MINNESOTA EXTENSION SERVICE

UNIVERSITY OF MINNESOTA
SEA GRANT EXTENSION PROGRAM

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Round Goby WATCH

Ruffe WATCH

Sea Grant Nonindigenous Species Site
Zebra Mussel and Other Aquatic Nuisance Species
sgnis

http://www.ansc.purdue.edu/sgnis/
The Ruffe

The Eurasian ruffe (rhymes with tough) may pose a serious ecological threat to water environments and to sport and commercial fishing. This invader may compete with native fish for food and habitat. First reported in western Lake Superior in 1986, the ruffe population has rapidly increased in the St. Louis River at Duluth-Superior and spread to other rivers and bays along the south shore of western Lake Superior.

There is great concern over the potential for the ruffe to expand its range in North American waters. Early detection of isolated populations may help slow or restrict the spread of the Eurasian ruffe. Your help is vital to prevent the spread of ruffe and to report new sightings.

What you can do

- Learn to identify the ruffe (see back cover). If you catch a ruffe outside the Duluth area of Lake Superior or the St. Louis estuary, kill it, freeze it, and call the Minnesota Department of Natural Resources, Exotic Species Program in St. Paul, (612) 296-2835, a local DNR fishery office, or Minnesota Sea Grant Extension in Duluth, (218) 726-8712. **Minnesota prohibits possession of live ruffe. Do not throw it back alive!**
- Always drain your livewells, bilge water, and transom wells before leaving the water access.
- Never empty your bait bucket into the water, always empty it on land.
- Never dip your bait bucket into one lake if it has water in it from another.
- Never dump live fish from one body of water into another.

WARNING!

Never transport a live ruffe. States have differing regulations and penalties regarding possession and/or transportation of live or dead ruffe. Know your State statutes.

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The Sea Grant Nonindigenous Species Site

is a peer-reviewed national information center that contains a comprehensive, searchable, collection of research publications and education materials produced by the National Sea Grant College Program.

This site includes research findings, training and education materials, newsletters, distribution maps, a Sea Grant Graphics Library of slides, Illustrations, and videos, with links to local Sea Grant personnel and related Web sites.

Mission:

to involve people in improving the quality of life and enhancing the economy and the environment through education, applied research, and the resources of the University of Minnesota.

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Zebra Mussel

**ALERT**

The barnacle-like zebra mussel poses a multibillion-dollar threat to North America's ecological, agricultural and municipal water supplies, and it could become a costly nuisance for freshwater shipping, boating, fishing and clamming as well. First found in 1988 in the Great Lakes, this invader could become much more widespread than the German carp and cause far more economic damage than the Mediterranean fruit fly.

**PUBLIC ASSISTANCE IN REPORTING ZEBRA MUSSEL SIGHTINGS AT NEW LOCATIONS IS ESSENTIAL TO HELP PREVENT ITS SPREAD TO OTHER LAKES AND RIVERS!**

How to Identify It

- Zebra mussels look like small clams with a yellowish or brownish "D"-shaped shell, usually with dark- and light-colored stripes (hence the name "zebra").
- They can be up to two inches long, but most are under an inch. Zebra mussels usually grow in clusters containing numerous individuals (see photo) and are generally found in shallow (6-30 feet), algae-rich water.
- Zebra mussels are the ONLY freshwater mollusk that can firmly attach itself to solid objects — submerged rocks, dock pilings, boat hulls, water intake pipes, etc.

What to Do

- Note the date and precise locations where the mussel or its shell(s) were found;
- Take the mussel with you (several, if possible) and store in rubbing alcohol (in any case, DON'T throw it back in the water); and
- IMMEDIATELY call the Minnesota Department of Natural Resources Exotic Species Program in St. Paul at 1-800-766-6000 or (612) 296-2835, a local DNR fishery office, or Minnesota Sea Grant Extension in Duluth (218) 726-8712.

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The Round Goby

The round goby may pose a serious threat to North American water ecosystems, with potential impacts on sport and commercial fishing. Since its discovery in the St. Clair River in 1990, this bottom-dwelling fish has rapidly spread to many areas of the Great Lakes. Once established, populations typically increase rapidly. The round goby can displace native fish, eat their eggs and young, take over optimal habitat, spawn multiple times a season, and survive in poor quality water -- giving them a competitive advantage.

Anglers, commercial fishermen, and fishery professionals should know how to identify the round goby. Often, anglers are the first to discover round gobies because these aggressive fish are commonly caught by hook and line. Your help is vital to report new sightings and to prevent their spread.

What you can do

- Learn to identify the round goby (see back cover). If you catch one in the Great Lakes or other waters, kill it, freeze it, and call Minnesota Sea Grant in Duluth, (218) 726-8712, or the Minnesota Department of Natural Resources Exotic Species Program in St. Paul, 1-800-766-6000 or (612) 296-2835, or a local fishery office. **Do not throw round gobies back alive!**
- Always drain water from your boat, livewell, and bilge before leaving any water access.
- Always empty your bait bucket on land, never into the water.
- Never dip your bait bucket into a lake or river if it has water in it from another.
- Never dump live fish from one body of water into another.

REMEMBER: **Know the rules!**

Round goby specimens are needed to confirm sightings, but many Great Lakes jurisdictions have differing rules regarding possession and transport. Always contact your local resource management agency for instructions. Never transport a live round goby.

© University of Minnesota Sea Grant
How to Identify Eurasian Ruffe

- Rows of dark spots between spines
- Sharp spiny fin
- Glassy eye
- Small down turned mouth
- Gill cover with many sharp spines
- One sharp spine
- Two very sharp spines

General Characteristics
- Very slimy when handled
- Usually less than 6" (15.5 cm) long
- Perch-like body shape

How to Identify a Round Goby (adult shown)

- Fin may be tinged in green
- Black spot
- Frog-like raised eyes
- Thick lips
- Body mostly slate gray, mottled with black to brown spots
- Single scallop-shaped pelvic (bottom) fin

General Characteristics
- Key Feature: no other native fish in the Great Lakes has the single pelvic fin.
- Young are solid slate gray.
- Usually 3-6 inches (7.6 - 15.2 cm) long; may be up to 10 inches (25.4 cm) long.
Northern Watermilfoil

- Usually 5-10 leaflet pairs
- Leaves rigid out of water
Eurasian Watermilfoil

- Usually 12-21 leaflet pairs
- Leaves limp when out of water
The Sea Lamprey Battle

Great Lakes Fishery Commission

National Biological Service Research Agent
United States Fish and Wildlife Service Sea Lamprey Control Agent
Department of Fisheries and Oceans Canada Sea Lamprey Control Agent
What Is a Sea Lamprey?

Sea lampreys are aquatic vertebrates resembling eels, but unlike eels, they feed on large fish. They can live in both salt and fresh water. Sea lampreys, now found in all the Great Lakes, attach to fish with a sucking disk and sharp teeth. Sea lampreys feed on body fluids...often scarring and killing host fish.

How Are Sea Lampreys Controlled?

Fishery managers and scientists are developing a combined sea lamprey control and fish management program.

Lampricides

In the 1950s, a selective toxicant called TFM was developed. This lampricide kills sea lampreys in streams during their vulnerable larval stage. Laboratory tests show that at the dose needed to kill sea lampreys, TFM is nontoxic or has minimal effect on aquatic plants, invertebrates, other fish, and wildlife. Studies have also shown TFM to be nontoxic to humans and other mammals. This chemical, registered as a lampricide by the U.S. Environmental Protection Agency and Agriculture Canada, is still the principal method of sea lamprey control. An annual cycle of lampricide treatments must be maintained to prevent sea lamprey resurgence.

How Destructive Are Sea Lampreys?

Sea lampreys were a major cause of the collapse of lake trout, whitefish, and chub populations in the Great Lakes during the 1940s and 1950s. These fish were the mainstay of a vibrant and important commercial fishery.

Since then, sea lamprey management programs have contributed significantly to the revival of the recreational and commercial fisheries. These revitalized fisheries have contributed 2-4 billion dollars annually to economic activity in the Great Lakes region. Approximately 55 million angler days are now spent on Great Lakes sport fishing each year.

Barriers

Specially designed low-head sea lamprey barriers with traps have been constructed on streams to block and catch sea lampreys before they spawn. These barriers are designed to allow passage of jumping fish. The effectiveness of this control technique is limited to locations with suitable water depth, water flow, bank stability, and accessibility.

Although the number of sea lampreys has been reduced, they remain a constant threat and still kill many fish. For example, in Lake Superior sea lampreys kill as many trout as are harvested in sport and commercial fisheries.
Are There Chemical Control Alternatives?

Ongoing research shows that other forms of sea lamprey control may be effective, such as:

**Sterile-Male-Release Field-Trial Program**

Male sea lampreys are captured, sterilized, and then released back into spawning streams where they compete with fertile males. Matings between sterile male and fertile female sea lampreys result in infertile eggs. This reduces the number of sea lampreys produced.

**Water Velocity Barriers**

Research is aimed at developing barriers that speed up water flows to velocities that block sea lampreys (which are relatively weak swimmers), but allow most fish to pass.

![Image of a water velocity barrier]

**Other Research Areas**

Certain natural chemical substances (pheromones) released by sea lampreys serve as chemical cues. When identified and synthesized in the laboratory, they could be used to attract sea lampreys into traps or to unsuitable spawning areas of a stream.

Other research involves the study of sea lamprey life-cycle changes, especially the transformation from harmless larvae to voracious predators. Delay or prevention of any key event in the life cycle could help reduce adult sea lamprey populations and associated fish mortality.

Are We Successful?

Funding to support existing sea lamprey control programs and continued research into alternative control techniques is necessary for the future health of our Great Lakes ecosystem.

Under the present program, the sea lamprey population is now at only 10% of what it used to be, except in northern Lake Huron. This control of sea lampreys has enabled phenomenal success in re-establishing valuable fisheries throughout the Great Lakes.

The sea lamprey battle is not over. We must keep pace through adequate controls and development of new control techniques. If we don’t, the successes of the past decades will deteriorate.

What Are Our Present and Future Challenges?

Sea lamprey populations continue to expand as water-quality improvements increase available habitat. Significant populations have developed off the mouths of some streams where traditional treatment methods cannot be used.

Some rivers with large volumes of water and strong currents have huge, uncontrolled larval populations. The St. Marys River, which drains Lake Superior, contributes large numbers of young sea lampreys to northern Lake Huron. The sea lamprey population in Lake Huron is estimated to be equal to that of the other four Great Lakes combined.

![Image of a sea lamprey control program in action]

The sea lamprey control program is delivered with the cooperation and strong support of federal, provincial, state, and tribal agencies; non-governmental organizations; local business communities; and the fishing public.
How Did Sea Lampreys Get Here?

Sea lampreys are native to the Atlantic Ocean but made their way as far inland as Lake Ontario. Niagara Falls served as a natural barrier to keep sea lampreys out of the upper Great Lakes. However, when the Welland Canal was constructed in 1829 for the shipping industry (and then deepened in the early 1900s), a new route for sea lampreys was opened and the invasion to the upper Great Lakes began. By the late 1930s, sea lampreys were found in all five Great Lakes.

What Are the Sea Lamprey’s Life Stages?

Adult sea lampreys move into gravel areas of tributary streams during spring and early summer. They build nests and lay eggs before dying. After the eggs hatch, small, wormlike larvae are swept downstream from the nest and burrow into sand and silt. The larvae feed on bottom debris and algae carried to them by stream currents. During this stage, which can range from 3 years to as many as 17 years, larvae grow to approximately 15 cm (6 inches). After the larval life stage, sea lampreys transform into their parasitic phase and migrate into the Great Lakes.

Sea lampreys spend the next 12-20 months feeding on fish. Each sea lamprey can kill more than 18 kg (40 pounds) of fish during its lifetime. Adult sea lampreys grow to an average length of 18 inches.

The total sea lamprey life cycle, from egg to adult, averages approximately 7 years, and may take as long as 20 years.
In 1956, the Great Lakes Fishery Commission was created by Convention between the United States and Canada to find ways to manage sea lampreys and improve fishery resources. The Commission contracts a large part of the sea lamprey management and research program to the U.S. Fish and Wildlife Service and the Department of Fisheries and Oceans Canada. Under the Commission's direction, these agencies work together to minimize sea lamprey populations in the Great Lakes. The Commission also provides a resource-oriented forum in which the federal, provincial, state, and tribal agencies responsible for the welfare of Great Lakes fishery resources can work together to develop mutually beneficial plans and programs for research, assessment, stocking, harvest, disease control, and environmental quality improvement. By working together, these agencies have provided the productive sport and commercial fisheries that exist today in the Great Lakes.

The Great Lakes Fishery Commission plans to continue its program of sea lamprey research and management, to encourage and influence Great Lakes basin ecosystem rehabilitation, and to promote coordinated fishery management and research among its cooperating agencies for the benefit of the citizens of Canada and the United States.

For information on sea lamprey management and research, contact the Great Lakes Fishery Commission and/or the facilities listed below.

**National Biological Service**  
U.S. National Fisheries Research Center  
2630 Fanta Reed Road  
LaCrosse, WI 54602-0818  
(608) 783-6451  
(608) 783-6066 (fax)

**National Biological Service**  
Lake Huron Biological Station  
11188 Ray Road  
Millersburg, MI 49759  
(517) 734-4768  
(517) 734-4494 (fax)

**U.S. Fish and Wildlife Service**  
Marquette Biological Station  
1924 Industrial Parkway  
Marquette, MI 49855  
(906) 226-6571  
(906) 226-3632 (fax)

**U.S. Fish and Wildlife Service**  
Ludington Biological Station  
229 S. Jebavy Drive  
Ludington, MI 49431  
(616) 845-6205  
(616) 843-8468 (fax)

**Department of Fisheries and Oceans Canada**  
Central and Arctic Region  
Sea Lamprey Control Centre  
1 Canal Drive  
Sault Ste. Marie, Ontario, CANADA P6A 6W4  
(705) 949-1102  
(705) 949-2739 (fax)

**Great Lakes Fishery Commission**  
2100 Commonwealth Blvd., Suite 209  
Ann Arbor, MI 48105-1563  
(313) 662-3209  
(313) 741-2077 FTS  
(313) 741-2010 (fax)
MINNESOTA SEA GRANT
EXOTIC AQUATICS
TRAVELING TRUNK REQUEST FORM

Name: _____________________________

Organization: _______________________

Address: ___________________________

Phone #: ___________________________

Fax #: ______________________________

E-mail: ______________________________

Please indicate dates that you would like to reserve the Exotic Aquatics Traveling Trunk. Include several alternates.

Mail or Fax to: Minnesota Sea Grant
Exotic Species Information Center
2305 East Fifth Street
Duluth, MN 55812-1445
Phone: (218) 726-8712
Fax: (218) 726-6556
djensen@mes.umn.edu

Exotic Aquatics LENDING CENTERS

IOWA
Effigy Mounds National Monument, Harpers Ferry

MICHIGAN
Isle Royale National Park, Houghton
Michigan Sea Grant College Program, East Lansing
Sleeping Bear Dunes National Lakeshore, Empire

MINNESOTA
Lake Superior Center, Duluth
Minnesota Sea Grant Program, Duluth
University of Minnesota Bell Museum of Natural History, Minneapolis
Voyageurs National Park, International Falls

WISCONSIN
St. Croix National Scenic Riverway, St. Croix Falls

Sea Grant

Illinois-Indiana Sea Grant and Minnesota Sea Grant are part of the National Sea Grant Program, which is funded by the National Oceanic and Atmospheric Administration.
ZEBA MUSSELS, WHICH INVADED NORTH AMERICA IN 1988, HAVE CAUSED SERIOUS ECONOMIC AND ENVIRONMENTAL PROBLEMS. THEY ARE RAPIDLY SPREADING BEYOND THE GREAT LAKES REGION INTO MANY INLAND WATERWAYS.

ZEBA MUSSEL MANIA TRAVELING TRUNK

Tune into zebra mussels and other exotic species with this award-winning science kit and curriculum. The experiments, games, stories and other hands-on activities, which meet science education standards, will help educators teach kids ages 9-14 about a wide range of problems associated with zebra mussels and other exotics. Students can inquire and discover while learning how to become involved in community action projects to help slow the spread of zebra mussels.

brochure. Call a lending center near you. A user fee/deposit may be charged.

Duplicate the trunk yourself by purchasing the curriculum guide ($35), resource portfolio ($35) and materials at local stores (about $200). Use the tear-off request form inside this brochure. (Prices include shipping and handling charges).

Purchase a complete trunk, curriculum guide and resource portfolio for $360, plus $20 shipping from the address listed on the request form. Use the tear-off request form inside this brochure.

WHO DEVELOPED THIS TRUNK?

The Zebra Mussel Mania Traveling Trunk Project was sponsored and coordinated by Illinois-Indiana Sea Grant in partnership with Illinois Rivers Project with funds appropriated by the 1994 Congress based on the Nonindigenous Species Act. Fifth and sixth grade teachers created the curriculum. Technical expertise was provided by the Illinois Natural History Survey, Illinois American Water Company, Illinois Power Company, and a curriculum specialist from the Bell Museum of Natural History.

WHAT'S IN THE TRUNK?

Each trunk includes a teacher-friendly curriculum guide with ten activities that integrate science with other subjects. Other resources used in experiments and games include; zebra mussel shells, four video programs, student worksheets, posters, shell classification, web of life ecology game, pre- and post-tests, and a teacher resource portfolio filled with background reading.

WHERE DO I ORDER THE TRUNK?

(Choose 1 of 3 options:)

• Borrow the Zebra Mussel Mania Traveling Trunk from one of the lending centers listed in this

QUESTIONS?

Call Illinois-Indiana Sea Grant at (217) 333-9448.
If you have Internet access, our homepage is at: http://www.ansc.purdue.edu/II-in-sg/
ILLINOIS-INDIANA SEA GRANT
ZEBRA MUSSEL MANIA
TRAVELING TRUNK REQUEST FORM

Name: ____________________________________________
Agency/Organization: _______________________________
Address: ______________________________________________________________________________________
Phone #: _____________________________________________
Fax #: ______________________________________________
E-mail: _____________________________________________

If you would like to borrow a Zebra Mussel Mania Traveling Trunk, please contact a lending center near you; please see the list in this brochure.

☐ Please send me information on duplicating the trunk.

☐ I want to purchase a curriculum guide ($35).

☐ I want to purchase a resource portfolio ($35).

Make a check payable to: University of Illinois
Mail to: Robin Goettel
Illinois-Indiana Sea Grant Program
University of Illinois, 65 Mumford Hall
1301 West Gregory Drive
Urbana, IL 61801
(217) 333-9448, r-goettel@uiuc.edu

☐ I would like to purchase a complete trunk.

Make a check for $380 payable to: Illinois Rivers Project
Mail to: Robert Williams
Illinois Rivers Project
Box 2222, SIUE
Edwardsville, IL 62026
(618) 692-3788, rivers@siue.edu

How did you hear about the traveling trunk?
_____________________________________________________________________________________________

How do you plan to use the trunk? In what kind of activities?
_____________________________________________________________________________________________

ILLINOIS-INDIANA SEA GRANT
ZEBRA MUSSEL MANIA
TRAVELING TRUNK REQUEST FORM

CALIFORNIA
Marine Activities Resources and Education Program
UC-Berkeley
Roberta Dean 408/684-9105

ILLINOIS
Illinois Cooperative Extension Service
Countryside Center
Sandra Lignell 708/352-0109
Marion Center
Cyndi Regan 618/997-3919

Illinois-Indiana Sea Grant
Urbana
Robin Goettel 217/333-9448

Southern Illinois University-Edwardsville
Virginia Bryan 618/692-3557
Robert Williams 618/692-3788

INDIANA
Fort Wayne Children's Zoo
Cheryl Piropato 219/427-6800

Indianapolis Zoo
Debra Messenger 317/630-2044

Purdue Cooperative Extension
Lake County Center
Ronald Hoyt 219/755-3240

Mesker Park Zoo
Randy Smith 812/428-0715

Richardson Wildlife Sanctuary
John Thiele, Jr. 219/787-8983

LOUISIANA
Louisiana Energy and Environmental Resource and Information Center
Baton Rouge
Bob Bradley 504/388-6349

MARYLAND
Columbus Center
J. Adam Frederick 410/576-5743

MASSACHUSETTS
MIT Sea Grant College Program
Christina James 617/252-1675

MICHIGAN
Michigan Sea Grant College Program
John McKinney 616/622-4620

MINNESOTA
University of Minnesota Bell Museum of Natural History
Jane Greenberg 612/626-2299

Lake Superior Center
Christa Berg 218/720-3033

Minnesota Valley National Wildlife Refuge
Keith Van Cleave 612/854-5900

NEW HAMPSHIRE
UNH Sea Grant Extension Ctr.
Julia Dahlgren 603/749-1565

NEW YORK
New York Sea Grant Institute
SUNY Oswego
Pat MacNeil 315/341-3042

New York Sea Grant Institute
SUNY at Stony Brook
Julie Zocher 516/632-6905

OHIO
Cincinnati Zoo
Dan Marsh 513/559-7725

Toledo Zoo
Mitch Magdich 419/385-5721

SOUTH CAROLINA
Charleston Math and Science Hub
Paula Keener-Chavis 803/953-5812

VERMONT
Lake Champlain Basin Science Center
Julie Silverman 802/864-1848

WEST VIRGINIA
Oglebay Zoo
Gretchen Henrich 304/243-4029

WISCONSIN
Environmental Resource Center
University of Wisconsin-Madison
Suzanne Wade 608/265-3257

CANADA
Ontario Federation of Anglers and Hunters
Beth MacKay 705/748-6324

Additional lending centers are being established. Contact Robin Goettel for current list (see request form).

Purdue University, University of Illinois, and University of Minnesota are equal opportunity educators and employers.
THE ARRIVAL
Purple loosestrife (Lythrum salicaria), a beautiful but aggressive invader, arrived in eastern North America in the early 1800s. Plants were brought to North America by settlers for their flower gardens, and seeds were present in the ballast holds of European ships that used soil to weigh down the vessels for stability on the ocean. Since it was introduced, purple loosestrife has spread westward and can be found across much of Canada and the United States.

THE PROBLEM
Purple loosestrife is a very hardy perennial which can rapidly degrade wetlands, diminishing their value for wildlife habitat. Wetlands are the most biologically diverse, productive component of our ecosystem. Hundreds of species of plants, birds, mammals, reptiles, insects, fish and amphibians rely on healthy wetland habitat for their survival.

However, when purple loosestrife gets a foothold, the habitat where fish and wildlife feed, seek shelter, reproduce and rear young, quickly becomes choked under a sea of purple flowers. Areas where wild rice grows and is harvested, and where fish spawn, are degraded. An estimated 190,000 hectares of wetlands, marshes, pastures and riparian meadows are affected in North America each year, with an economic impact of millions of dollars.

Purple loosestrife also invades drier sites. Concern is increasing as the plant becomes more common on agricultural land, encroaching on farmers' crops and pasture land.

THE CHALLENGE
Many organizations throughout North America have taken action to control the spread of purple loosestrife. Their response has been characterized by unparalleled cooperation. National wildlife services, state/provincial natural resource and environment agencies, universities, nursery trades associations, and conservation and community organizations have responded to the purple loosestrife invasion by raising awareness of the threat posed by this invasive plant, and how to prevent its spread.

Individuals, resource managers and community groups can make a valuable contribution to conserving our wetlands for future generations by acting on the information in this brochure. Contact the organizations listed on page seven for additional information.
HOW TO IDENTIFY PURPLE LOOSESTRIFE

Before control activities begin, use the following diagram to be sure you are correctly identifying purple loosestrife.

Flower: Individual flowers have five or six pink-purple petals surrounding small, yellow centers. Each flower spike is made up of many individual flowers.

Seed Capsule: As flowers begin to drop off, capsules containing many tiny seeds appear in their place. Depending on where you live, plants may go to seed as early as late July.

Seed: Each mature plant can produce up to 2.7 million seeds annually. As tiny as grains of sand, seeds are easily spread by water, wind, wildlife and humans. Germination can occur the following season, but seeds may lay dormant for several years before sprouting.

Leaves: Leaves are downy, with smooth edges. They are usually arranged opposite each other in pairs which alternate down the stalk at 90° angles, however, they may appear in groups of three.

Stalk: Stalks are square, five- or six-sided, woody, as tall as 2m (6+ ft.) with several stalks on mature plants.

Perennial Rootstock: On mature plants, rootstocks are extensive and can send out up to 30 to 50 shoots, creating a dense web which chokes out other plant life.

DON’T BE FOOLED BY THESE LOOK-ALIKES

Swamp Loosestrife: Individual flowers ring the stem above leaf pairs. They do not form a flower spike like purple loosestrife.

Fireweed: The conical flower spike is 10-13 cm (4-5 inches) wide at the base. Stem is round and leaves alternate.

Blue Vervain: Small purple flower spikes; edges of leaves are toothed.

Winged Loosestrife: Leaves alternate with small stems attaching to main stem.

HOW TO CONTROL PURPLE LOOSESTRIFE

Controlling the spread of purple loosestrife is crucial to protecting vital fish, wildlife and native plant habitat! Purple loosestrife can easily spread if improper control methods are used. The following simple guidelines will ensure that your efforts to control the spread of purple loosestrife are effective.

Estimate the size and density of the infestation, and use the following chart to choose one or more appropriate loosestrife control options.

In areas too heavily infested to pull, cut or dig plants, these control techniques can still be used to control plants that may sprout as a result of seeds escaping the area. Watch drainage ditches or streams leading from heavily infested areas, as new purple loosestrife colonies are likely to become established there. Pulling, cutting or digging plants in these more manageable infestations will limit the spread of purple loosestrife beyond the area of heavy infestation.
### Size of Infested Area

<table>
<thead>
<tr>
<th>Density of Infested Area</th>
<th>Isolated plants</th>
<th>Small less than 1 acre (0.1 - 0.5 hectares)</th>
<th>Medium up to 4 acres (0.5 - 2 hectares)</th>
<th>Large more than 4 acres (more than 2 hectares)</th>
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<td>Low Density</td>
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<td>1 to 50 plants</td>
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<td>Medium Density</td>
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<td>50 to 1,000</td>
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<td>(25 - 75% of the area)</td>
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<td>High Density</td>
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<td>more than 1,000</td>
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<td>(75 to 100% of the area)</td>
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### Key to Chart Symbols

- **Digging & Hand Pulling**
  - Pulling purple loosestrife by hand is easiest when plants are young (up to two years) or when in sand. Older plants have larger roots that can be eased out with a garden fork. Remove as much of the root system as possible, because broken roots may sprout new plants.

- **Biological Control**
  - In areas of severe purple loosestrife infestation, manual and chemical control efforts are ineffective and may in fact contribute to the problem. However, the use of specially selected insects that feed on purple loosestrife is being studied to determine the effectiveness of this method for long-term control in these higher density areas. Biological control is discussed in more detail in a following section.

- **Cutting**
  - Removing flowering spikes will prevent this year's seeds from producing more plants in future years -- remember each mature plant can produce over 2 million seeds per year. Also, remove last year's dry seed heads, as they may still contain seeds. Finally, cut the stems at the ground to inhibit growth.

- **Chemical Control**
  - If an infestation is in a dry, upland area, and on your own property, an approved herbicide can be applied to individual plants by selective hand spraying. Broadcast spraying is not recommended as it kills all broad-leaved plants, leaving the area open to further invasion from nearby sources of purple loosestrife. This also provides an opportunity for seeds present in the soil to sprout.

Chemical control is used in the United States to control purple loosestrife near or in water, however, as of 1996, no herbicide has been approved for this type of application in Canada. **NOTE:** In the U.S. a permit is required; call a state natural resource agency for more information.
The best time to control purple loosestrife is in late June, July and early August, when it is in flower, plants are easily recognized, and before it goes to seed. Once flower petals start to drop from the bottom of the spike, the plant begins to produce seed. Control activities can continue during this time, but require greater care so seeds are not shaken from the plant. At sites where plants have gone to seed, remove all of the flowering spikes first by bending them over a plastic bag and cutting them off into the bag. Further cutting of stems or pulling can now take place without fear of spreading the tiny seeds.

Proper disposal of plant material is important. Put all plant pieces in plastic bags (vegetation rots quickly in plastic) and take the bags to a sanitary landfill site. Be sure the landfill site doesn’t require bags to be broken open for composting. Composting is not advised, as purple loosestrife seeds may not be destroyed and the thick, woody stem and roots take a long time to decompose. If facilities exist in your area, incineration is an effective way to dispose of plant material.

Be aware that your clothes and equipment may transport the small seeds to new areas. Thoroughly brush off your clothes and equipment before leaving the site.

Keep site disturbance to a minimum. Wetlands provide habitat for many native songbirds, waterfowl, mammals, amphibians, and fish which depend on native wetland vegetation. Wetlands are also home to many rare and delicate plants. Take care not to trample or damage native vegetation when controlling purple loosestrife.

WHY BIOLOGICAL CONTROL?

When a plant from one continent is introduced to another, it usually leaves behind the natural enemies that help prevent population explosions where it normally grows. The purpose of biological control (biocontrol) is to reunite a plant with its natural enemies. Complete eradication is unlikely; the goal of biocontrol is to reduce numbers of the target plant to lessen its ability to displace native vegetation.

The aggressive spread of purple loosestrife across North America prompted the consideration of biological control in the battle against this invader.

Obviously, extreme caution must be taken when introducing one organism to control another. Prior to any introduction of a biological control agent, intensive testing is conducted to ensure that a safe and effective agent is selected.

SELECTION AND SCREENING PROCEDURES

Before approval is granted to release biological control agents in Canada or the U.S., years of testing are required to determine host specificity and ecological specificity.

Testing is usually done in Europe by the International Institute of Biological Control in collaboration with Canadian and U.S. scientists. This enables controlled laboratory testing and natural field testing to be conducted in the insects’ native home, eliminating the high cost of meeting the requirements of working in North American quarantine to avoid the risk of a foreign species escaping.

Once testing is completed, a report is written for submission to a Canadian Advisory Committee and a U.S. Technical Advisory Group. If both the Canadian and U.S. representatives are satisfied that the benefits outweigh the risks, they recommend the release of biological control agents.

Once approved for release in Canada or the U.S., insects must pass through national quarantine facilities to ensure that they are the correct species and are free of disease and parasites. A limited number of insects are imported for use as brood stock, to reproduce and supply additional insects for release.
FINDING BIOLOGICAL CONTROLS

In the mid-1980s, biologists began to conduct a search for biological control agents of purple loosestrife. Of the more than 100 insects that feed on purple loosestrife in Europe, several species were thought to have had excellent potential. Testing began in Europe and was completed in North America between 1987 and 1991 prior to the insects being approved for release. Included in the tests were “feeding trials” which exposed the insects to approximately 50 species of plants including wetland species native to North America, and important commercial and agricultural species.

Following the rigorous testing process and evaluation of the test results, five species of beetles received approval for release in North America, first from the United States government, and then from the Canadian government in 1992.

The following five species of beetles were selected for purple loosestrife to be introduced without fear of negative impacts to native North American plants: Galerucella pusilla and G. calmariensis are leaf-eating beetles which seriously affect growth and seed production by feeding on the leaves and new shoot growth of purple loosestrife plants. Hylotopus transversovittatus is a root-boring weevil that deposits its eggs in the lower stem of purple loosestrife plants. Once hatched, the larvae feed on the root tissue, destroying the plant's nutrient source for leaf development, which in turn leads to the complete destruction of mature plants. Finally, two flower-eating beetles, Nanophyes brevis and N. marmoratus, severely reduce seed production of purple loosestrife.

RELEASE AND MONITORING PROTOCOL

Since the initial importation of these insects into North America for the biological control of purple loosestrife, three of the control agents have been released in Canada, including H. transversovittatus, G. pusilla, and G. calmariensis; the United States has released these as well as N. marmoratus. The other flower-eating beetle has yet to be released in North America.

As of 1996, insects have been released for the control of purple loosestrife in 25 U.S. states and in seven Canadian provinces.

At the time of insect release, site characteristics including habitat and soil type, size of infestation and water levels are recorded. Follow-up visits to the site occur later in that season, and in subsequent years, so that survival and establishment of the beetles can be assessed and their impact on the plant population evaluated.

THE IMPACT OF BIOLOGICAL CONTROL ON PURPLE LOOSESTRIFE

Scientists expect that once established at initial release sites, insect populations will increase, effectively reducing the density of purple loosestrife by reducing shoot growth, preventing or delaying flowering, and reducing seed production. When the number of loosestrife plants on a site dwindles, the beetles will move to other loosestrife stands to feed. Since the control agents will never completely eradicate loosestrife populations, there will be a food source for remaining insect populations.

In North America, it is hoped that the impact of the biological control agents will result in reductions of purple loosestrife abundance of approximately 80%. However, this is a long-term goal. It is estimated that it will be 10 to 20 years after the insect populations become established before their densities will be high enough to result in this reduction.

In the meantime, it is important that we work together to control the spread of purple loosestrife to new areas by using the guidelines outlined previously.

Releasing Galerucella sp. at a site. Inset left: H. transversovittatus, a root-boring weevil, is about eight millimetres long. Inset right: Galerucella sp. is approximately four millimetres in length.
In some states and provinces, noxious weed laws or other state/provincial laws make it illegal to plant purple loosestrife (*Lythrum salicaria*) and its cultivars. However, it is still legally available for sale at some locations. **DO NOT BUY IT!** Also, purple loosestrife seeds are present in some wildflower seed mixes—check the label before you buy any seed packages.

Garden varieties of loosestrife, which were once thought to be sterile, have been proven to cross-pollinate with wild purple loosestrife to produce viable seed. Gardeners can help control the spread of this plant and protect our environment from its harmful impacts by not planting purple loosestrife or the following cultivars:

- *Atropurpureum*
- *Columbia Pink*
- *Firecandle*
- *Floralie*
- *Gypsy Blood*
- *Lady Sackville*
- *Morden Pink*
- *Pink Spires*
- *Purple Spires*
- *Rose Gleam*
- *Rosaeum superbum*
- *Rosy Glow*
- *The Rocket*
- *Brightness*
- *Dropmore Purple*
- *Flashfire*
- *Florarose*
- *Happy*
- *Morden Gleam*
- *Morden Rose*
- *Purple Dwarf*
- *Robert*
- *Rose Queen*
- *Rosy Gem*
- *The Beacon*
- *Tomentosum*

**ALTERNATIVE PLANTINGS**

If you currently have purple loosestrife or a cultivar growing in your garden, it could contribute to the loss of fish and wildlife habitat. Please remove it (roots and all) or at least cut off the flower tops before they begin to form seed. For proper disposal, please see "Things to Keep in Mind" on page four of this publication.

The Canadian Nursery Trades Association has discouraged the sale of purple loosestrife by its members. As a result, many garden centres and seed distribution companies have responded to the purple loosestrife epidemic by voluntarily refusing to sell purple loosestrife and its cultivars, and by providing an alternative selection of environmentally-friendly perennials to landscapers and home gardeners.

Several species of garden perennials display characteristics similar to purple loosestrife, yet they pose no threat to our natural environment. The following plants are an example of some of the environmentally-friendly species available at garden centres and nurseries.

**BLAZING STAR, GAY FEATHER (*Liatris spp.*)**

There are several species of *Liatris* that are native to North America. Plants grow flowering spikes of blue, pink or purple. Availability and appropriateness of the *Liatris* species and their varieties will vary in the different geographic areas of North America.

**DELPHINIUM (*Delphinium spp.*)**

This traditional perennial grows up to 2m (6') tall, producing a brilliant spike of blue to purple flowers. Individual flowers are about 5-7.5cm (2-3") with a single or double ring of petals. *Delphinium* grows best in full sun.

**FALSE SPIREA (*Astilbe arendsii*)**

*Astilbe* grow 0.75-1m (2-3') tall and form 20 to 30cm (8 to 12") spikes of tiny flowers ranging in colour from purple to pink and crimson. *Astilbe* grows in moist but well-drained soil and in light shade where it will not dry out too quickly during the summer months.
**FOXGLOVE (Digitalis purpurea)**
This popular perennial grows to a height of 1-1.25m (3-4') and produces masses of bright flowers in a range of colors that bloom in early summer. Foxglove grows best in full sun.

**LUPINE (Lupinus)**
This spectacular perennial provides flowers in a variety of colors ranging from blue to pink and yellow. The flowers form large 0.5m (2') spikes along the 1-1.75m (3-5') stem. Lupines grow best with full sun and in well-drained, neutral or slightly acidic soils.

**LOBELIA (Lobelia cardinalis)**
A wildflower of wet areas in North America. This plant has spikes of scarlet-red flowers in summer. Excellent beside a pond or stream.

**OBEDIENT PLANT (Physostegia virginiana)**
Also known as False Dragonhead, this native plant has showy 2.5cm (1") flowers in pairs on spikelike clusters that appear from July to September. Two cultivars that have pink blossoms are "Bouquet Rose" and "Vivid."

**SALVIA (Salvia superba)**
Salvia is a hardy perennial that is drought resistant and somewhat bug-proof. Most Salvia have blue to violet flowers, appearing as spikes during June and August. Plants grow 0.75-1m (2-3') tall, preferring full sun and good garden soil.

**SIBERIAN IRIS (Iris)**
Siberian Iris has purple flowers with typical iris-shaped blooms. It grows best in moist but well-drained soil and prefers acidic soils (pH 5.5 to 6.5); sulphur can be added to help acidify the soil.

**SPIKE SPEEDWELL (Veronica spicata)**
This plant will grow about 40 cm (18") tall with blue or pink flowers in dense, spikelike racemes. It grows well in well-drained soil with full sun.
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Photo by M.J. O'Grady