In general, people cannot harvest bait for personal use from waters listed as infested with AIS.

REGULATIONS

Regulations, including laws and rules, are an important part of Minnesota's AIS prevention strategy that complement our education and outreach efforts. The Invasive Species Program works to review and refine state regulations to prevent the introduction and spread of invasive species and to clarify regulations for the public. That includes establishing new and revising existing regulations to address pathways of AIS spread, designating certain nonnative species as prohibited or regulated invasive species, and listing water bodies as infested with AIS within our existing authorities.

Minnesota state law governing AIS is primarily located in Minnesota Statutes, chapter 84D. Authorities and prohibitions related to AIS also can be found in chapter 86B, Water Safety and Watercraft; chapter 97C, Fishing; and chapter 103G, Waters of the State. The administrative rules related to AIS are primarily found in Minnesota Rules, chapter 6216.

Past annual reports of the program are also a good source of summaries of changes to statute and rule related to invasive species; many of these are available from the Minnesota Legislative Reference Library. The most recent reports are available on the DNR website.

In 2023, Minnesota Statutes, section 84D.10, subdivision 3(5) was changed to allow a conservation officer or other licensed peace officer to order decontamination of water-related equipment even if decontamination equipment is not available on site.

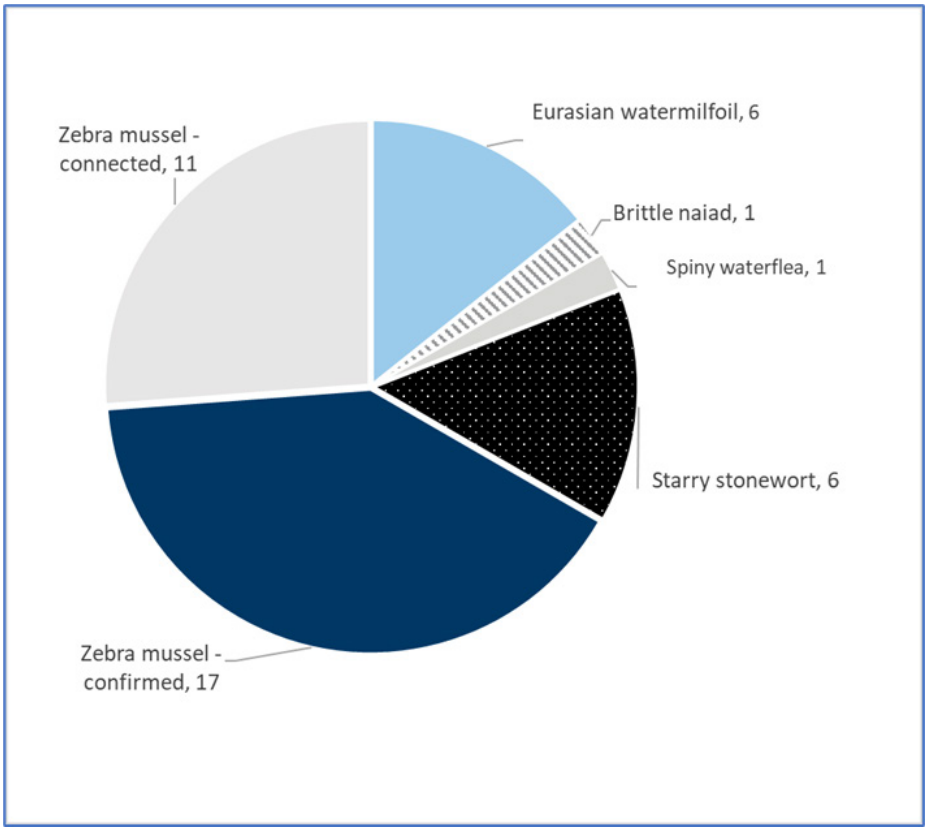
Minnesota Statutes, section 84D.02, subdivision 3, was changed to require the state management plan for invasive species to be revised every five years and to include the impacts of climate change on invasive species management in the plan.

The Invasive Species Program proposed rule changes that would add species to the prohibited invasive species list. The rule was proposed to strengthen our ability to prevent the introduction and spread of priority species like jumping worms and nonnative *Phragmites*, align invasive species classifications with regional priority species lists, and fill critical gaps created by a 2015 legal decision that reinterpreted federal injurious species authorities. The public comment period for the proposed rule closed on December 9, 2022. The DNR responded to public comments and continued to proceed with the rulemaking process in 2023.

Infested Waters

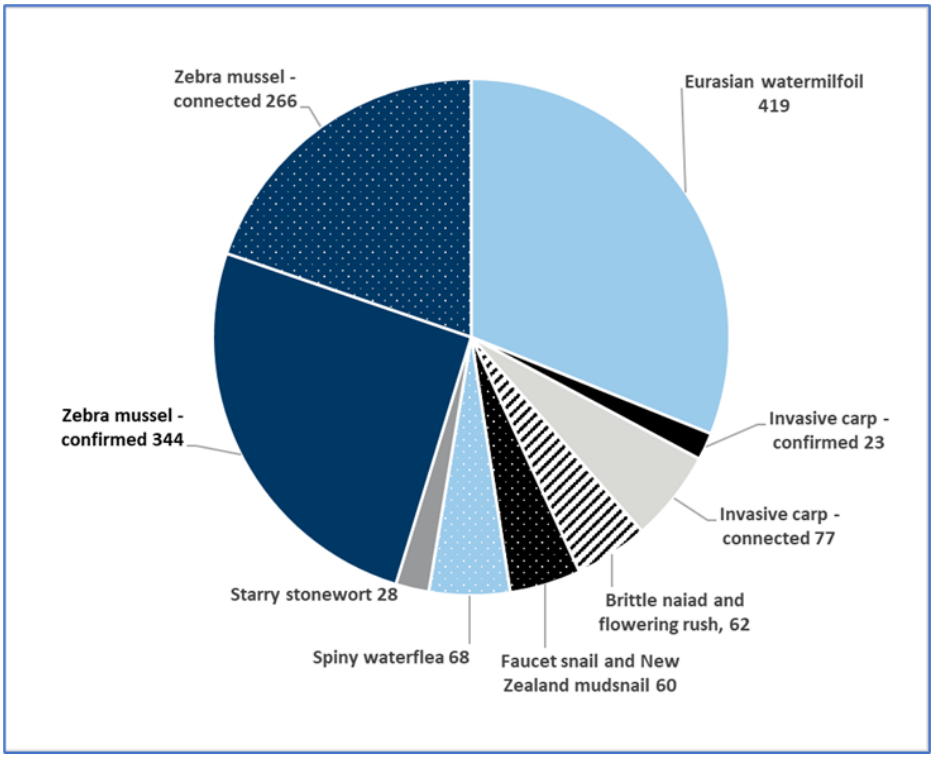
The DNR will add a lake, river, pond, or wetland to the infested waters list if it contains certain AIS that could spread to other waters. The DNR may also list a lake, river, pond, or wetland as infested if it is connected to a body of water where AIS are present. To reduce the risk of spreading AIS, activities like bait harvest, commercial fishing, and water use are managed differently in infested waters. In 2022, invasive species program staff updated guidance for moving water from infested waters so that permits require filtration or other measures to prevent the introduction and spread of AIS.

NEW WATER BODIES LISTED AS INFESTEDIN 2023



For more information on waters listed in 2023, see Appendix B.

TOTAL WATER BODIES LISTED AS INFESTED



Not included in the summary chart:

- One lake is listed as infested with red swamp crayfish, though red swamp crayfish have not been detected there since 2016.
- Lake Superior, the St. Louis River estuary, and other Superior tributaries are listed as infested with Viral Hemorrhagic Septicemia Virus (VHS), Eurasian ruffe, round goby and white perch.

INVASIVE SPECIES IN TRADE

Global trade drives invasive species introductions to Minnesota and the United States. There are trades built on the movement and possession of live plants and animals which have historically led to invasive species introductions. The DNR invasive species program received GLRI funding to support a new position focused on trade and commerce pathways for invasive species introduction. This position will build on the work of a previous three-year, federally funded project from June 2019 through June 2022.

Examples of priority areas of work to prevent the introduction and spread of invasive species in trade pathways includes:

- Continuing to build a database of sellers of live organisms
- Periodic invasive species education to sellers and further developing partnerships with sellers
- Development of additional educational materials and further educational outreach to hobbyists and buyers of live organisms
- Outreach and enforcement of illegal online sales of invasive species
- Enforcement of invasive species in trade regulations when needed
- Continuing coordination with other jurisdictions

PARTNERSHIPS

The Invasive Species Program partners with other people and organizations in Minnesota, regionally and nationally to help prevent the introduction and spread of AIS. For example, Invasive Species Program staff are part of the Minnesota Invasive Species Advisory Council (MISAC), and regularly collaborate with counties (as described in the chapter on Aquatic Invasive Species Prevention Aid), Minnesota Aquatic Invasive Species Research Center (MAISRC) and others.

Invasive Species Program staff represent the state on two regional panels of the federal Aquatic Nuisance Species Task Force: Great Lakes Panel on Aquatic Nuisance Species and the Mississippi River Basin Panel on Aquatic Nuisance Species. These panels provide an opportunity to share Minnesota's prevention priorities with other jurisdictions in those regions, and to hear about emerging AIS threats in locations further downstream to inform adaptive management actions in Minnesota.

The USFWS provides scientific expertise about the risk of AIS to Minnesota as well as critical funding for Minnesota's invasive species prevention and management work through GLRI grants and State Aquatic Nuisance Species Management Plan grants administered by the USFWS.

FUTURE NEEDS AND PLANS

Over the next year, the DNR will continue to:

- Work with partners and stakeholders to plan and implement prevention activities.
- Monitor the distribution of AIS in the state.
- Assess the risk of spreading AIS during different activities.
- Improve and refine the DNR AIS prevention program and supporting regulations.

While goldfish are a popular aquarium fish, they can be harmful to wildlife and the environment if released into Minnesota waters.

Education and Public Awareness

GOALS

- Help Minnesota residents and visitors understand their role in preventing the spread of AIS.
- Provide clear actions to prevent the introduction and spread of AIS, including both the Clean, Drain, Dispose steps required by Minnesota law and other specific behaviors identified by the DNR and partners.
- Heighten understanding of aquatic invasive species' potential negative impacts on natural resources that are central to Minnesota's ecology, economy, recreation, identity and overall quality of life.
- Increase awareness of the DNR's AIS research, management and prevention efforts.
- Inform stakeholders, residents and other agencies of available training, funding and educational resources.

HIGHLIGHTS

- Continued to promote the "Pledge to Protect Minnesota Waters" webpage, where participants can affirm that they will follow Minnesota's "Clean, Drain, Dispose" laws (https://www.dnr.state.mn.us/data/ais-pledge).
- Redesigned the "Purple Loosestrife: What You Should Know, What You Can Do" brochure to streamline information and promote biological control efforts.
- Worked with a developer to install a new interactive educational game in the DNR Building at the Minnesota State Fair. Up to four players can use four different hand-held tools to clean off invasive species and mud from a boat, ATV and boots.
- Promoted proper bait handling and disposal at bait shops that sell minnows through the "Engaging Bait Shops" pilot project with local partners.
- Developed a standardized interpretive sign to accompany free cleaning tools at public water accesses in collaboration with interested lake associations and local governments.
- The Enforcement Division worked with lake associations, user groups and the media to raise awareness about controlling the spread of invasive species and the importance of AIS regulations and compliance. This includes attending statewide public input meetings to maintain and increase dialogue with concerned stakeholders.
- The Enforcement Division K9 zebra mussel detection teams provided educational demonstrations at several public events, including the Minnesota State Fair.

Invasive Species Specialist Emelia Hauk-Jacobs instructs how to identify aquatic plants at the Aquatic Plant Identification training hosted by the Minnesota DNR, the University of Minnesota Extension and MAISRC.

Strategic Communications

DNR information officers continued the integration of news and media relations, web, social media, publications and graphic design, public access signs, advertising and public interactions.

Promoting Behavior Change

The Invasive Species Program, in consultation with behavior change experts, continued to utilize "community-based social marketing" (CBSM) methodologies to promote AIS prevention behaviors in Minnesota (https://www.dnr.state. mn.us/invasives/ais/prevention/behavior-change. html). CBSM is a social science approach to foster sustainable, environmentally beneficial behaviors, providing a step-by-step process for assessing risks and identifying opportunities for long-term change. People may be aware of an issue such as invasive species but may not adopt or consistently practice desired behaviors over the long-term. The Invasive Species Program wants to understand what people know, believe and currently do about AIS, in order to build community norms around effective prevention actions. These efforts focus on the previously identified five major pathways of AIS: watercraft, live bait, gear/equipment, aquarium trade and aquatic plant trade. The DNR piloted a few projects in 2023 with local partners.

The "Engaging Bait Shops" pilot project provided new behavior change-based materials (posters, stickers, fliers) for distribution at bait shops that sell minnows. Guidance and materials were free to local AIS program coordinators that agreed to distribute the materials and conduct evaluation. Six local programs participated in the pilot, reaching out to local bait shops to share outreach materials and assess staff AIS knowledge, attitudes and outreach needs. Participating bait shops encouraged customers to sign a poster demonstrating their pledge to never release bait and were given pledge stickers and information cards showing how they can prevent the spread of AIS. The pilot provided key initial feedback on the ease, effectiveness and benefits of the materials and approach. The DNR will continue to work with local partners to improve and expand this effort.

The DNR worked with interested lake associations and local governments to develop a standardized interpretive sign to accompany free cleaning tools at public water accesses. Local organizations can print the signs and install them with permission from access owners. This supports behavior change because it provides consistent messaging and tools in the right place and time – making it easier for boaters to take AIS prevention actions.

The DNR hired a consultant to observe how boaters interact with self-serve cleaning tools at public water accesses. The project team visited 12 different accesses across the state, completed 595 observations and found 12% of exiting boaters used the cleaning tools provided. They also interviewed a subset of boaters about their attitudes regaurding AIS prevention and preferences surrounding cleaning tool use. The results of this project will inform future decisions on self-serve tools that may be most effective and economic to install at public boat accesses by the DNR, local AIS program managers, and other water access administrators in Minnesota and beyond.

Informational Materials

The program continued to assess and revise informational materials for public distribution. Program staff worked with the DNR Creative Services Unit and other staff to create the following new materials:

- Red Lake AIS Prevention Swedish Dishcloth,
- "Purple Loosestrife: What you should know, what you can do" brochure,
- Interpretive signage with AIS prevention messages to accompany cleaning tools at water accesses.

Digital versions of most AIS materials can be found on online.
https://www.dnr.state.mn.us/invasives/ais/outreach.html

The Invasive Species Program provided invasive species content and advertising for the 2024 Minnesota Fishing Regulations handbook. The handbook, available in five languages, includes information about AIS laws and watercraft inspections, species identification information, advertising to remind anglers to help prevent the spread of AIS, and information about the infested waters list. More than 850,000 copies of the fishing regulations will be distributed beginning in March.

Events

The Invasive Species Program co-hosted an Aquatic Plant Identification Training with University of Minnesota Extension and MAISRC. Staff and researchers throughout the state collected, sorted and identified over 60 plant species to be used in the training. Attendees included seven consultants, 13 local government staff that conduct aquatic plant surveys and 24 volunteers interested in building identification skills.

Staff co-hosted booths with partners at several festivals and fairs to promote public awareness and actions to prevent the spread of invasive species. Hundreds of publications, license holders and temporary tattoos were distributed.

The Invasive Species display area within the DNR Building at the 2023 Minnesota State Fair featured a new interactive game called "Muck Hunt." It was designed for people to have fun while modeling invasive species prevention actions. Up to four players can use different hand-held tools to clean off a boat, ATV and boots on screen. Messaging focused on the steps people can take to prevent the spread of terrestrial and aquatic invasive species. Nineteen DNR staff and 14 volunteers worked the informational tables and distributed publications, license holders, boot brushes and temporary tattoos featuring six invasive species prevention designs.

Web/Digital

Anyone 18 or older can visit the Pledge to Protect Minnesota Waters website (mndnr.gov/ AISPledge) to take the pledge and upload a photo, if desired. The pledge affirms that participants will follow Minnesota's "Clean, Drain, Dispose" laws and encourages others to do so. Regardless of the activity—boating, paddling, fishing, moving shoreline equipment, using recreational gear on the water, or caring for aquarium pets or water gardens—everyone can pledge to do their part and take several simple actions to prevent the spread of AIS. The program will continue to explore promotion of this webpage through various methods, partnerships and events as well as opportunities to involve youth.

Media Relations

In 2023, the program continued to expand placement of more stories about innovations and new steps to reduce the spread of invasive species. DNR news releases about new AIS confirmations focused on the unique dynamics of each lake and river. News releases created greater awareness of proactive steps the program is taking, such as aggressive actions to prevent the spread of invasive carp, advances in research and technologies, and the broad range of partnerships with stakeholders across the state and nation. Additionally, the Enforcement Division conducted media interviews on the importance of AIS regulation compliance. Finally, the state's operations to remove and tag invasive carp from the Mississippi River in the fall of 2023 were a focal point for media and legislators, with the DNR coordinating communications with multiple agencies and providing video and photos for media use.

Public Engagement

Staff participated in conferences, workshops, trainings, water festivals and many other special events throughout the year to educate the public. Program staff also made presentations to lake associations and community groups to answer questions and discuss invasive species issues and activities.

A homepage graphic for the DNR landing webpage and a QR code were developed to promote the AIS Pledge.

mndnr.gov/AISPledge

PARTNERSHIPS

Statewide Aquatic Invasive Species Advisory Committee

This committee plays a vital role in reviewing and guiding the AIS prevention and management work of the Invasive Species Program. Members are appointed by the DNR Commissioner. They bring a range of personal and professional experience to the discussion on preventing the spread and managing impacts of invasive aquatic plants and animals in Minnesota. Their interest and engagement with other stakeholders informs the program regarding policy, watercraft inspection, outreach, research, operations and other stakeholder interests. Visit mndnr.gov/aisadvisory.

Minnesota Aquatic Invasive Species Research Center

MAISRC, at the University of Minnesota, is a valuable partner, working closely with the program on research and advances in AIS management and related information. MAISRC researchers join Invasive Species Program meetings to discuss the latest research. The DNR's Assistant Commissioner that oversees the Ecological and Water Resources Division is a member of the Center's Advisory Board (CAB). The section manager and the Invasive Species Unit supervisor have monthly coordination meetings with MAISRC's director and assistant director. Many Invasive Species Program staff attend an online version of the center's annual showcase. Visit maisrc.umn.edu.

FUTURE NEEDS AND PLANS

- Apply behavior change findings and related messaging to communications, planning and implementation.
- Deepen engagement with behavior change experts and trained partners and staff.
- Develop and use surveys, pilot testing and focus groups to better understand and measure effectiveness of communication efforts.
- Improve public education to emphasize proper bait disposal options.
- Continue to engage and train Invasive Species Program staff about plain language, behavior change, electronic information accessibility and other communication techniques.
- Building from our previous trade pathways efforts, support AIS in commerce efforts within the state and Great Lakes region.
- Continue to work collaboratively with MAISRC, local and tribal governments, non-profits and other stakeholders to pursue research and secure funding through the Great Lakes Restoration Initiative, U.S. Fish and Wildlife Service, foundations and other sources for additional invasive species public awareness efforts.

Enforcement

GOALS

- Provide advanced training to conservation officers and train local law enforcement to effectively enforce AIS laws.
- Analyze the DNR AIS laws and work with stakeholders on legislative issues to give law enforcement necessary tools to assist in AIS prevention.
- Continue to emphasize AIS as priority work and a core responsibility.
- Continue inspections by conservation officers to reduce the risk of spreading AIS by water-related equipment. Assist level 1 and level 2 watercraft inspectors at public access sites and investigate violations reported by inspectors.
- Continue to analyze data, develop protocols and secure equipment to administer AIS check stations safely and effectively.
- Train and educate commercial entities to increase compliance with invasive species regulations.

HIGHLIGHTS

- DNR conservation officers provided 13,121 hours of AIS enforcement and education.
- The Enforcement Division added two new zebra mussel detection canine (K9) officer teams to the program.
- The Enforcement Division's four zebra mussel detection K9 officers assisted conservation officers and AIS inspectors. The dogs improved the efficiency of conservation officers and inspectors, with faster and more thorough inspections of water-related equipment.
- Four conservation officers, designated as water resource enforcement officers (WREOs), are currently dedicated to prioritizing a significant portion of their work toward aquatic invasive species enforcement.

Conservation Officer Phil Mohs with the K9 zebra mussel detection dog Mack.

ENFORCEMENT CONTACTS (Citations/Warnings)

Numbers of enforcement contacts vary due to officer staffing levels, public compliance, length of open-water season, local law enforcement involvement and outreach efforts. Enforcement activity related to AIS violations during the 2023 season increased. It should be noted that Enforcement Division hours dedicated to AIS efforts also increased during the same period likely due in part to the introduction of two new AIS K9 teams and additional opportunities for focused invasive species enforcement activities.

NUMBER OF CITATIONS AND WARNINGS BY YEAR

	2023	2022	2021	2020	2019	2018	2017	2016	2015
Citations issued	57	58	39	61	98	95	127	123	244
Warnings	321	310	266	365	485	476	557	671	911

AQUATIC INVASIVE SPECIES CHECK STATIONS (SPRING TO FALL 2023)

To date in 2023, DNR Conservation Officers have completed 12 roadside check stations around the state to inspect watercraft and watercraft equipment transported in Minnesota. Conservation Officers also dedicated time to numerous AIS assignments around busy holidays and fishing openers.

Statewide Open Water Season Enforcement Results

Review of past data from DNR Enforcement check stations shows the compliance with invasive species regulations has generally risen every year since the first year of check stations back in 2012.

Conservation Officer Adam Seifermann and K-9 Jet. One of our 2 new K9 teams!

PARTNERSHIPS

Enforcement of Minnesota's invasive species regulations is essential to preventing invasive species' spread into and across Minnesota. Conservation Officers continue to work with local law enforcement, lake associations, local government units, user groups and other DNR divisions to assist in controlling the spread of invasive species.

FUTURE NEEDS AND PLANS

The Enforcement Division continues to focus its efforts on enforcement and education, both critical tactics in preventing the introduction and spread of invasive species.

The Enforcement Division 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 initiatives to provide law enforcement with the tools necessary to prevent the spread of AIS.

The Enforcement Division will continue to emphasize invasive species enforcement as priority work and a core responsibility.

Watercraft Inspections

GOALS

- Conduct watercraft inspections at public water accesses throughout Minnesota and require watercraft users to decontaminate their watercraft if AIS or water are found.
- Increase public awareness about AIS and reduce the potential for boaters to transport species to other water bodies.
- Increase education efforts with stakeholder and user groups.
- Distribute information at events throughout the state.
- Employ level 1 and level 2 watercraft inspectors.
- Provide training and support to local government inspection programs.

HIGHLIGHTS

- Watercraft inspection training materials were completely overhauled for the 2023 season which included new online and in-person modules, as well as new manuals. This hybrid learning system trained 878 level 1 inspectors, with 213 of those staff also completing level 2 training.
- DNR trainers trained 301 inspectors in 27 in-person trainings before the fishing opener. An additional 68 inspectors attended in-person training before Memorial Day.
- Hired 68 DNR watercraft inspectors for the 2023 season.
- Completed 469,038 incoming and outgoing watercraft inspections with DNR and local government watercraft inspectors. This number reflects a 7% increase in total inspections when compared with 2022.
- Over 270,000 incoming watercraft were in compliance with state laws. 98% of incoming watercraft were found free of plants, invasive animals, mud or water.
- 97% of incoming watercraft arrived in compliance with state drain plug laws.
- 96% of incoming watercraft were in compliance with all AIS transport laws.
- Watercraft inspection staff participated in the Great Lakes Panel AIS landing blitz, an event that coordinates watercraft inspection efforts across Great Lakes jurisdictions during the same week.
- Region 2 staff decontaminated and removed a number of zebra mussels from a large houseboat before being transported to another water body.
- A new “on-demand” decontamination station was installed at Upper Red Lake.
- Participated in 12 AIS check stations in partnership with the Division of Enforcement, including K9 teams with specially trained zebra mussel detecting dogs that are able to detect zebra mussels on boats and other equipment that otherwise may have gone undetected.

Level 2 Inspector Matt Dwelly conducts an engine decontamination on a pontoon boat's outboard motor in 2022.

Transportation of Invasive Species

Boaters in Minnesota must remove drain plugs from watercraft and livewells to reduce the risk of transporting AIS like spiny waterflea or zebra mussel larvae, as required by the state's "drain plug law." People in Minnesota also may not transport aquatic plants under most circumstances. This helps prevent the spread of invasive plants as well as other AIS that can be attached to plants, like zebra mussels.

In 2023, watercraft inspectors observed that a majority of people arriving at accesses were in compliance with state AIS prevention laws. Ninety-seven percent of people arriving at accesses had removed drain plugs from their watercraft.

Ninety-eight percent of people arrived at accesses with watercraft and trailers that were free of aquatic plants.

- In 2023, watercraft inspectors found zebra mussels on 225 incoming watercraft (2022 had 174 occurrences). Eight were at water bodies not known to be infested with zebra mussels.

DNR-authorized watercraft inspectors took the following actions to follow-up with the few individuals who were in violation of state laws:

- Instructed owners not to launch until watercraft passes inspection.
- Forwarded zebra mussel violations to DNR Enforcement for follow-up.
- required decontamination prior to launching for any watercraft with vegetation or attached zebra mussels attempting to enter a water body. Decontamination methods include hand removal, draining or a high-pressure, hot water treatment.

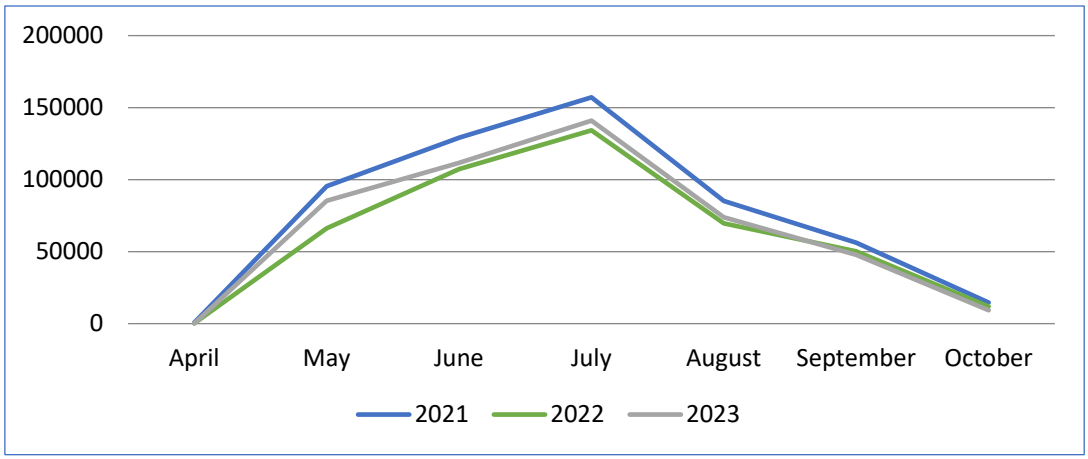
Decontamination Units

The Watercraft Inspection Program hires level 2 watercraft inspectors to decontaminate watercraft with high-pressure, hot-water wash units. DNR staff used 26 portable wash units around the state to perform 2,234 decontaminations. Local inspection programs operated an estimated 34 decontamination units in addition to DNR operated units. Level 2 watercraft inspectors employed by local programs decontaminated an additional 2,836 watercraft. DNR decontamination units were located at high-use watercraft accesses on zebra mussel-infested water bodies.

DNR Volunteer Training

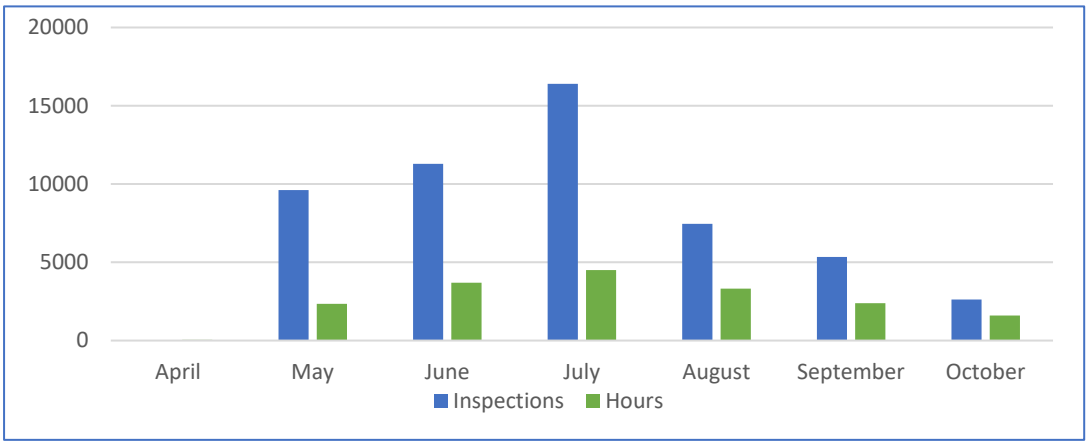
The Watercraft Inspection Program conducts AIS volunteer training sessions to teach people how to educate watercraft users at waters where they live or recreate. In 2023, volunteers were given the opportunity to take a self-guided online training for volunteers at public water accesses. Typically, volunteers receive classroom training every three years, with an online refresher course each year between classroom training. In 2023, 44 people signed up for the online training. Volunteers must pass a yearly background check.

DNR AND LGU INSPECTIONS PER MONTH 2021 – 2023



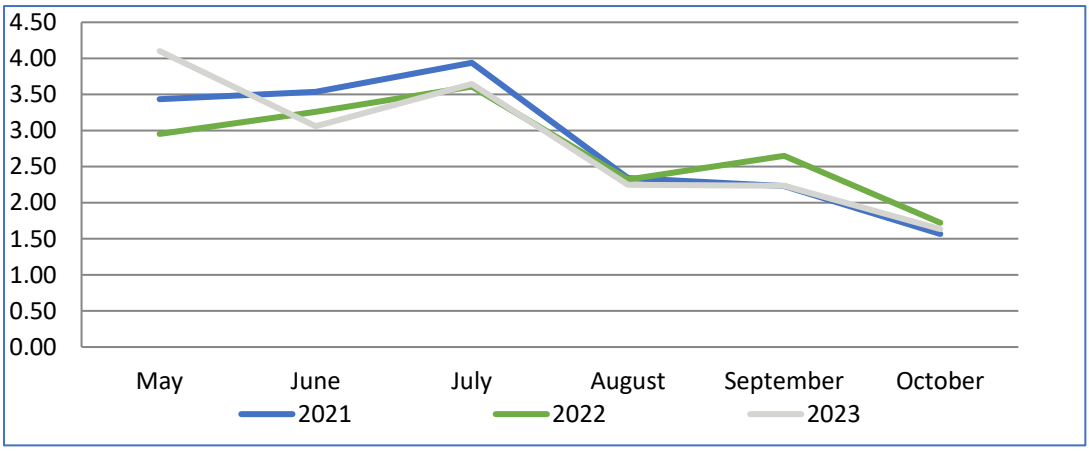
Authorized watercraft inspections start in early April, peak in July, and decline in October when most inspection programs end and boat activity reduces.

DNR INSPECTIONS AND HOURS PER MONTH: 2023



Inspections are performed statewide from April through October. The number of inspections peak in July, while staff presence remains fairly consistent.

DNR INSPECTIONS PER HOUR, BY MONTH



DNR inspections per hour have followed a consistent pattern each year since 2021.

NUMBER OF DNR WATERCRAFT INSPECTIONS

	2023	2022	2021	2020	2019	2018	2017	2016
Inspections	52,744	47,682	66,574	56,813	70,762	66,833	84,824	102,445
Inspection Hours	17,891	16,876	22,755	19,509	25,451	21,826	29,400	38,000
Inspections per Hour	2.65	2.83	2.93	2.91	2.78	3.06	2.88	2.7

NUMBER OF DNR WATERCRAFT INSPECTIONS BY REGION

DNR Region	2023	2022	2021	2020	2019	2018	2017	2016
Northwest - 1	14,006	11,947	18,102	18,121	19,437	13,539	17,857	23,575
Northeast - 2	5,951	6,625	7,560	7,093	8,152	7,266	11,413	13,770
Central - 3	30,214	26,167	35,874	27,797	40,623	43,653	51,513	62,150
Southern - 4	2,573	2,943	5,038	3,778	2,550	2,375	4,041	2,950
Total Inspections	52,744	47,682	66,574	56,813	70,762	66,833	84,824	102,445

PARTNERSHIPS

Local and Tribal Governments

Local and tribal governments can partner with the DNR through a delegation agreement. This agreement allows governments to hire authorized watercraft inspectors to support local watercraft inspection programs. There were 66 active delegation agreements during the 2023 season. These programs hired an additional 810 watercraft inspectors. This compares with 65 active delegation agreements and 797 watercraft inspectors in 2022.

The local and tribal government employees follow the DNR's watercraft inspection process using DNR survey questions. The findings are reported to the Watercraft Inspection Program through a statewide watercraft inspection mobile application.

A watercraft inspector shows a boater how to inspect her trailer for invasive species

FUTURE NEEDS AND PLANS

In 2024, the Watercraft Inspection Program will continue to improve online and in-person training requirements to ensure programs have trained staff that are ready to start at their desired timeframes. The program has purchased two ski-boats for use at inspection trainings to provide more hands-on training opportunities for new inspectors. Training materials for the AIS volunteer program are currently being updated to include new information from watercraft inspection manuals.

The program will review 2023 data to refine the DNR's watercraft inspection survey process and adjust the hours and days spent at watercraft accesses to try to increase our inspections per hour. The program will train local units of government staff to conduct AIS education at local watercraft accesses, and work to expand the number of partnerships with tribal and local governments to increase total watercraft inspection capacity throughout the state.

Aquatic Invasive Species Prevention Aid

The Minnesota Legislature provides $10 million directly to Minnesota counties to help prevent the spread of aquatic invasive species: AIS Prevention Aid. The funds are allocated based on each county's share of watercraft trailer launches (50%) and watercraft trailer parking spaces (50%).

Each county board and/or designated local government decides how to use the funds. Each county submits a copy of its guidelines for use of the funding to the DNR by December 31 of each year. The Invasive Species Program has two full-time staff dedicated to working with these local programs.

GOALS

- Annually review and document county AIS plans and resolutions.
- Provide opportunities for local government staff to share and learn from one another's collective experiences.
- Provide opportunities for local government staff to maintain strong relationships with stakeholders such as other local governments, tribal governments, state and federal agencies, nonprofits, businesses, lake associations, outdoor recreation groups, etc.
- Provide technical support and training to local governments and their partners as they develop, implement and evaluate their local programs.
- Provide opportunities for local government staff to infuse their AIS prevention programs with behavior change strategies.

HIGHLIGHTS

- Facilitated a series of five, two-hour online workshops and one in-person workshop in February and March designed to help local AIS program managers and their partners to be more successful in their AIS prevention work through peer-to-peer sharing and collaboration.
- Worked with counties to revise and put into practice a metrics template designed to build reporting consistency and capture data and stories about local AIS prevention programs. This information helps demonstrate the statewide investment and impact of the AIS Prevention Aid.

AIS Prevention Planner Doug Jensen gives a presentation at the 2022 Upper Midwest Invasive Species Conference in Green Bay Wisconsin.

Technical support

Provided technical support to local governments and their partners as they develop, implement and evaluate their AIS prevention strategies. For example:

- Provided feedback on guidelines, which includes plans and resolutions, to the 83 Minnesota counties that qualify to receive funds.
- Provided information on DNR AIS programs (e.g., public engagement, watercraft inspection, trade pathways, invasive aquatic plant management and behavior change). This included updating key resources and promoting available support from the DNR on the AIS Prevention Aid webpage (AIS prevention).
- Provided technical support and a connection to the DNR at county AIS task forces and advisory committees.
- Developed guidance documents and online resources, hosted workshops and provided presentations as ways to relay information to counties and their stakeholders.
- Provided feedback on communication materials developed by local AIS program managers to promote consistent messages about AIS and prevention steps (e.g., Clean, Drain, Dispose).
- Completed the annual update of the metrics template, which provides a voluntary way for local AIS program managers and their partners to track accomplishments and demonstrate how AIS Prevention Aid is making a difference in their communities.
- Sixty-three counties submitted a template summarizing their work in 2022. We learned that in 2022, 746 paying jobs were supported with AIS Prevention Aid and $1,269,578 in additional funds were leveraged from 159 organizations to support AIS prevention activities. Forty-five counties surveyed 641 lakes and rivers for AIS. Twenty-seven counties funded invasive aquatic plant management on 187 lakes in partnership with 133 lake groups.

Engaged local governments and partners

- Maintained a network and community of support by continuously updating a primary contact list of county AIS program managers online and encouraged them to use the list to collaborate with one another. DNR planners used the list to disseminate timely and relevant information about AIS Prevention Aid funding and requirements, including new resources, innovative activities, learning/collaboration opportunities and DNR program updates.
- Hosted annual workshops for local AIS program managers and stakeholders to share their AIS prevention experiences, discuss successes and challenges, support collaborative efforts, broaden their knowledge on AIS issues and build stronger inter-county relationships.
- In February and March 2023, the DNR hosted a series of five, two-hour online meetings each on a specific topic of interest that included a few short presentations primarily from local programs and a facilitated discussion: (1) AIS Activities at Water Accesses, (2) Public Engagement, (3) Strategic Planning and Evaluation, (4) Monitoring, Detection and Response and (5) Northern Collaboration. The online workshops each attracted over 60 attendees. In addition, a Southern Collaboration workshop was held in person with 17 attendees. Attendees included staff and stakeholders involved in developing and implementing local AIS programs. This included, but was not limited to, local and tribal government staff overseeing an AIS Prevention Aid or local AIS programs, watercraft inspection staff, local AIS task forces/committee members, state and federal agency staff, regional and statewide partners, non-government organizations, academia and businesses.
- Provided information about the AIS Prevention Aid program and general AIS education to groups such as AIS task forces, lake associations, college courses and youth events.

PARTNERSHIPS

Creating new and deepening existing partnerships at all scales with a diversity of stakeholders is the heart of the AIS Prevention Aid program.

The DNR connected local AIS program managers interested in conducting new AIS projects with AIS experts and other local organizations that have experience implementing similar projects. Often these connections evolved into multi-county collaborative initiatives.

FUTURE NEEDS AND PLANS

AIS Prevention Aid funded programs are diverse, at different stages of development and implementation, and cover a spectrum of AIS activities. As the needs of the programs change, the technical support provided by the DNR will continue to be updated.

- Work to improve online resources, like the DNR's Local Aquatic Invasive Species Prevention Aid webpage, to provide a "one-stop shop" of resources local governments and their partners can use to develop and implement their programs.
- Continue to support development of programs that prevent release through the pet and live bait trades.
- Support implementation of local projects that employ behavior change strategies.
- Continue to support communication and collaboration among local program managers about AIS prevention strategies. For example, continue to host workshops and learning sessions.
- Continue to support local program managers in their efforts to track metrics and performance measures. For example, continue to refine the metrics template to help meet their needs and compile results to showcase statewide achievements.
- Continue to provide technical support, tools, and resources to help tribal and local governments achieve their goals and run successful AIS prevention programs.

AIS Prevention Planner Tina Fitzgerald working at the Invasive Species Booth in the DNR building at the 2022 Minnesota State Fair.

Invasive Aquatic Plant Management

GOALS

- Reduce the impacts of invasive aquatic plants on Minnesota's ecology, society and economy.
- Prevent the spread of invasive aquatic plants within Minnesota.
- Provide technical and financial assistance to individuals and organizations working to manage invasive aquatic plants.
- Issue permits for the management of invasive aquatic plants.
- Support research that leads to improved aquatic invasive plant management techniques.

HIGHLIGHTS

- The DNR continued to work with cooperators to implement a coordinated response to nonnative *Phragmites* (*Phragmites australis* subsp. *australis*) in Minnesota. In 2023, DNR contractors visited 420 nonnative *Phragmites* sites in 38 counties. At 95 of the sites no nonnative *Phragmites* was found at the site, largely due to previous years' effective treatment. Most of the treated sites were very small. Of the 292 sites where treatment occurred, 210 of them were less than one tenth of an acre.
- The DNR made $400,000 in grants available for the management of Eurasian watermilfoil, curly-leaf pondweed, flowering rush and starry stonewort. Grants were selected by lottery of all applicants with a higher priority assigned to waterbodies that did not receive funding in 2022, and waterbodies with new infestations of starry stonewort. One hundred and two grants were awarded to local organizations for both pre-treatment delineation surveys and management of those invasive species.

Eurasian watermilfoil.

Management

Invasive aquatic plant management is an attempt to reduce the abundance or distribution of an invasive plant in a waterbody or wetland. Sometimes this work is done to help prevent the spread of that species to other waterbodies. The DNR's invasive plant management program supports efforts to minimize the harmful effects caused by invasive plants while also protecting natural resources and their use in the state. The program uses adaptive management to continually improve our efforts to reach these goals.

Plant management is complex, and reductions in invasive plants often require long term and resource-intensive efforts. Management that involves either mechanical removal of plants or application of herbicides to public waters requires a permit from the DNR. Permits may be issued to property owners, lake organizations and local governments. Permit applications are accepted through the Minnesota DNR Permitting and Reporting System (MPARS). DNR Aquatic Invasive Species Specialists worked with permit applicants and contractors to provide permits for work, advice on best management practices for treatments and assistance in monitoring the results of management projects.

Eurasian watermilfoil, curly-leaf pondweed and flowering rush

The three most commonly managed aquatic invasive plant species have been in the state for many decades. Curly-leaf pondweed (*Potamogeton crispus*) was first noted in Minnesota in 1910, flowering rush (*Butomus umbellatus)* in 1968, and Eurasian watermilfoil *(Myriophyllum spicatum)* in 1987.

The DNR supports the management of these species through the issuance of permits for their management, grants to help cover the costs of management and support for research into new management methods. In 2023 the DNR issued a total of 402 Invasive Aquatic Plant Management Permits, 346 of which were for those species.

Management Grants

The Invasive Species Program has provided grants for the management of Eurasian watermilfoil, curly-leaf pondweed, and/or flowering rush since 2006. In recent years, the DNR has awarded approximately $400,000 per year in grants for the management of those species and has included starry stonewort management in the list of allowable projects. In 2023 the DNR made $400,000 in grants available for the management of Eurasian watermilfoil, curly leaf pondweed, flowering rush and starry stonewort. Grants were selected by lottery of all applicants with higher priority assigned to waterbodies that did not receive funding in 2022, and waterbodies with new infestations of starry stonewort. The DNR provided 102 grants to local partners such as lake associations, watershed districts and lake improvement districts.

Starry Stonewort

Starry stonewort (*Nitellopsis obtusa*) was detected in Minnesota in 2015 and has been confirmed in 22 waterbodies in the state. AIS management is most effective early, when spread is limited, so efforts to manage starry stonewort are especially valuable at this time.

Since the initial discovery, treatment methods have included chemical treatment with herbicides or algaecides, Diver Assisted Suction Harvesting (DASH), suction dredging, and hand pulling followed by chemical treatment. Combination treatments, using harvesting by SCUBA divers followed by chemical treatments have been found to be successful in small areas.

Curly-leaf pondweed

INVASIVE AQUATIC PLAN T MANAGEMENT PERMITS ISSUED BY REGION IN 2023

Species	Northwest	Northeast	Central	Southern	Total
Curly-leaf pondweed	18	10	126	34	188
Eurasian watermilfoil	11	18	87	15	131
Curly-leaf pondweed and Eurasian watermilfoil			4		4
Eurasian watermilfoil and starry stonewort	2				2
Eurasian watermilfoil and flowering rush		1			1
Flowering rush	9		10		19
Brittle naiad			1		1
Java water dropwort				1	1
Nonnative *Phragmites*	2	1	16	3	22
Purple loosestrife	1	1	2		4
Starry stonewort	13		10	1	24
Yellow iris			3		3
Flowering rush and nonnative *Phragmites*			2		2
Total	56	31	261	54	402

Invasive Species Specialist Keegan Lund demonstrates how to collect purple loosestrife biocontrol beetles.

Nonnative *Phragmites*

The overall statewide response to nonnative *Phragmites* is coordinated by University of Minnesota researcher Julia Bohnen, whose efforts are funded in part by the DNR Invasive Species Program through a Great Lakes Restoration Initiative (GLRI) grant. Cooperators on this project include the other University of Minnesota researchers, the Minnesota Department of Agriculture, counties, private landowners, the Minnesota Department of Transportation, the U.S. Fish and Wildlife Service, Soil and Water Conservation Districts, professional herbicide applicators and other stakeholder groups.

Using GLRI funding, the DNR continued to fund nonnative *Phragmites* management throughout the state. Management efforts focused on "clearing counties" by targeting management in areas of the state with a limited number of small infestations. In 2023, DNR contractors visited 420 nonnative *Phragmites* sites in 38 counties. Of the 292 sites where treatment occurred, 210 of them were less than one tenth of an acre (0.1 acre). At 95 sites no nonnative *Phragmites* was found.

In addition, the DNR provided GLRI funding to four metro counties (Chisago, Anoka, Carver, and Washington) to manage their populations. The DNR also administered a grant from the U.S. EPA to support Community Action Duluth's nonnative *Phragmites* response effort in the Duluth area.

To track the spread of nonnative *Phragmites* and to evaluate treatment effectiveness, the DNR hired two Conservation Corps Minnesota-Iowa (CCMI) summer workers to monitor treated sites and to locate new populations of nonnative *Phragmites*. University of Minnesota researcher Julia Bohnen designed the monitoring protocol they used and supervised their work, confirming the identity of every nonnative *Phragmites* site they visited. They monitored 795 sites throughout the state, using the online invasive species reporting tool EDDMapS to record their findings.

Purple loosestrife

The DNR began work on the biological control of purple loosestrife in 1992, and it has been a success. After years of rigorous testing, the DNR, in cooperation with partners all over the state, reared and released more than eight million leaf-eating beetles on more than 700 purple loosestrife infestations statewide. Once the leaf-eating beetles successfully limited the abundance of a purple-loosestrife infestation, the beetles dispersed to other sites with higher abundance of the plant. Statewide, purple loosestrife beetle populations also declined. Over time, purple loosestrife reemerged from seed in areas where it had been controlled in the past. In 2023, the DNR conducted two workshops on biological control of purple loosestrife, where participants learned about the plant and biocontrol beetles. Participants were able to collect biocontrol insects so that they could be relocated to other areas where they were needed.

Purple loosestrife biocontrol beetle on a purple loosestrife plant.

PARTNERSHIPS

The management of nonnative *Phragmites* (*Phragmites australis* subsp. *australis*) in Minnesota has been an area of ongoing research by MAISRC at the University of Minnesota. Both the native subspecies of *Phragmites* (*Phragmites australis* subsp. *americanus*) and the nonnative subspecies occur in Minnesota. The DNR began work with the center in 2015 to identify gaps in knowledge about the extent, distribution and genetic diversity of *Phragmites* in the state, and to strategize the best method to limit its spread. The DNR Invasive Species Program continues to work closely with University of Minnesota researchers on the statewide nonnative *Phragmites* response effort.

The University of Minnesota continued its project to provide technical and extension support for the transition away from nonnative *Phragmites* at wastewater treatment facilities (WWTFs). This project involves the development of best practices for complete, cost-effective treatment and containment of established populations of invasive *Phragmites* at WWTFs. They are also working to identify candidate native plant species and develop improved approaches for cultivating and establishing new plant materials. Several promising species have been identified, including river bulrush and native *Phragmites*. The DNR has assisted with this project by arranging for the management of nonnative *Phragmites* in reed beds so that native species can be tested in the future. This project is funded by the DNR through funding obtained from the GLRI Aquatic Invasive Species Interjurisdictional Grants to Great Lakes States and Tribes.

The DNR, in partnership with the University of Minnesota Extension and MAISRC, put on the popular Aquatic Plant Identification Workshop. This workshop supports the management of invasive aquatic plants by training professional aquatic plant surveyors and citizen scientists in the identification of native and invasive aquatic plants found in Minnesota.

The DNR partnered with MAISRC, the University of Minnesota Extension and many counties and local partners on an annual statewide search for new populations of starry stonewort and other invasive species, called “Starry Trek”. In 2023, 187 volunteers searched 215 Minnesota waterbodies. No new starry stonewort infestations were found during the 2023 Starry Trek.

FUTURE NEEDS AND PLANS

- Continue to work with stakeholders to refine the issuance of permits and grants for the management of invasive aquatic plants.
- Work with partners to manage invasive aquatic plants.
- Monitor the distribution of invasive aquatic plants in the state, with emphasis on verification of reports of new occurrences.
- Assess risks posed to Minnesota by various nonnative aquatic plants.
- Continue to work with researchers to improve our understanding of the ecology and management of invasive aquatic plants, including nonnative *Phragmites*, the macroalgae starry stonewort, and hybrids of Eurasian watermilfoil.
- Review and revise best management practices for herbicide treatment of aquatic invasive plants, in light of results from ongoing research and pilot projects.

Invasive Aquatic Animals – Invertebrates

GOALS

- Prevent introduction and spread of AIS invertebrates, such as zebra mussels, spiny water fleas and faucet snails, and reduce their impacts to Minnesota's aquatic environments, society and economy.
- Detect, verify and respond to new infestations early by leveraging the expertise and contacts of DNR's regional AIS specialists, verifying EDDMapS and other AIS records, and conducting focal field studies of newly-infested sites.
- Coordinate with partners to support, assist and/or conduct research on AIS invertebrate biology, ecology, life history, impacts, and management measures to help manage AIS invertebrate infestations.

HIGHLIGHTS

- DNR invertebrate biologists continued to work with the DNR's Large Lakes and Sentinel Lakes programs to monitor zebra mussel veliger and spiny water flea populations.
- DNR divers continued to contribute days underwater for long-term monitoring of settled zebra mussel populations in Mille Lacs Lake. Observed densities continue to decline gradually and were the lowest since 2011.
- The DNR confirmed the first records of rusty crayfish in Mille Lacs Lake and Tenmile Lake (Sentinel Lakes program).
- Dewatering projects for Region 2 mine pits (with and without zebra mussels) are under development and being monitored by AIS staff to prevent the spread of zebra mussel veligers and other AIS.
- Research published by DNR scientists showed that co-invasion of Mille Lacs Lake by zebra mussels and spiny water fleas had unexpected long-term effects on pelagic (water-column) primary productivity. https://www.nature.com/articles/s42003-022-04355-z
- DNR staff confirmed the first record of nonnative signal crayfish (*Pacifastacus leniusculus*) in Minnesota waters and initiated AIS response planning and actions. https://www.dnr.state.mn.us/invasives/aquaticanimals/signal-crayfish.html

Defensive display by a nonnative seven-inch-long female signal crayfish, Winona Lake, Douglas County.

Research and AIS monitoring

EWR staff continued to coordinate with the Fish and Wildlife Division to monitor zebra mussel veliger and spiny water flea populations in 9 of Minnesota's largest lakes; 4 with zebra mussels (Cass, Leech, Red, Winnibigoshish), 2 with spiny water fleas (Kabetogama, Vermilion), and 3 with both zebra mussels and spiny water fleas (Lake of the Woods, Mille Lacs, Rainy).

Long-term monitoring of settled zebra mussel populations in Mille Lacs Lake continued in 2023, with AIS program and Lake Ecology Unit divers contributing days underwater. The overall density of zebra mussels observed in 2023, 326 per square foot, was the lowest observed since 2011, and the population continues to show declining abundance since its peak of 1,269 per square feet in 2012.

A study published on the co-invasion of Mille Lacs Lake by zebra mussels and spiny water fleas authored by DNR Fisheries Research Scientist, Heidi Rantala, and colleagues from the DNR and UMN Duluth, showed that there was an unexpected long-term net-zero effect on water clarity, as spiny water flea predation of algae-grazing zooplankton compensated for removal of algae in the water column by filtering zebra mussels (https://doi.org/10.1038/s42003-022-04355-z).

AIS program staff observed native crayfish in Mille Lacs prying open and predating adult zebra mussels.

EWR staff continued to coordinate with the Fish and Wildlife Division to monitor zebra mussel veliger populations in two of the Sentinel lakes; Lake Carlos where zebra mussel populations are abundant and were discovered in 2009, and Tenmile Lake where adult zebra mussels have not been found, but veligers were documented in plankton samples in 2019 and 2022.

Examination of hundreds of native mussels in August 2023 from 15 sites on Tenmile Lake by DNR's Center for Aquatic Mollusk Programs (CAMP) found no evidence of zebra mussel colonization on native mussel shells. Zebra mussels often attach to native mussel shells.

DNR invertebrate biologists and AIS specialists continued to verify AIS reports submitted to EDDMapS.

DNR staff continued to educate the public about AIS invertebrates by responding to inquiries to the DNR Info Center, by giving presentations and by attending outreach events such as "Detector Connector" organized by MAISRC.

Work began in 2022 to address concerns over rising water levels in the Canisteo Mine Pit, an abandoned iron ore mine. Just weeks before pumping began, zebra mussels were discovered in the pit. A seasonal pumping plan was quickly approved that provided relief from the rising water, but only during winter months. A permanent dewatering project is currently underway that will eliminate pumps and seasonal constraints. Until that project is operational, seasonal pumping will be used to lower water levels. AIS staff are responsible for late-season veliger monitoring in the pit. The absence of veligers, not water temperature, is the condition that allows dewatering to begin. Live veligers were documented well into November in 2022.

In September 2023, the DNR confirmed the presence of nonnative signal crayfish in Lake Winona, near Alexandria in Douglas County. This was the first confirmation of signal crayfish in Minnesota waters. At this time, netting by the commercial harvester that discovered the crayfish and follow-up trapping by the DNR have shown no evidence of signal crayfish reproduction: no eggs or juveniles have been found. An AIS response plan for signal crayfish was developed and initiated.

AIS staff monitor zebra mussel veligers during winter dewatering of Canisteo (top) and Hill Annex (bottom) mine pits, Itasca County.

Inset photo: *a cone-shaped plankton net is pulled up through the cold ultra-clear waters of Hill Annex mine pit.*

Volunteer Zebra Mussel Monitoring Program

Since 2015, volunteers participating in DNR's Volunteer Zebra Mussel Monitoring Program have been documenting zebra mussels in lakes and rivers by submitting an online form: https://www.dnr.state.mn.us/volunteering/zebramussel_monitoring/report.html

The volunteers regularly look at docks, lifts, boats, recreational equipment, shorelines and other objects for the presence of zebra mussels and report their findings. The reporting form was updated in 2023 to modernize the data collection from this program. These data will complement zebra mussel reports submitted to EDDMapS.

PARTNERSHIPS

Minnesota Aquatic Invasive Species Research Center (MAISRC) — University of Minnesota

DNR biologists continued to provide technical assistance, expertise and input on AIS invertebrate project proposals ranging from zebra mussels to freshwater golden clams (*Corbicula fluminea*) and rusty crayfish, as well as the evaluation of new AIS for potential inclusion in the MAISRC priority species list.

National Park Service — Voyageurs National Park

DNR staff provided technical assistance and information to NPS staff to develop an enhanced sampling program for zebra mussels in Rainy and other lakes. DNR staff will screen for post-veliger zebra mussel stages in samples collected from settling plates in Voyageurs National Park lakes.

FUTURE NEEDS AND PLANS

- Examine potential uses of pesticides, intensive harvesting, and game fish management to manage AIS invertebrates as opportunities arise.
- Work with partners to monitor the post-treatment efficacy and non-target impacts of previous AIS management projects.
- Update information on the status, spread and management of AIS invertebrates from all classification categories. Use results to plan and prioritize focal studies of AIS invertebrates.
- Continue to investigate AIS invertebrate biology, ecology, life history, impacts and potential management measures.

DNR's team from Center for Aquatic Mollusk Programs (CAMP) identifies native mussel species and searches for attached zebra mussels during an intensive survey of Tenmile Lake, Cass County.

Invasive Aquatic Animals - Invasive Carp

GOALS

- Prevent or limit the range expansion and proliferation of the following invasive carp: bighead carp (*Hypophthalmichthys nobilis*), black carp (*Mylopharyngodon piceus*), grass carp (*Ctenopharyngodon idella*) and silver carp (*Hypophthalmichthys molitrix*).
- Monitor Minnesota waters for changes in population sizes, range expansion and reproduction, and respond to changes.
- Encourage and support research on management strategies.

HIGHLIGHTS

- The DNR invasive fish coordinator continues to participate in regional efforts to prevent the expansion of invasive carp populations.
- DNR staff tagged 17 invasive carp which will be used to better target invasive carp for removal. Tracking those carp led to the discovery and removal of 408 invasive carp from Pool 6 of the Mississippi River in late 2023.
- DNR staff co-led an operation with USGS to test new technologies for invasive carp management.
- The DNR worked with the U.S. Geological Survey to lead a comprehensive series of discussions with stakeholders to evaluate additional options for active invasive carp management in the Mississippi River. The process incorporated public stakeholders and invasive carp experts to evaluate options and the outcomes will be used to inform an update to the statewide Minnesota Invasive Carp Action Plan.

Some of the hundreds of invasive carp captured in Pool 6 of the Mississippi River during the November 2023 capture event.

New Detections of Adult, Juvenile, and Larval Invasive Carp

The DNR relies on multiple methods to detect and monitor invasive carp in Minnesota:

- DNR and other agencies may detect invasive carp in the course of traditional fisheries monitoring programs.
- The DNR tags, releases, and tracks small numbers of invasive carp to better understand patterns of movement and find additional invasive carp. Tagging and tracking of invasive carp led to the successful removal of 351 silver carp, 52 grass carp, and five bighead carp in Pool 6 of the Mississippi River in November and December 2023.
- The DNR invasive carp program and other agencies conduct sampling targeted at all life stages of invasive carp.
- The DNR contracts with commercial fishing businesses.
- The DNR monitors the commercial catch from businesses not on contract.
- The DNR follows up on suspected sightings of invasive carp reported by the public.
- USFWS and other agencies share the results of eDNA surveys with the DNR.
- The DNR coordinates with researchers on modeling to determine key locations and actions for invasive carp monitoring and management.

A silver carp is tagged to allow DNR to track its movements.

INVASIVE CARP CAPTURES IN 2023

Location	Species	Date of Capture	Number	Method of Capture	Notes
MississippiRiverPool5A	Silver Carp	3/15/2023	1	Contracted Commercial Fisher	
MississippiRiverPool6	Silver Carp	3/20/2023	29	Contracted Commercial Fisher	
Mississippi River Pool 5A	Silver Carp	3/27/2023	1	Contracted Commercial Fisher	
Mississippi River Pool 5A	Grass Carp	3/28/2023	1	Contracted Commercial Fisher	
Mississippi River Pool 8	Silver Carp	4/7/2023	4	Contracted Commercial Fisher	Three tagged and released, one removed
St. Croix River	Silver Carp	4/12/2023	1	Contracted Commercial Fisher	Tagged and released
Mississippi River Pool 5A	Silver Carp	5/22/2023	5	Contracted Commercial Fisher	Tagged and released
Mississippi River Pool 5A	Grass Carp	5/22/2023	2	Contracted Commercial Fisher	
Mississippi River Pool 5A	Silver Carp	5/23/2023	2	Contracted Commercial Fisher	Tagged and released
Mississippi River Pool 5A	Silver Carp	5/25/2023	1	Minnesota DNR	
Mississippi River Pool 7	Silver Carp	6/1/2023	1	Contracted Commercial Fisher	
Root River	Grass Carp	6/14/2023	1	Minnesota DNR	
Mississippi River Pool 5A	Silver Carp	6/22/2023	2	Contracted Commercial Fisher	
Mississippi River Pool 8	Silver Carp	10/11/2023	5	Carp capture method testing	Tagged and released
Mississippi River Pool 8	Grass Carp	10/11/2023	1	Carp capture method testing	Tagged and released
Mississippi River Pool 6	Silver Carp	11/30/2023	289	Contracted Commercial Fisher	
Mississippi River Pool 6	Grass Carp	11/30/2023	39	Contracted Commercial Fisher	
Mississippi River Pool 6	Bighead Carp	11/30/2023	3	Contracted Commercial Fisher	
Mississippi River Pool 6	Silver Carp	12/4/2023	62	Contracted Commercial Fisher	
Mississippi River Pool 6	Grass Carp	12/4/2023	13	Contracted Commercial Fisher	
Mississippi River Pool 6	Bighead Carp	12/4/2023	2	Contracted Commercial Fisher	

The invasive carp monitoring crew received four encounter reports from the public in 2023. All reports were investigated in person, by phone or via email. Three of the reports were determined to be invasive carp, based on follow-up conversations and photos.

In 2023, 465 invasive carp were captured in Minnesota and border waters. Seventeen of the initial 57 fish that were captured between March and October were tagged and released to gather data on invasive carp movements. Tracking these tagged fish led to the capture of an additional 408 invasive carp in Pool 6 of the Mississippi River in late November and early December. Of the 465 total invasive carp captured, 457 were captured by commercial fishers, two by Minnesota DNR sampling and six during a multi-agency operation to test methods for invasive carp capture.

In late November Wisconsin DNR located six tagged carp in Pool 6 of the Mississippi River. Those detections, along with observations by DNR contracted commercial fishers led to the successful capture of 408 invasive carp in Pool 6.

Extended flooding in spring 2023 caused dams on the Mississippi River to open, allowing floodwaters to pass and allowing invasive carp to move upstream. Multiple invasive carp were seen jumping below Lock and Dams 5 and 8 in May 2023. Data from invasive carp tagged downstream of Minnesota by the USFWS indicate that multiple tagged invasive carp moved upstream to Minnesota during the spring flooding. These tagged fish are being used to target invasive carp for capture. To date, no evidence of reproduction has been found in Minnesota waters.

The Minnesota Legislature granted the DNR authority to tag invasive carp for research in 2017.

This allows the DNR to better understand the movements of individual fish and leads researchers and managers to other invasive carp. The DNR tagged its first invasive carp, a bighead carp, in the St. Croix River on July 28, 2017. Fish biologists continue to track this bighead carp, but we expect that the tag in this fish will stop transmitting in the next year, and we will lose this signal.

Five silver carp were tagged in Pool 8 of the Mississippi River in October 2020. Active and passive tracking show that one of those fish moved from Pool 8 to Pool 5A in 2022, and up to Pool 3 and the St. Croix River in 2023. Data from the other four silver carp that were tagged in 2020 suggest that they have moved downstream outside of Minnesota waters. In response to tracking data and sightings, DNR has moved additional sampling effort to Pool 5A, including larval tows, agency sampling, contracted commercial fishing, and coordinated capture efforts.

The DNR tagged one silver carp in Pool 8 of the Mississippi River on May 18, 2022, with assistance from the USFWS. The last known location of this individual is Pool 9 of the Mississippi River.

On March 7, 2023, the DNR tagged three silver carp in Pool 8 of the Mississippi River with assistance from USFWS. Their last known location is Pool 8.

One silver carp was tagged by DNR and USFWS in the St. Croix River on March 12, 2023. It was last detected in the lower St. Croix River.

A total of seven silver carp were tagged by DNR with assistance from USFWS in Mississippi River Pool 5A on May 22-23, 2023. These fish were captured below Lock and Dam 5 during spring flooding. Their last known locations are Pool 5a, Pool 6, Pool 8, and Pool 10, all downstream of where they were tagged.

The DNR tagged five silver carp and one grass carp in Pool 8 of the Mississippi River on October 11, 2023, during a multi-agency operation to test capture methods for invasive carp. This is the first grass carp the invasive carp crew has tagged.

Tagged fish are actively tracked when river conditions allow. The DNR coordinates with partners including Wisconsin DNR and USFWS to share data about detections of tagged fish. Data from USFWS show that additional tagged invasive carp moved into Minnesota waters from downstream during spring 2023 flooding. The locations of these fish are being used to inform detection and removal efforts. DNR is working with Wisconsin DNR, Iowa DNR, and USFWS to maintain and expand the receiver network that detects tagged fish in the Upper Mississippi River Basin. This project has received funding to maintain its dedicated tracking crew in 2024.

Partner organizations work with DNR to remove fish from nets during a capture method testing operation in October 2023.

Developing Invasive Carp Capture Techniques

The DNR has partnered with USGS to develop and test methods for invasive carp capture. The low-density population of invasive carp and large complex river systems in Minnesota present unique challenges to capturing invasive carp. This project began in spring 2021, when the Modified-Unified Method (MUM) was first deployed in Pool 8 of the Mississippi River. The project has since evolved to include other sites and techniques specifically designed for use with a low-density invasive carp population. As a general approach, agency staff block off areas of the river with large nets while using sound and electricity to herd fish into nets for capture. The goal of this project is to develop methods that can be quickly deployed, that maximize capture of invasive carp, and can be integrated into DNR's regular sampling.

Other partners integral to this project include: USFWS, Wisconsin DNR, NPS, and Wild Rivers Conservancy. These valuable partnerships expand DNR's capability to respond to the presence of invasive carp by providing staff and equipment support as well as additional information and expertise.

The DNR and USGS co-led an operation to test new technologies for invasive carp capture on October 9-12, 2023. Multiple sites were sampled in Mississippi River Pools 6 and 8. Three new technologies developed by USGS were successfully deployed:

- Floating gill nets that entangle jumping carp.
- Speakers attached to a buoy to help direct invasive carp movement.
- Remotely operated kayaks that can be used for surveys, herding fish and likely more uses.

The new technologies were tested in the fall so they can be adapted for more extensive use in spring, when invasive carp are most active.

Six invasive carp (five silver and one grass carp) were captured, tagged, and released during the operation. This is the most invasive carp the Minnesota DNR has tagged in one day. Previously tagged fish were tracked to identify the sampling location and an approach for capture. Staff from DNR, USGS, USFWS, NPS, Wisconsin DNR, and Wild Rivers Conservancy worked together to herd, capture, and tag the six invasive carp.

The DNR and USGS plan to continue testing methods for invasive carp capture. Algae baits will be tested in 2024, to determine if they are able to concentrate invasive carp for capture. The jumping nets, speakers, and kayaks will be adjusted based on what was learned this fall and integrated into spring 2024 sampling. Data on movement patterns from tagging and tracking, eDNA detections, and standard sampling will be important to enhancing our ability to capture invasive carp. The DNR will continue to use the best available science and information to guide targeted detection and capture efforts.

Minnesota Invasive Carp Action Plan

In 2023, the DNR contracted with the USGS to lead a participatory process using structured decision-making (SDM) to evaluate options for invasive carp prevention and management in the Mississippi River. The SDM process incorporated stakeholders and invasive carp experts using a transparent, inclusive, and comprehensive process to evaluate options to address invasive carp. A combination of virtual workshops, in-person meetings, and individual exercises were used to gather information from participants. The process produced valuable information on stakeholders' values and goals for invasive carp management in Minnesota. Suites of management actions were evaluated considering those goals to provide recommendations to DNR.

The information from the participatory process is being used to update the statewide Minnesota Invasive Carp Action Plan. An updated action plan will help quantify future resource needs and identify priority activities. The updated plan will be available in January 2024.

PARTNERSHIPS

Minnesota Aquatic Invasive Species Research Center

The DNR is an active partner with MAISRC at the University of Minnesota. The DNR serves on both the advisory board and the technical committee. Technical committee responsibilities include prioritizing AIS research needs, scoring project proposals, and providing comments on research project plans.

Invasive carp continues to be a priority for the center. Please visit the MAISRC website, https://maisrc.umn.edu/common-carp, for past, current, and future projects.

U.S. Fish and Wildlife Service

The USFWS leads environmental DNA (eDNA) sampling for invasive carp. 2023 eDNA sampling of water from five sites in Pool 8 of the Mississippi River showed multiple positive detections for invasive carp. An April 2023 sampling event found that of 495 samples, ten were positive for silver carp DNA and two were positive for a genetic marker that indicates bighead and/or silver carp. Given the recent invasive carp captures in Pool 8, these eDNA detections were expected. The eDNA sites in Pool 8 are regularly sampled using commercial fishing and during capture method testing. The monitoring data from eDNA helps DNR track relative changes in invasive carp abundance at these locations over time.

A May 2023 sampling event in the Minnesota River below Granite Falls Dam did not detect invasive carp eDNA in any of the 84 samples taken.

Two sites in the St. Croix River were sampled for eDNA in May 2023. Of the 110 eDNA samples taken in Andersen Bay near Bayport, five tested positive for bighead carp DNA and two tested positive for a general marker that indicates bighead and/or silver carp. The DNR regularly samples for invasive carp in Andersen Bay and has removed five bighead and one silver carp from the bay since 2017 when one bighead was captured and tagged in the area. Andersen Bay is one of the locations that the DNR-tagged bighead carp frequents, making this area a target for surveillance and management. Invasive carp DNA was not detected in any of the 110 samples taken at the Boom Site just upstream of Stillwater.

The DNR uses eDNA data as a monitoring tool that may indicate changes in relative abundance of invasive carp. Most recent and past results can be viewed at https://fws.maps.arcgis.com/apps/dashboards/52b22abe9c4d4575adfe851a946f444d

The USFWS also collaborates extensively with Minnesota DNR on tagging and tracking. Staff assist with implanting tags into captured invasive carp, manual tracking of tagged fish, and they maintain receivers that detect tagged fish across multiple pools of the Mississippi River. USFWS has provided tags, staff time, and funding in support of the Minnesota invasive carp program.

New floating entanglement nets and remotely operated kayaks were tested in October 2023.

Invasive Carp Regional Coordinating Committee (ICRCC)

The ICRCC was formally established in 2010 and represents the collective efforts of international, federal, tribal, state and municipal organizations to combat the spread of invasive carp into the Great Lakes. The ICRCC provides oversight and coordination of interagency prevention activities through development and implementation of an annual Invasive Carp Action Plan and a complementary Monitoring and Response Plan. The work of the ICRCC is supported by the Great Lakes Restoration Initiative, as well as partner agency resources. The ICRCC works to ensure a sustainable population of invasive carp does not become established in the Great Lakes by funding monitoring, management and technological development for invasive carp. The DNR is an active member of the committee. The ICRCC maintains a webpage at invasivecarp.us with background information, recent news, resource materials, action plans, and reports.

Other Collaborations

The DNR is an active partner in a multi-state and federal agency collaboration working on preventing the expansion and reducing the impacts of invasive carp. This workgroup operates at an Upper Mississippi River basin level to develop projects and strategies to meet regional objectives. Projects include a system-wide detection and evaluation program, implementing a commercial harvest program at the reproduction front, and deploying a deterrent strategy. The DNR represents the collaboration at federal briefings, meetings, and conferences. The DNR also meets regularly with the Stop Carp Coalition and Friends of the Mississippi River to share updates and discuss perspectives on invasive carp efforts.

FUTURE NEEDS AND PLANS

- The DNR is growing its invasive carp program by adding additional staff, implementing large, targeted netting efforts, tracking tagged fish, and increasing commercial harvest of invasive carp. Continued funding is needed for these and other prevention, monitoring and response projects.
- The Minnesota legislature awarded DNR $1.72 million in July 2023 for invasive carp prevention and management. Planned projects for these funds include continuing to explore options for a deterrent at Lock and Dam 5, a feasibility study of options for selective native fish passage at Minnesota locks and dams, a study to optimize flow through dam spillway gates to prevent invasive carp movement, adding two field staff and a field staff supervisor position to the invasive carp crew, a hands-on training trip to an area with more invasive carp for staff to learn about capture methods in use in those high-density invasive carp populations, additional tagging and contracted commercial fishing for invasive carp removal, and purchasing needed equipment.
- DNR will also be partnering with USGS in 2024 to model silver carp reproduction in Pools 1-9 of the Mississippi River. USGS will run the FluEgg model, which simulates reproduction below each lock and dam in the system and uses a hydrologic model to simulate transport of eggs and larvae downstream. This will help DNR target egg and larval monitoring efforts and inform management to prevent reproduction from occurring.

Terrestrial Invasive Species Program

GOALS

- Improve or enhance the ability of DNR staff to effectively manage terrestrial (land-based) invasive species on DNR-managed lands.
- Prevent or limit the negative impacts on Minnesota's ecology, economy and human health that can result from terrestrial invasive species such as round leaf bittersweet, wild parsnip, buckthorn, garlic mustard, earthworms, emerald ash borer and spongy moth.
- Prevent and manage terrestrial invasive species to protect and/or restore native plant communities, rare plant species and natural features and biological diversity.
- Prevent and manage terrestrial invasive species to protect and/or restore habitats for wildlife species, especially those species in greatest conservation need.
- Engage partners in invasive species prevention, management, inventory, outreach, communication and research.

HIGHLIGHTS

Prevention

- Jumping worms (*Amynthas agrestis* and related species) are an emerging invasive earthworm threat in Minnesota that damage plants and soils. They are called "jumping worms" because of their unusual behavior: when disturbed, they move like a snake and sometimes appear to jump. The program continued to work with partners to examine how regulations, research, and outreach can prevent jumping worm spread in Minnesota. Visit https://www.dnr.state.mn.us/invasives/terrestrialanimals/jumping-worm/index.html.
- The program led the Invasive Species Operational Order 113 Committee, an interdisciplinary team that works to engage DNR divisions in prevention and management efforts. The committee wrote articles for the DNR Spotlight newsletter, provided field season reminders, and shared prevention resources and trainings.

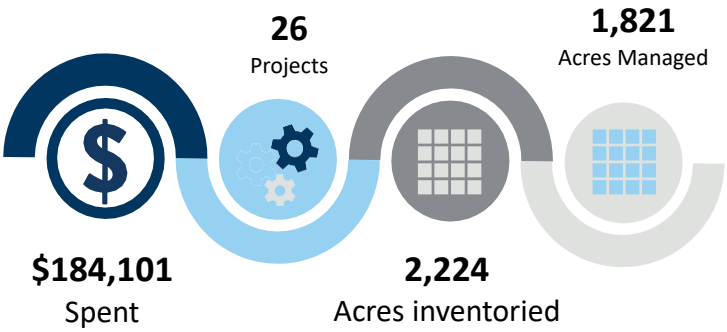
Management and Inventory

The Invasive Species Program initiated a funding program in 2006 for the management and inventory of terrestrial invasive plant species on state managed lands. DNR divisions and regions spent $184,101 in fiscal year 2023 for high priority activities. Priorities include treatment of early detection invasive plants and management in high quality habitats. The funds were also used to purchase equipment for managing invasive plants such as backpack sprayers, brush cutters, chain saws, herbicide storage cabinets, herbicide spill kits and loppers. Additionally, the program funded boot brush kiosks for 89 Wildlife Management Areas to reduce the introduction of new species to those sites. For fiscal year 2024, $139,250 was distributed among 16 projects.

The following species were inventoried and/or managed in fiscal year 2023 projects: Amur maple, birdsfoot trefoil, Canada thistle, common buckthorn, common tansy, crown vetch, garlic mustard, glossy buckthorn, Japanese barberry, Japanese knotweed, leafy spurge, miscanthus, multiflora rose, nonnative honeysuckles, poison hemlock, Queen Anne's lace, round leaf bittersweet, spotted knapweed, wild parsnip.

DNR staff installed updated signage for the educational boot brush kiosks at the Minnesota state fair.

FISCAL YEAR 2023



FUNDING HISTORY AND RESULTS

Fiscal Year/s	Dollars Spent	Acres (Inventoried and Managed)	Number of Projects
2006-2007	$365,000	27,375	31
2008	$435,660	26,523	32
2009	$610,807	40,000 est.	47
2010	$606,777	27,955 + 40,000 from aerial survey	42
2011	$438,000	18,258	33
2012	$178,340	24,989+13,500 from aerial survey	26
2013	$160,000	7,547	22
2014	$144,249	11,860	18
2015	$270,674	12,994	26
2016	$192,339	5,501	23
2017	$219,834	5,755	21
2018	$173,824	6,592	24
2019	$245,727	6,186	21
2020	$165,735	2,331	24
2021	$159,857	3,728	28
2022	$105,451	1,875	14
2023	$184,101	4,046	26

Outreach and Communication

The 2023 Minnesota State Fair provided an opportunity for outreach. The terrestrial invasive species display showcased temporary tattoos, signage and display materials. Visitors learned about using boot brushes to prevent the spread of invasive plants, how to prevent the spread of invasive insects by not moving firewood and how to avoid introducing jumping worms to their yards. The new, interactive game "Muck Hunt" debuted. In this game visitors could use four cleaning tools to virtually clean invasive species off equipment. They could remove mud, weed seeds and earthworm egg cases from an ATV and hiking boots. The game emphasized the message "PlayCleanGo".

The program continued to promote the use of EDDMapS.org for reporting invasive species locations. Reporters include state agency staff, members of the public, county agricultural inspectors and cooperative weed management area partners. DNR staff assisted in sharing information about reporting, making reports, and verifying reports before they are made public.

DNR terrestrial invasive species webpages are an important resource for the public. Key webpages include the terrestrial invasive plants homepage, buckthorn webpages, additional invasive plant webpages and the jumping worm webpage. Staff created new webpages for the plants that were newly added to the noxious weed list in 2023.

DNR staff regularly responded to reports of jumping worms by coordinating identification, reporting and follow up actions. DNR staff communicated with other state agencies, industry, master gardeners and researchers about jumping worm best management practices and continued to update information available about jumping worms.

Research

The program collaborated with University of Minnesota researchers leading the "Jumping worms in Minnesota" research project that focuses on detecting jumping worms, understanding their survival and pathways of spread, and studying potential management methods. Research funding for this project was supported by the Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC), through an appropriation from the Environmental and Natural Resources Trust Fund.

PARTNERSHIPS

Minnesota Department of Agriculture

The Minnesota Department of Agriculture (MDA) is the state regulatory lead for terrestrial invasive plant pests (such as emerald ash borer) and noxious weeds. Visit mda.state.mn.us.

The DNR is a member of the Noxious Weeds Advisory Committee convened by the MDA to evaluate plant species for invasiveness, difficulty of management, cost of management, benefits and amount of injury caused by the species. For each species evaluated, the committee recommends to the MDA commissioner whether the species should be placed on a noxious weed list. Visit https://www.mda.state.mn.us/plants/pestmanagement/weedcontrol/mnnwac

PlayCleanGo

The PlayCleanGo program is built around partnering and using consistent messaging to prevent the introduction and spread of invasive species. Visit playcleango.org.

Minnesota Invasive Species Advisory Council

The Minnesota Invasive Species Advisory Council (MISAC) continues to provide a mechanism for interagency and inter-organization communication and collaboration on invasive species issues. The DNR Invasive Species Program collaborated with MISAC members in the implementation of the statewide plan "A Minnesota Management Plan for Invasive Species." MISAC produced a 2024 wall calendar highlighting 12 invasive species and issues of concern to Minnesotans. Visit mninvasives.org.

Minnesota Invasive Terrestrial Plants and Pests Center

The Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC) at the University of Minnesota focuses on science-based solutions to protect Minnesota's prairies, forests, wetlands, and agricultural resources. Funding for this work is provided by the Environment and Natural Resources Fund (ENRTF). In total, 11 projects active in 2023 involved a level of coordination and collaboration between MITPPC researchers and DNR staff at some point. For example, DNR Forestry and Parks and Trails staff helped with projects on emerald ash borer, *Heterobasidion* root disease, Dutch elm disease and buckthorn. Visit mitppc.umn.edu to view current research projects.

FUTURE NEEDS ANDPLANS

There is an ongoing need to expand awareness, data, tools and resources to reduce impacts of terrestrial invasive species in Minnesota. The DNR's future focus includes continuing outreach on jumping worms, assisting in the implementation of MISAC's Statewide Management Plan for Invasive Species, verifying invasive species reports in EDDMapS.org, updating additional DNR terrestrial invasive species webpages and preparing for the 2024 Minnesota State Fair. Funding for terrestrial invasive species work has decreased since 2010. The terrestrial invasive species program plans to continue to work to meet the growing needs for outreach materials, data, tools and resources.

Ecological and Water Resources Division Districts by County

Northwest Region (1—Bemidji)
North district: Beltrami, Cass, Clearwater, Hubbard, Kittson, Lake of the Woods, Marshall, Pennington, Polk, Red Lake, Roseau, and Wadena

South district: Becker, Clay, Douglas, Grant, Mahnomen, Norman, Otter Tail, Pope, Stevens, Traverse, and Wilkin

Northeast Region (2—Grand Rapids)
East district: Carlton, Cook, Lake, and St. Louis

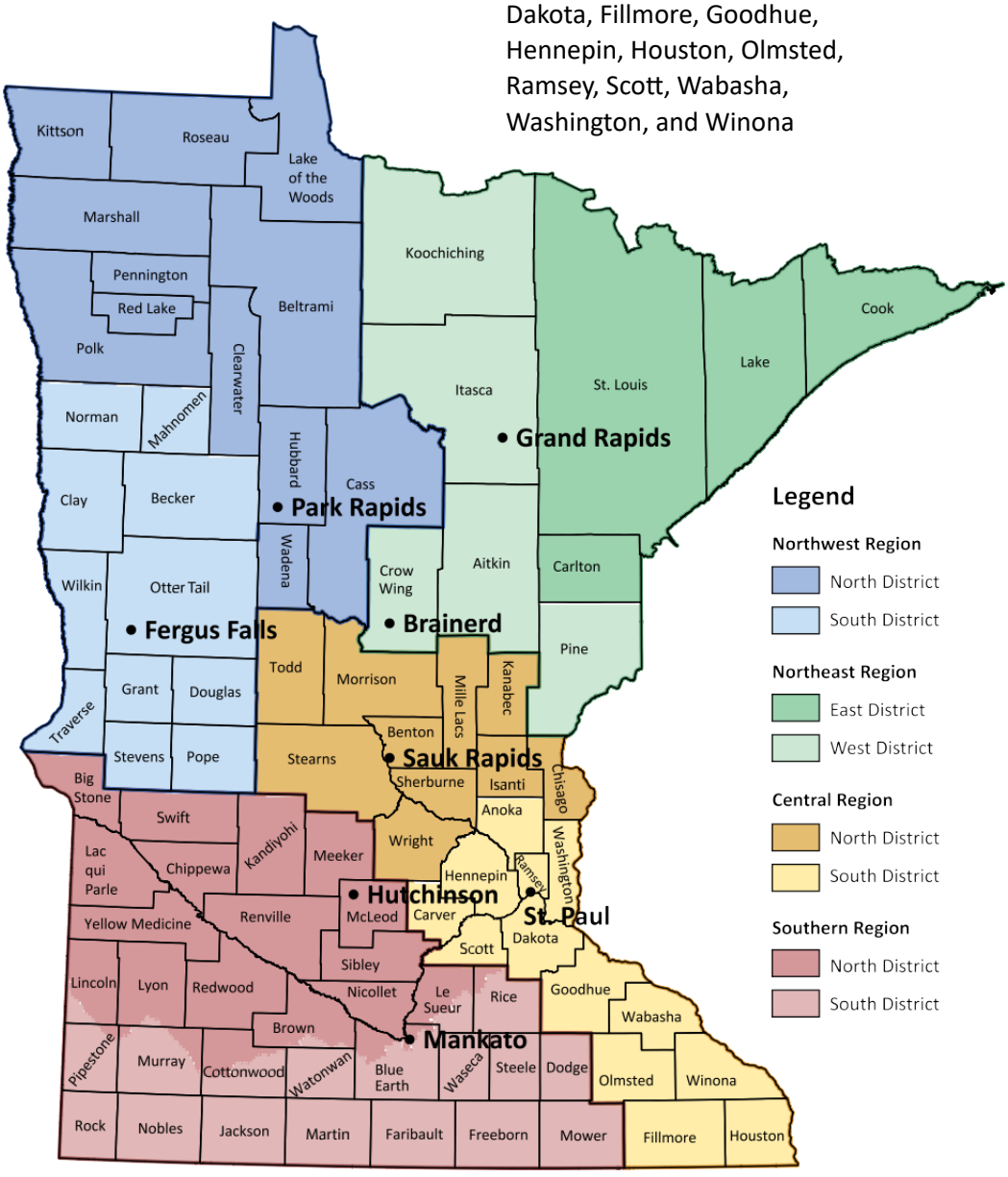
West district: Aitkin, Crow Wing, Itasca, Koochiching, and Pine

Central Region (3—St. Paul)
North district: Benton, Chisago, Isanti, Kanabec, Mille lacs, Morrison, Sherburne, Stearns, Todd and Wright

South district: Anoka, Carver, Dakota, Fillmore, Goodhue, Hennepin, Houston, Olmsted, Ramsey, Scott, Wabasha, Washington, and Winona

Southern Region (4—New Ulm)
North district: Big Stone, Brown, Chippewa, Cottonwood—north of the Minnesota River, Kandiyohi, Lac qui Parle, LeSueur—north of the Minnesota River, Lincoln, Lyon, McLeod, Meeker, Nicollet, Redwood, Renville, Sibley, Swift, and Yellow Medicine

South district: Blue Earth, Cottonwood—south of the Minnesota River, Dodge, Faribault, Freeborn, Jackson, LeSueur—south of the Minnesota River, Martin, Mower, Murray, Nobles, Pipestone, Rice, Rock, Steele, Waseca, and Watonwan



Appendix A. INVASIVE SPECIES PROGRAM STAFF

Felix Amenumey
Aquatic Invasive Species Trainer Central and Southern Regions

Michael Bolinski
Watercraft Inspection Program Supervisor Northwest Region, Fergus Falls

Chad Burback
Watercraft Inspection Program Assistant Northeast Region, Brainerd

Rafael Contreras-Rangel
AIS in Commerce Prevention Planner, Central Office, St. Paul

Wendy Crowell
Aquatic Invasive Species Management Consultant, Central Office, St. Paul

Angelique Dahlberg
Aquatic Invasive Species Research and Grants Coordinator, Central Office, St. Paul

Adam Doll
Watercraft Inspection Program Coordinator, Central Office, St. Paul

Aquatic Invasive Species Prevention Consultant, Central Office, St. Paul

Don Eaton
Aquatic Invertebrate Biologist, Central Office, St. Paul

Traci Eicholz
Watercraft Inspection Program Assistant Central Region, Sauk Rapids

Tina Fitzgerald
Aquatic Invasive Species Prevention Planner, Central and Southern Regions

Jessamyn Foley
Watercraft Inspection Program Supervisor Northeast Region, Brainerd

Emelia Hauck-Jacobs
Assistant Invasive Species Specialist Central Region, North district, Sauk Rapids

Christine Hokkala-Kuhns
Watercraft Inspection Program Supervisor Central Region, Sauk Rapids

Jeannine Howland
AIS Training Specialist, Central Office, St. Paul

Greg Husak
Communications/Information Officer, Central Office, St. Paul

Doug Jensen
Aquatic Invasive Species Prevention Planner Northeast and Northwest Regions

Christine Jurek
Invasive Species Specialist Central Region, North district, Sauk Rapids

Eric Katzenmeyer
Invasive Species Specialist Southern Region, North district, Hutchinson

Travis Kinsell
Watercraft Inspection Supervisor Southern Region, Hutchinson

Nicole Kovar
Invasive Species Specialist Northwest Region, North district, Park Rapids

April Londo
Invasive Species Specialist Central Region, South district, St. Paul

Grace Loppnow
Invasive Fish Consultant, Central Office, St. Paul

Jenna Nelson
Assistant Invasive Species Specialist Central Region, South district, St. Paul

Anna Ness
Watercraft Inspection Program Assistant Northwest Region, Fergus Falls

Kelly Pennington
Invasive Species Unit Supervisor Central Office, St. Paul

Tim Plude
Invasive Species Specialist Northeast Region, West district, Brainerd

Darrin Rain
Watercraft Inspection Program Assistant Southern Region, Hutchinson

Mark Ranweiler
Invasive Species Specialist Northwest Region, South district, Fergus Falls

Richard Rezanka
Invasive Species Specialist Northeast Region, East district, Grand Rapids

April Rust
Training Coordinator, Central Office, St. Paul

Laura Van Riper
Terrestrial Invasive Species Coordinator, Central Office, St. Paul

Carli Wagner
Invasive Species Specialist Southern Region, South district, Mankato

Heidi Wolf
Ecosystem Management and Protection Section Manager Central Office, St. Paul

Appendix B. WATER BODIES LISTED AS INFESTED IN 2023

This table includes all water bodies added to the infested waters list in 2023. Explanations of the last two columns are below:

Year species was first confirmed, or connected water body: Either 1) the year in which we first confirmed a population of the aquatic invasive species in the water body, or 2) "connected" to indicate that we listed the water body because it is connected to a water body where the aquatic invasive species has been confirmed; this column may also contain the name and/or Lake ID number of the connected, confirmed water body.

Lake ID number: an identifying number the DNR uses for lakes. Ponds and wetlands that are not on the public waters inventory are listed with "none" in the number column. Most rivers and streams on the public waters inventory are listed without a number or "NA" in the number column; some river pools are identified with a Lake ID number.

Water body name	County or counties	Listed for aquatic invasive species	Year listed as infested	Year species was first confirmed, or connected water body	Lake ID number
Ann	Carver	zebra mussel	2023	2023	10-0012
Bass	Kandiyohi	Eurasian watermilfoil	2023	2023	34-0078
Big Stone	Big Stone	zebra mussel	2023	2023	06-0152
Blackduck	Beltrami	starry stonewort	2023	2023	04-0069
Cedar Island (Koetter)	Stearns	Eurasian watermilfoil	2023	2023	73-0133
Clearwater	Wright	starry stonewort	2023	2023	86-0252
Deer	Wright	zebra mussel		connected to Buffalo (86-0090)	86-0107
Dora	Itasca	starry stonewort	2023	2023	31-0882
East Leaf	Otter Tail	zebra mussel	2023	2023	56-0116
Gladstone	Crow Wing	zebra mussel	2023	2023	18-0338
Goose	Wright	zebra mussel		connected to Buffalo (86-0090)	86-0108
Great Northern	Stearns	Eurasian watermilfoil	2023	2023	73-0083
Hickory	Aitkin	zebra mussel	2023	connected to Spirit (01-0178)	1-0179
Jessie	Itasca	zebra mussel	2023	2023	31-0786

Water body name	County or counties	Listed for aquatic invasive species	Year listed as infested	Year species was first confirmed, or connected water body	Lake ID number
Lawrence	Cass	Eurasian watermilfoil	2023	2023	11-0053
Little Rice	Mahnomen	zebra mussel	2023	connected to Sargent (44-0108)	44-0019
Long	Douglas	zebra mussel	2023	2023	21-0343
Long	Hubbard	starry stonewort	2023	2023	29-0161
Long	Kandiyohi	zebra mussel	2023	2023	34-0066
Long	Kandiyohi	starry stonewort	2023	2023	34-0066
Mill Creek from Buffalo (86-0090) to the Crow River	Wright	zebra mussel	2023	connected to Buffalo (86-0090)	NA
Mink	Wright	zebra mussel	2023	connected to Buffalo (86-0090)	86-0088
Mitchell	Hennepin	brittle naiad	2023	2023	27-0070
Moon	Douglas	zebra mussel	2023	2023	21-0226
North Twin	Beltrami	starry stonewort	2023	2023	04-0063
Pine	Stearns	zebra mussel	2023	2023	73-0136
Plantagenet	Hubbard	zebra mussel	2023	2023	29-0156
					Continued
Rabbit River between Mahnomen (18-0126) and West Mahnomen (86-0088)	Crow Wing	zebra mussel	2023	connected to Mahnomen (18-0126)	NA
Red Rock	Cook	spiny waterflea	2023	2023	16-0793
Rice	Mahnomen	zebra mussel	2023	connected to Sargent (44-0108)	44-0024
Sargent	Mahnomen	zebra mussel	2023	2023	44-0108
Scandinavian	Pope	zebra mussel	2023	2023	61-0041
Spirit	Aitkin	zebra mussel	2023	2023	01-0178
Sunfish	Le Sueur	Eurasian watermilfoil	2023	2022	40-0009
Tamarac	Otter Tail	zebra mussel	2023	2023	56-0931
Trout	Itasca	zebra mussel	2023	2023	31-0216
Turtle	Itasca	zebra mussel	2023	2023	31-0725

Water body name	County or counties	Listed for aquatic invasive species	Year listed as infested	Year species was first confirmed, or connected water body	Lake ID number
Unnamed (Deer)	Wright	zebra mussel	2023	connected to Buffalo (86-0090)	86-0386
Unnamed (West Mahnomen)	Crow Wing	zebra mussel	2023	connected to Mahnomen (18-0126)	18-0418
Unnamed wetland	Wright	zebra mussel	2023	connected to Buffalo (86-0090)	86-0363
Wall	Otter Tail	zebra mussel	2023	2023	56-0658
Zumwalde	Stearns	Eurasian watermilfoil	2023	2023	73-0089