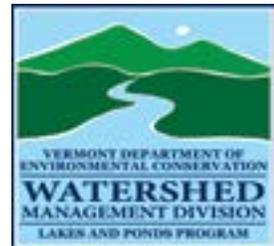




VTDEC

Vermont Invasive Patrollers Training Manual

2016



STOP AQUATIC HITCHHIKERS!

Prevent the transport of nuisance species.
Clean all recreational equipment.

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Introduction to the Vermont Invasive Patrollers Program

Overview

The Vermont Invasive Patrollers (VIP) program was established in 2007 and focuses on early detection of aquatic invasive species. Prior to 2007, volunteer surveying efforts were focused primarily on Eurasian watermilfoil through the Eurasian Watermilfoil Watchers. Although VIPs now emphasize aquatic invasive plants more broadly in their surveying efforts, they are trained to identify both aquatic invasive plants and animals that are either established in Vermont or in nearby states and pose the greatest threat to Vermont's water bodies.

In 2015, 30 volunteers invested more than 200 hours surveying 19 lakes (see map on page 2). No new AIS populations were detected through these efforts.



Program goals

Through hands-on workshops, lakeshore residents and lake users learn what AIS are, how to prevent the spread of AIS, and how to identify the species that pose the greatest threats to Vermont lakes and ponds.

It is understood that not all workshop attendees will commit to surveying a body of water regularly, but that there are benefits to increasing AIS knowledge of Vermonters more broadly. As such, the VIP program has three primary goals:

- To increase AIS knowledge of lakeshore residents and lake users
- To create an early detection volunteer network with a primary focus on aquatic invasive plants
- To increase VTDEC's knowledge of new AIS infestations in lakes and ponds

By enlisting the help of a trained network of volunteers, VTDEC staff are much more likely to learn of new AIS infestations early and as a result, may have more management options at their disposal.

Responsibilities of VIPs and VTDEC staff

VIPs are encouraged to:

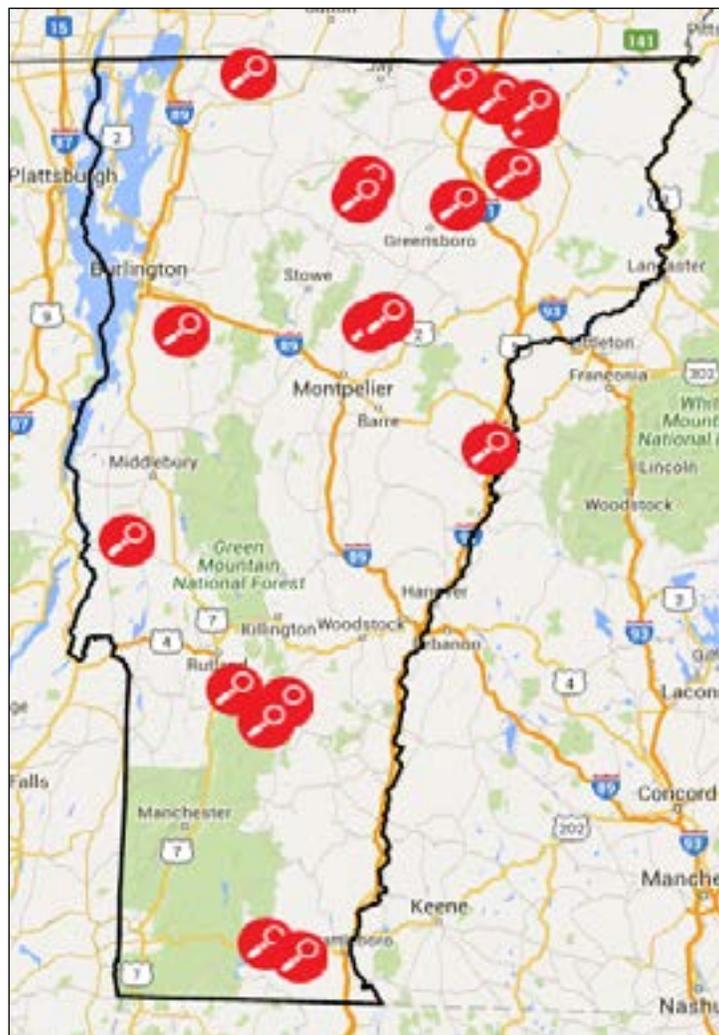
- Survey their lake (or a section of it) at least once between July and mid-September

- Submit surveys, even if nothing suspicious was found, and suspicious samples to VTDEC staff
- Attend a workshop or participate in a practice survey with VTDEC staff at least once every 3 years

If interested, VIPs may also submit samples or photos of unknown native species for positive identification.

VTDEC staff will support the efforts of VIPs by:

- Offering regular workshops on AIS biology and identification
- Accompanying volunteers on AIS surveys of their lake or pond
- Providing AIS identification resources, survey instructions and forms, sample submission instructions and forms, and water body maps if available
- Identifying unknown native or invasive specimens



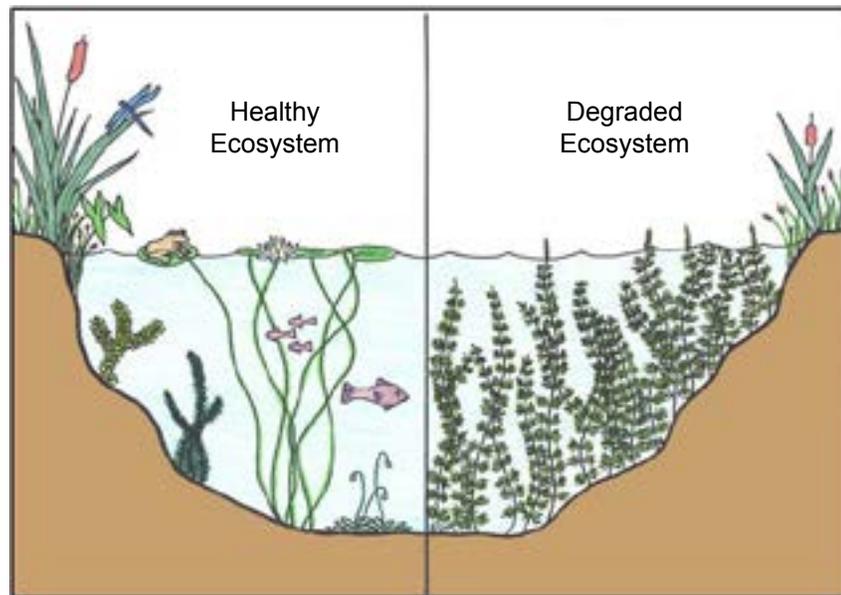
2015 VIP surveyed lakes

Aquatic Invasive Species Biology and Identification

Defining invasive

Often the terms nuisance, exotic, and invasive are used interchangeably; however these terms are not synonymous. A **nuisance species** is one that has adverse ecological or economic impacts. An **exotic species** is one that has been purposefully or accidentally introduced to an area outside its natural geographic range, but may not pose any threat to the natural communities in which they are introduced. An **invasive species** is an organism that has been introduced to an area outside its natural range, which causes ecological and economic harm.

Aquatic invasive species have several common characteristics. They reproduce abundantly (for example, aquatic invasive plants can often form a whole new plant from just a fragment) and lack natural predators and other control mechanisms. They also tend to be skilled hitchhikers, hitching rides on boats, fishing gear, and other recreational equipment as we travel from one lake to another.



Once established, they can reduce species diversity, out-compete native species that support fish habitat, and disrupt the ecosystem balance. They can also be hard on our pocket-books. For example, zebra mussels can attach to and clog intake pipes, and water chestnut can grow so dense it makes boating all but impossible, which can hurt recreation-based tourism.

Priority species of concern

Established in Vermont

Brittle naiad
Curly-leaf pondweed
Eurasian watermilfoil
European frogbit

Najas minor All.
Potamogeton crispus L.
Myriophyllum spicatum L.
Hydrocharis morsus-ranae L.

Spiny waterflea
Starry stonewort
Variable-leaved watermilfoil
Water chestnut
Zebra mussel

Bythotrephes longimanus Leydig
Nitellopsis obtusa [Desv.] J. Grove
Myriophyllum heterophyllum Michx.
Trapa natans L.
Dreissena polymorpha Pallas

Established in neighboring states

Asian clam
Brazilian waterweed
Fanwort
Hydrilla
Parrot feather

Corbicula fluminea O. F. Müller
Egeria densa Planch.
Cabomba caroliniana A. Gray
Hydrilla verticillata (L. f.) Royle
Myriophyllum aquaticum (Vell.) Verdc.

Brittle naiad *Najas minor* All.

There are several naiad species in Vermont, but only one that is invasive. It is found primarily in alkaline waters of streams, ponds, and lakes. It is very brittle and fragments easily, attributing to its spread. It can be differentiated from its native relatives by its easily visible serrations along the leaf margin.



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Identification

- Submersed annual
- Leaf margins have minor serrations visible to the naked eye
- Leaves are subopposite but appear to be whorled
- Leaves are somewhat stiff and brittle
- Leaves are 0.3-0.5 mm wide
- Flowers grow along the leaf axils

Distribution

- Native to Europe
- Has spread rapidly throughout the eastern half of North America
- Currently found in the southern half of Lake Champlain and in several other lakes within the basin, including Waterbury Reservoir



Easily visible serrated edges differentiate this species from other native naiads (VTDEC)

Spread

- Fragmentation is the primary means of spread due to the brittle nature of this plant
- Mass seed production contributes to seed dispersal and overwinter success

References

Crow, G.E. and C.B. Hellquist. *Aquatic and Wetland Plants of Northeastern North America*. Madison, WI: University of Wisconsin Press, 2000.

Curly-leaf pondweed *Potamogeton crispus* L.

This distinct plant can be easily identified by its noticeably wavy leaf edge that has finely toothed serrations. It is a submersed perennial plant, found in freshwater lakes, ponds, rivers, streams, and slightly brackish waters. It is tolerant to low light and low temperatures. This species gets a jump-start on the growing season, growing in the spring and early summer before conditions are favorable for most other species. By mid-July, it begins to die back.

Identification

- Submersed plant
- Alternate leaf arrangement along the stem
- Serrated leaf margin
- Leaf has a wavy edge
- Each leaf is approximately 0.5" wide and 2-3" long

Distribution

- Native to Eurasia, Africa, and Australia
- Introduced to North America in the mid-1800s
- Spread across 48 states
- Present in Lake Champlain and numerous other Vermont water bodies

Spread

- Spreads primarily by hard burr-like winter buds called turions
- A single plant can produce hundreds of turions
- Turions are capable of germinating the following spring
- Seeds are also a means of spread, but far less common
- Seeds mature around June

References

Hellquist, C.B. and G.E. Crow. 1980. *Aquatic Vascular Plants of New England: Part 1. Zosteraceae, Potamogetonaceae, Zannichelliaceae, Najadaceae*. New Hampshire Agricultural Experiment Station, University of New Hampshire, Durham, New Hampshire Station Bulletin 515.

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and Herbicide Use Guide. Volume II: Aquatic Plants and Susceptibility to Herbicides. US Army Engineer Waterways Experiment Station. Technical Report A-88-9.

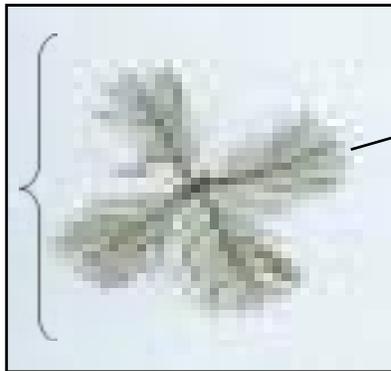
Whitley, James R., Barbara Bassett, Joe G. Dillard, and Rebecca A. Haefner. 1990. *Water Plants for Missouri Ponds*. Missouri Department of Conservation.

Eurasian watermilfoil *Myriophyllum spicatum* L.

Eurasian watermilfoil is a nonnative aquatic plant known for its rapid growth and ability to spread easily, which can lead to significant problems in a water body. It can form dense beds that may impair recreational use, reduce the availability of fish spawning grounds, out-compete beneficial native plants, and otherwise threaten a water body's ecological balance.

Identification

Whorls of typically four featherlike leaves around the stem



A cross sectional view of a whorl of leaves on the stem (VTDEC)

Each leaf is finely divided into 12 - 21 paired leaflets

Additional characteristics:

- Tops of the plant, both stems and leaves, are often red
- Grows in up to 20 feet of water

Distribution

- Introduced to North America in the mid-1900s and now widespread throughout the United States
- Rapid spread aided by its use as an aquarium plant and by the ease with which it is transported through recreational activity
- First identified in St. Albans Bay of Lake Champlain in 1962 and distribution in Vermont has steadily increased since then

Spread

- Reproduces almost exclusively by fragments just a few inches long, which can drift away, sink, develop roots, and grow into new plants
- Fragments occur both naturally and as a result of human activity; within a lake, wind and waves may break plants



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loose; boating activity through dense watermilfoil beds also contributes to fragmentation and spread

References

- Couch, Richard, and E. Nelson. 1985. *Myriophyllum spicatum in North America*. In: Proceedings of the First International Symposium on Watermilfoil and Related Haloragaceae Species. Vancouver, British Columbia, Canada.
- Crow, G.E. and C.B. Hellquist. 1983. *Aquatic Vascular Plants of New England: Part 6*. Trapaceae, Haloragaceae, Hippuridaceae. New Hampshire Agricultural Experiment Station, University of New Hampshire, Durham, New Hampshire. Station Bulletin 524.

European frogbit *Hydrocharis morsus-ranae* L.

This free-floating aquatic plant has a well-developed root system, yet it does not anchor itself in the sediment. It moves around a water body by wind and wave action. As a result, the plant is often found in quiet still waters, such as wetlands and coves. Plants are typically connected together by a runner, creating a dense surface mat.

Identification

- Free-floating plant; roots are not anchored in the sediment
- Small white flowers have three petals just above the water surface
- Round heart-shaped leaf 0.5-2.5” long
- Plants are often connected to each other by underwater runners

Distribution

- Native to Eurasia
- First discovered in Lake Champlain in 1993, it has also been found in several other lakes in Vermont
- Also present in Michigan, New York, and Washington

Spread

- Reproduction during a growing season can occur rapidly by runners
- Individual plants can produce flowers and winter buds that will develop into new plants the following spring
- Due to the free-floating nature of this plant, it can easily become tangled in other plant material and spread to other water bodies



References

- Countryman, W.D. 1978. *Nuisance Aquatic Plants of Lake Champlain*. Lake Champlain Basin Study.
- Hellquist, C.B. *Aquatic Weed Species for Possible Legislation*. Department of Biology. North Adams State College, North Adams, MA.

Spiny waterflea *Bythotrephes longimanus* Leydig

This is a zooplankton (a small crustacean), not a flea. It can cause major changes in the zooplankton community by preying upon other zooplankton. As a result, it directly competes with small fish, and has the potential to alter the overall structure of the ecosystem. It can be found in the upper portion of the water column in small and large lakes. Fishermen are likely to encounter this zooplankton due to masses of individuals becoming tangled on fishing lines and downrigger cables.



Identification

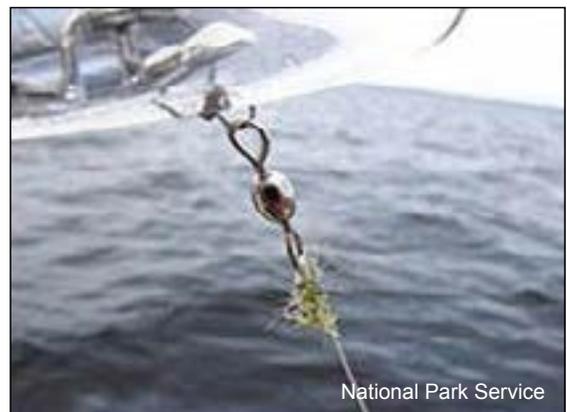
- Less than 0.5" at maturity
- Long barbed tail accounts for 70% of total body length
- Tail can have one to four pairs of barbs

Distribution

- Discovered in Lake Champlain in 2014 and now established throughout the lake.
- Discovered in Lake George (2012) and the Champlain Canal (2012), which are both connected to Lake Champlain
- Infests all of the Great Lakes and many inland lakes in that region
- Native to Northern Europe and Asia

Spread

- Most likely arrived to the Great Lakes through ballast water
- Spread is likely due to contaminated recreational gear, such as bait buckets and fishing line, that was not properly washed or dried out



Starry stonewort

***Nitellopsis obtusa* [Desv.] J. Grove**

A non-native invasive species of large algae in the Characeae or muskgrass family. It is more robust than most members of the family and can grow to over 2 meters tall. This species is found in alkaline waters of shallow to deep lakes and slow-moving streams. Only male starry stonewort exists in the U.S.

Identification

- Submersed perennial
- Branchlets 5-8 per whorl, each with 1-2 long bract cells, giving the branchlet the appearance of being forked
- Often encrusted with lime
- White, 1-2 mm long, star-shaped bulbils produced on colorless rhizoids (bulbils produce a new individual)

Distribution

- Native to Europe and western Asia
- First reported in the St. Lawrence River in 1978, now found in inland lakes throughout Michigan, northern Indiana, western New York, and more recently in Massachusetts, Pennsylvania, Wisconsin and Minnesota
- As of 2015, known only from one location in Lake Memphremagog

Spread

- Fragmentation and star-shaped bulbils

References

Skawinski, P.M. *Aquatic Plants of the Upper Midwest*. WI. 2014



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Variable-leaved watermilfoil
***Myriophyllum heterophyllum* Michx.**

Variable-leaved watermilfoil is a freshwater rooted perennial plant not native to Vermont. Like Eurasian watermilfoil, variable-leaved watermilfoil grows aggressively and rapidly in a wide variety of environmental conditions. Dense growth of variable-leaved watermilfoil can out-compete native aquatic vegetation, resulting in nearly monotypic growth producing an area with reduced habitat value for other species. Thick stands of the plant can impair recreational uses including boating, fishing, and swimming. Variable-leaved watermilfoil is difficult to control once fully established.

Identification

Variable-leaved watermilfoil is a rooted, submersed, perennial aquatic plant. Underwater leaves are finely divided into segments giving them a feather-like appearance.

To identify this species, look for:

- Densely packed whorls of four to six underwater leaves
- Underwater leaves have 7 to 11 paired leaflets
- On more mature plants, blade-like leaves with serrated margins float on the water's surface; flowers develop at the base of these leaves



Distribution

- In October 2008, aquatic biologists at the Agency of Natural Resources confirmed the arrival of this new invasive aquatic plant in Halls Lake, Newbury, Vermont
- The following year, a well established population was found in Missisquoi Bay in Lake Champlain
- Although it is not as well established in Vermont as its close relative Eurasian watermilfoil, future

surveillance and spread prevention measures are critical to impede the further spread of this aggressive plant to other water bodies in Vermont

Spread

- Spread of variable-leaved watermilfoil occurs via stem fragments, winter buds, roots, and, to a lesser extent, seeds
- Plant parts can easily hitchhike on recreational equipment if not removed
- It is also a popular aquarium trade species, therefore unwanted aquarium plants (and animals) should be disposed of where there is no risk of entering a water body

References

Crow, G.E. and C.B. Hellquist. 1983. *Aquatic Vascular Plants of New England: Part 6. Trapaceae, Haloragaceae, Hippuridaceae*. New Hampshire Agricultural Experiment Station, University of New Hampshire, Durham, New Hampshire. Station Bulletin 524.

Gleason, Henry A. and Arthur Cronquist. 1963. *Manual of Vascular Plants of Northeastern United States and Canada*. The New York Botanical Garden.

Whitley, James R., Barbara Bassett, Joe G. Dillard, and Rebecca A. Haefner. 1990. *Water Plants for Missouri Ponds*. Missouri Department of Conservation.

Water chestnut ***Trapa natans* L.**

A dense mat of water chestnut on Lake Champlain (VTDEC)

Water chestnut is one of the few invasive plant species that only reproduces by seed (as opposed to fragmentation, as do variable-leaved and Eurasian watermilfoil). As such, if the plant can be harvested before it drops mature seeds, it can be eradicated. If, however, it becomes established in a water body, it has the potential to rapidly reproduce to form dense surface mats that can crowd out native vegetation, reduce light penetration to plants below, and dramatically alter the natural biology and chemistry of a lake.

During the fall die-off of this annual, decomposition increases the nutrient load and reduces the oxygen level in the water column, which could lead to fish kills. Smaller mats are known to break off and drift with the current creating boating hazards and spreading seeds to other locations. If left unchecked, infestations can severely limit boating, fishing, hunting, swimming, and other recreational activities on the water.

Identification

There are two types of leaves:

- Submerged leaves are feather-like and oppositely paired along the stem
- The floating leaves on the water's surface collectively form a circular rosette; each surface leaf is triangular in shape and has a serrated margin; the petiole of a floating leaf has a bladder-like swelling filled with air and spongy tissue that provides buoyancy
- Plant stems are long and cord-like, and can attain lengths of up to 16 feet

Distribution

- Water chestnut was initially brought to the United States as an ornamental plant in the late nineteenth century and by the 1940's had spread to Lake Champlain
- It currently infests numerous water bodies throughout New England, including Vermont, and New York

Spread

- Water chestnut typically begins to flower in mid-July; the small, inconspicuous, white flowers form in the axils of the surfacing leaves
- Seeds mature approximately one month later, then sink to the sediments below or are carried to new locations by currents; the sticky seeds can also be dispersed as they cling to ropes, to the feathers and webbed feet of wildfowl, and to the fur of animals; seeds generally remain viable for five or more years, although viability of up to 12 years has been reported.



A native mussel smothered by a thick coating of zebra mussels (VTDEC)

References

Countryman, W.D. 1978. *Nuisance Aquatic Plants in Lake Champlain*. Aquatec, Inc.
Florida Department of Natural Resources. 1990. *Florida Prohibited Aquatic Plants*.
Madsen, John D. 1990. *Water chestnut (Trapa natans L.) Research in Watervliet Reservoir – 1989 Report*. Rensselaer Fresh Water Institute. FWI Report #90-8.

Zebra mussels

***Dreissena polymorpha* Pallas**

The zebra mussel is a small freshwater mollusk, native to the Caspian and Black Sea region of Eurasia. Adult zebra mussels attach themselves to firm surfaces with strong hair-like fibers called byssal threads. They can clog the intake pipes of industrial and water facilities, and attach to the hulls, engines, and other submerged parts of moored boats.

Zebra mussels are extremely efficient filter-feeders, consuming large portions of the microscopic plants and animals that form the base of the food web. This feeding has the potential to impact populations of species that depend on the same food source. Additionally, they attach to the shells of native mussels, impeding movement, feeding, and respiration, threatening the survival of native mussel species. Several native mussels are now listed as endangered or threatened in Vermont due to the introduction of zebra mussels.

Identification

- Adult zebra mussels are around one inch in length
- Shell forms the shape of a “D,” with a flat side

- Form dense colonies of up to 700,000 individuals/square meter on firm surfaces

Distribution

- First identified in the United States in 1988 in Lake St. Clair in the Great Lakes region
- Since then, zebra mussels have spread throughout the interconnected waterways in the eastern U.S.
- Confirmed in Lake Champlain during the summer of 1993; adult zebra mussels can now be found throughout much of Lake Champlain and the lower reaches of many of the lake's tributaries
- In 1998 adult zebra mussels were discovered in Lake Bomoseen in Hubbardton and Castleton, Vermont; they have not been found in any other Vermont lakes



Spread

- Each female zebra mussel can lay up to one million eggs during the summer months when water temperatures rise above 50°F
- Fertilized eggs hatch into microscopic juveniles called veligers, which can travel great distances on water currents or when transported on boats and trailers

Asian clam

***Corbicula fluminea* O. F. Müller**

The Asian clam is a freshwater bivalve filter feeder that can be found at the surface of the sediment or slightly buried in sandy areas. They usually dominate the benthic community through dense growth and crowd out native burrowing mussels, resulting in a loss of biodiversity. They can also clog water intake pipes and are associated with promoting an abundance of algae growth.

Identification

- Prominent concentric rings
- Straw yellow on the outside and white on the inside
- Anterior and posterior lateral teeth have many fine serrations

Distribution

- Not yet found in Vermont
- Discovered in Lake George, NY in 2010, which is a part of the Lake Champlain Basin
- Native to temperate and tropical southern Asia, west to the Mediterranean
- Infests many of the major waterways in North America

Spread

- Ability to reproduce rapidly while tolerating a wide range of temperatures (2-30°C)
- Can reproduce through self-fertilization
- Current methods of introduction are through bait buckets, aquarium dumping, and intentional

introduction by individuals that use them as a food item, as well as by water currents and overland transport in bilge or live-well water in boats

Brazilian waterweed
***Egeria densa* Planch.**

This submersed aquatic perennial is typically found in slow moving shallow waters that are somewhat acidic and enriched. It can also be found in lakes, ponds, and rivers. Dense monotypic growth can form beds that out-compete native vegetation, restrict water movement, and interfere with recreational uses of the water.



University of Florida/IFAS Center for Aquatic and Invasive Plants

Identification

- Submersed plant
- Leaves arranged in whorls around the stem
- Typically four leaves per whorl, but can range from three to six
- Leaves entire, linear shape, typically under 1" long
- Small white male flowers rise above the water's surface
- Female flowers have not been reported in North America



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Distribution

- Not yet found in Vermont
- Native to South America
- First recorded in Long Island, New York, in 1893
- Widespread distribution throughout the U.S.

Spread

- As a popular aquarium species, it is thought that careless dumping of aquariums contributes to its movement
- Only male flowers have been found in North America, therefore it is incapable of spreading from seeds; spreads only through fragmentation
- Overwinters primarily from root-crowns

References

Crow, C.E. and Hellquist C.B. 1982. *Aquatic Vascular Plants of New England: Part 4. Juncaginaceae, Scheuchzeriaceae, Butomaceae, Hydrocharitaceae.* University of New Hampshire, Durham, New

Hampshire. Agricultural Experiment.
Station Bulletin 520.

Getsinger, Kurt D. 1991. *Egeria: Biology and Management in Temperate Lakes*. Aquatics. Vol. 13, No. 4.

McCann, James A., Lori N. Arkin, and James D. Williams. 1996. *Nonindigenous Aquatic and Selected Terrestrial Species of Florida: Status, Pathway and Time of Introduction, Present Distribution and Significant Ecological and Economic Effects*.

National Biological Service. *Written Findings of the Washington State Noxious Weed Control Board*. February, 1996.

Fanwort

***Cabomba caroliniana* A. Gray**

A species that is typically found in freshwater lakes, ponds, and slow moving streams, this submersed perennial aquatic plant looks fairly similar to several native species. But unlike most native species, it is extremely persistent and competitive. Dense stands can out-compete native species, clog water flow, and impede recreational and agricultural water use.

Identification

- Mostly a submersed species, it can produce floating leaves as well
- Underwater leaves are opposite along the stem
- Each underwater leaf has a distinct leaf stem (petiole)
- Underwater leaves are branched divided, which create a fan shaped appearance

Distribution

- Not yet found in Vermont
- Native to sub-tropic regions of South America and eastern North America
- Native locations ranging from Virginia to Florida
- Invasive locations are in Massachusetts, Michigan, New Hampshire, New York, Oregon, Pennsylvania, and Washington

Spread

- Spread primarily through fragmentation
- Seeds also contribute to its spread
- As a popular aquarium species, it is thought that careless dumping of aquariums contribute to its movement

References

Crow, G.E. and C.B. Hellquist. 1984. *Aquatic Vascular Plants of New England: Part 7. Cabombaceae, Nymphaeaceae, Nelumbonaceae, and Ceratophyllaceae*.

New Hampshire Agricultural Experiment Station, University of New Hampshire, Durham, New Hampshire. Station Bulletin 527.

Crow, G.E. and C.B. Hellquist. 2000. *Aquatic & Wetland Plants of Northeast North America*. University of Wisconsin Press.

Hanlon, Chuck. 1990. *A Florida Native - Cabomba (Fanwort)*. Aquatics. Vol. 12, No. 4.

Written Findings of the Washington State Noxious Weed Control Board. February, 1996.



Hydrilla

Hydrilla verticillata (L. f.) Royle

Hydrilla is a very aggressive submersed perennial that can produce a heavily branching monotypic bed of plant material. It tolerates a wide range of environmental conditions, including low light, high or low nutrient levels, and temperate or tropical temperatures. As a result, this species is very adaptable and able to out-compete many natives. Impacts of an infestation range from reducing biodiversity to impeding water flow to hindering recreational activity.



University of Florida/IFAS Center for Aquatic and Invasive Plants

Identification

- Typically five leaves per whorl
- Each leaf is visibly serrated
- Distinct tubers and turions are produced

Distribution

- Not yet found in Vermont
- Native to Australia, Asia, and central Africa
- Initially released from the aquarium trade in Florida in the 1950s
- Very problematic in the southeastern United States
- Several populations are now in Connecticut, Maine, Massachusetts, and New York

Spread

- Primarily spread by stem fragments
- Tubers and turions also contribute to potential spread

References

Langeland, K.A. 1990. *Hydrilla: A continuing problem in Florida waters*. Cooperative Extension Service/ Institute of Food and Agricultural Sciences. University of Florida, Gainesville.

Madsen, John D. and C.S. Owens 1996. *Phenological management*. Aquatic Plant Control Research Program. U.S. Army Experiment Station. Vol. A-96-2.



Parrot feather

Myriophyllum aquaticum (Vell.) Verdc.

Parrot feather is a perennial aquatic plant with both submersed and emergent leaves. Stems rarely branch and plants can grow along the banks and shores of water bodies. It tends to grow in slow moving to still waters along muddy banks up to 7 feet of water. Although it has not been a widespread nuisance in North America, Japan and South Africa have reported significant problems with this plant where it has clogged rivers, water supplies, and irrigation channels.



University of Florida/IFAS Center for Aquatic and Invasive Plants

Identification

- 4-6 leaves per whorl around the stem
- Each leaf is finely feather divided
- Submersed leaves are limp and appear decaying
- Emergent leaves are rather stiff with a waxy gray-green color
- Growth along shorelines and in the shallows have stems growing up to a foot above the water level

Distribution

- Not yet found in Vermont
- Native to South America
- Found on every continent (excluding Antarctica) as a result of introductions made through the aquarium/horticultural trade
- Present in Connecticut, New York, and Pennsylvania, and most of the Southeastern U.S.

Spread

- In North America, this plant reproduces exclusively by plant fragments; no seeds are produced here

References

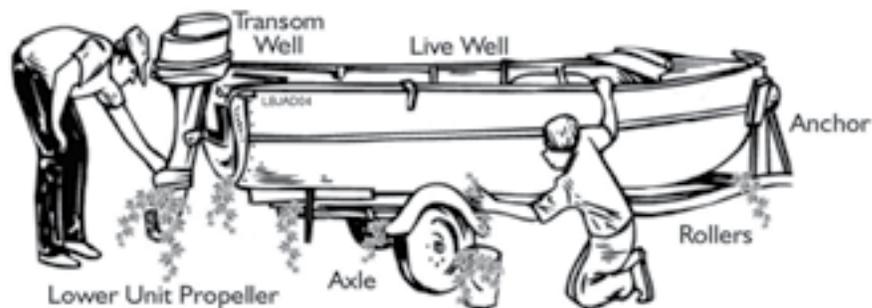
- Nelson, Edward N. and R. W. Couch. 1985. *History of the Introduction and Distribution of Myriophyllum aquaticum in North America*. In: Proceedings of the First International Symposium on Watermilfoil and Related Haloragaceae Species. Vancouver, British Columbia, Canada.
- Sutton, David L. 1985. *Biology and Ecology of Myriophyllum aquaticum*. In: Proceedings of the First International Symposium on Watermilfoil and Related Haloragaceae Species. Vancouver, British Columbia, Canada.

Survey Methods

Spread prevention

Following proper spread prevention protocol is critical to minimizing the spread of aquatic invasive species.

- ❑ **Clean** off mud, all plant material, and any animals from your canoe, kayak, or boat, and associated gear. Dispose of it on dry land. If possible wash your boat and gear with hot, pressurized water.
- ❑ **Drain** boat and equipment away from water.
- ❑ **Dry** thoroughly anything that comes into contact with water.



Equipment checklist

- Boat, paddle, and life-vest
- Map of water body
- Survey data sheet
- Pencil
- Clipboard (optional)
- Dichotomous key or plant guide
- Rake (optional)
- Zip-lock plastic bags (for collecting plant samples)
- Polarized sunglasses (optional)
- View scope (optional)
- Cooler (optional, for keeping plant samples cool)

Conducting your survey

General guidelines

- Surveys are best conducted from July through mid-September when aquatic plant populations are abundant and diverse.
- If possible, conduct surveys on a calm day with minimal boating activity.
- Survey from the shoreline out as deep as plants are growing (or as deep as you can see). You can use a rake to collect plants beyond your arm's reach.
- It is helpful to know the length of your boat, so you can use it to estimate the size of a plant bed.
- Pay particular attention to boat access areas, inlets and outlets, shallow bays, and areas around flow-restriction structures (e.g. dams).

Data sheet instructions

- Complete the top portion of the data sheet, including your name and contact information, the total number of hours spent surveying, the number of surveyors, and their names.
- *Relative Water Level*: Indicate the current water level relative to normal. Vegetation and scour marks on the bank can be good indicators.
- *Water Clarity*: Use the following estimates for the depth of water through which plants are visible – Good (>5 meters), Fair (3 – 5 meters), Poor (<3 meters)
- *Light Conditions*: Given that light conditions (cloud cover) can change in a short period of time, check all conditions that would apply during the time the survey is conducted.
- *Surface Conditions*: Given that surface conditions can change readily, check all conditions that would apply during the time the survey is conducted.
- *Aquatic Invasive Species Survey (Mandatory)*: Please survey for the invasive species listed. Note the letter code (e.g. brittle naiad = BN) of any suspicious species observed, along with the location, approximate size of the plant bed or colony, and any additional comments on a map of the water body. Check the appropriate box regarding plant sample submission, and list the letter codes of suspected species. Follow the guidelines below for handling and submitting a suspicious specimen. If

invasive populations are already established, please note any significant changes in size or location of those populations.

- *New Native Plant Survey* (Optional): If a new native species is observed (a species not on the lake's current plant inventory), list the name, and submit a sample to VTDEC. VTDEC staff will confirm the specimen identity, if possible, and if it is new to the lake, update the plant inventory to reflect this finding.

Handling and submitting a suspicious specimen

If you find a suspicious plant:

- Mark the location on a map, noting any nearby landmarks. If a map for your water body is not available, draw a sketch.
- Do not remove the entire plant from the water. Instead, carefully remove the top half of the plant, including any flowering or fruiting portions if available. If the plant is collected in deep water using a rake, be sure to include any portions with flowers or fruit from what was gathered.
- Wrap the plant fragment in a wet paper towel, then place it in a zip-lock bag. The fragment does not need to be stored in water; it just needs to be moist and cool, so keep it away from direct sunlight.
- Place the bag in a cooler as soon as possible and refrigerate when you get home.
- Report the sighting to VTDEC as soon as possible – call (802) 828-1535.
- Keep plant specimens in refrigerator if collected Thursday – Sunday. Plant samples will degrade if they sit at room temperature over a weekend.
- Mail plant sample(s) to VTDEC Monday – Wednesday only:
 - Make sure the sample is in a moist paper towel in the plastic zip-lock bag.
 - Complete the sample submission form (see *Forms and Data sheets*) and affix it to the zip-lock bag.
 - Write “plant sample” on the mailing envelope.

Mail to the following address:

**ATTN: Plant Sample
VTDEC – Watershed Management Division
1 National Life Drive, Main 2
Montpelier, VT 05620-3522**

If you find a suspicious animal (such as zebra or quagga mussel, Asian clam, spiny waterflea, etc.):

- Mark the location on a map, noting any nearby landmarks. If no map for your waterbody

• **Survey Data Sheet**  con
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Waterbody: _____ Town: _____

Area Surveyed: _____ 

Date: _____ Total Survey Hours: _____ # Surveyors: _____

• Name: _____ iter,

Address: _____ Town: _____ State: _____ Zip: _____

Phone: _____ Email: _____

Additional Surveyor Names: _____

Fc
Su

Relative Water Level (Check one)	Water Clarity (Check one)	Light Conditions (Check all that apply)	Surface Conditions (Check all that apply)
<input type="checkbox"/> Above	<input type="checkbox"/> Good	<input type="checkbox"/> Clear	<input type="checkbox"/> Calm
<input type="checkbox"/> Normal	<input type="checkbox"/> Fair	<input type="checkbox"/> Partly Cloudy	<input type="checkbox"/> Rippled
<input type="checkbox"/> Below	<input type="checkbox"/> Poor	<input type="checkbox"/> Overcast	<input type="checkbox"/> Choppy

Aquatic Invasive Species Survey (Mandatory)

<input checked="" type="checkbox"/> Curly-leaf pondweed (CP) <i>Potamogeton crispus</i>	<input checked="" type="checkbox"/> Brittle naiad (BN) <i>Najas minor</i>	<input checked="" type="checkbox"/> Eurasian watermilfoil (EW) <i>Myriophyllum spicatum</i>	<input checked="" type="checkbox"/> European frogbit (EF) <i>Hydrocharis morsus-ranae</i>
<input checked="" type="checkbox"/> Spiny Water Flea (SWF) <i>Bythotrephes longimanus</i>	<input checked="" type="checkbox"/> Starry stonewort (SS) <i>Najas obscura</i>	<input checked="" type="checkbox"/> Water chestnut (WC) <i>Trapa natans</i>	<input checked="" type="checkbox"/> Variable-leaf watermilfoil (VM) <i>Myriophyllum heterophyllum</i>
<input checked="" type="checkbox"/> Zebra mussel (ZM) <i>Dreissena polymorpha</i>	<input checked="" type="checkbox"/> Asian clam (AC) <i>Corbicula fluminea</i>	<input checked="" type="checkbox"/> Brazilian waterweed (BW) <i>Egeria densa</i>	<input checked="" type="checkbox"/> Fanwort (F) <i>Cabomba caroliniana</i>
<input checked="" type="checkbox"/> Hydrilla (H) <i>Hydrilla verticillata</i>	<input checked="" type="checkbox"/> Parrot feather (PF) <i>Myriophyllum aquaticum</i>	<input checked="" type="checkbox"/> = Found in Vermont	

For new suspicious species observed (please indicate location, approximate size of plant bed or colony, if applicable, and additional comments on map): _____

Sample(s) submitted to Vermont DEC: Yes No If yes, suspected species:

New Native Plant Survey (Optional)

Suspected Species	Sample submitted to VT DEC (Y or N)	Location (please indicate on lake map as well)

Aquatic Plant Sample Submission Form

Keep the sample in a cool place until it is mailed, then mail this completed form with the sample (Monday – Wednesday only) to: ATTN: Plant Sample, VT DEC – Watershed Management Division, 1 National Life Drive, 2 Main, Montpelier, VT 05620-3522. Questions? Call (802) 828-1535.

Are you a: VIP Greeter Other _____

Waterbody Name: _____ Town: _____

Was this sample collected during a boat inspection? **Yes** **No**

If **yes**, name of previously visited waterbody: _____

If **no**, description of the location of collection: _____

Suspected ID: _____ Date Collected: _____

Sa Have you contacted VT DEC? **Yes** **No** If **yes**, with whom did you speak: _____

Your Name: _____ Phone: _____

Email Address: _____

Packaging your sample:

- Please wrap a representative piece (collect 8 – 12 inches of a plant specimen, including any flowers or fruit, if possible) in a wet paper towel and place it into a sealable plastic bag.
- If there is more than one species obtained per waterbody, individually wrap them.
- If there are samples from more than one waterbody, divide the samples into separate plastic bags and clearly mark the different locations on the bags.
- Place the plastic bags in a manila envelope and mail the sample to the address above, or use the mailing label below.



ATTN: Plant Sample

VT DEC – Watershed Management Division

1 National Life Drive, Main 2

Montpelier, VT 05620-3522

Are you a: VIP

Greeter

Other

Additional Resources

How to make an aquatic view scope (a.k.a. the “Stangel Scope”)

Single scope (for use from a kayak or canoe)

Materials

- Clean 5 gallon bucket with lid
- 1 can of flat black spray paint
- Clear, water-proof silicone
- 1/8” plexiglass
- 3/16” screws (1/2” long) with nuts
- 6 washers
- Foam padding (optional)

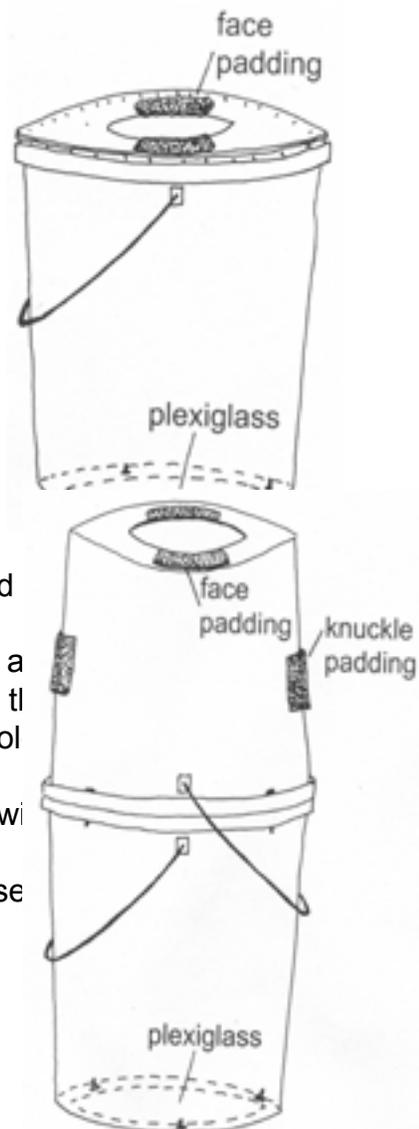
Instructions

1. Make a template of the inside of the bucket, a circle approximately 10 3/8 inch in diameter. Mark three places for holes to be drilled (hole size is 3/16 inch) and template.
2. Cut out the bottom of the bucket, leaving a one inch lip a
3. Drill three holes (that match your template locations) in th
4. Cut a hole in the lid that is half the size of the bottom hol
5. Paint the inside of the bucket and lid black.
6. Fit the plexiglass in the bucket and attach with screws wi
7. Seal plexiglass and screws with silicone.
8. Place lid on and add foam around face hole to make use (optional).

Double scope (for use from a motor boat)

Materials

- The same materials are required except the number



of screws, nuts, and washers needs to be doubled as well as obtaining a second identical bucket.

Instructions

1. Follow the same instructions for the single scope for producing the viewing bucket.
2. Cut a hole in the second bucket that is half the size of the hole in the other bucket (face hole).
3. Place the buckets together with the handles on opposite sides so that you will have a way to hold the scope.
4. Drill three holes in each upper lip of the buckets making sure they are properly aligned in order to screw them together.

Quick reference to Vermont laws pertaining to aquatic invasive species

10 V.S.A. § 1454. TRANSPORT OF AQUATIC PLANTS AND AQUATIC NUISANCE SPECIES

No person shall transport an aquatic plant or aquatic plant part, zebra mussels (*Dreissena polymorpha*), quagga mussels (*Dreissena bugensis*), or other aquatic nuisance species identified by the secretary by rule to or from any Vermont waters on the outside of a vehicle, boat, personal watercraft, trailer, or other equipment. This section shall not restrict proper harvesting or other control activities undertaken for the purpose of eliminating or controlling the growth or propagation of aquatic plants, zebra mussels, quagga mussels, or other aquatic nuisance species.

VERMONT AGENCY OF AGRICULTURE, FOOD & MARKETS QUARANTINE #3 - NOXIOUS WEEDS

Whereas, the Vermont Agency of Agriculture, Food & Markets having found that certain noxious weeds out-compete and displace plants in natural ecosystems and managed lands; and Whereas, competition and displacement of plants by certain noxious weeds has significant environmental, agricultural and economic impacts; and Whereas, it has been determined to be in the best interest of the State of Vermont to regulate the importation, movement, sale, possession, cultivation and / or distribution of certain noxious weeds: Therefore, the State of Vermont is hereby establishing this noxious weed quarantine regulation in order to protect Vermont's environmental and economic resources.

10 V.S.A. § 4616. FELT-SOLED BOOTS AND WADERS; USE PROHIBITED

It is unlawful to use external felt-soled boots or external felt-soled waders in the waters of Vermont, except that a state or federal employee or emergency personnel, including fire, law enforcement, and EMT personnel, may use external felt-soled boots or external felt-soled waders in the discharge of official duties.

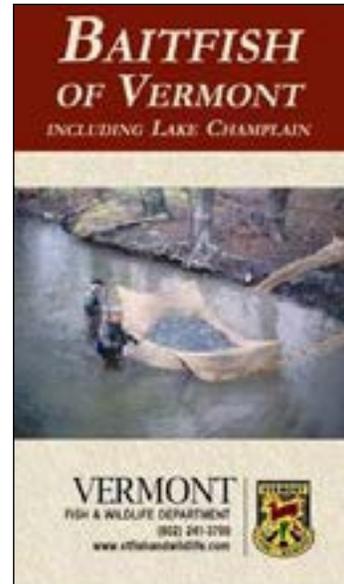
TRANSPORT OF LIVE FISH AND USE OF BAITFISH – SUMMARY OF KEY RULES

Personal Baitfish Harvest:

- Personally harvested baitfish may be used only on the same water body from which they were collected.
- Personally harvested baitfish shall not be transported by motorized vehicle away from the water body from which they were collected.

Commercially Purchased Baitfish:

- A person purchasing baitfish shall retain a transportation receipt issued by a state-approved commercial bait dealer, authorizing transportation of baitfish overland by motorized vehicle. Greeters do not have the power to demand proof of the transportation receipt - only a law enforcement official may do so.
- A transportation receipt shall be valid for 96 hours from time and date of sale.
- Anglers shall not transport baitfish away from state waters by motorized vehicle. Unwanted baitfish shall be discarded dead in the water, on the ice, or safely disposed of in the trash.
- Anglers may purchase baitfish from a New York bait shop for use on Lake Champlain only, provided the bait shop is Vermont-licensed, and the baitfish is accompanied by a Vermont-issued baitfish transportation receipt. Likewise, anglers may purchase baitfish from a New Hampshire bait shop for use on the Connecticut River and its setbacks only, provided the bait shop is Vermont-licensed, and the baitfish are accompanied by a Vermont-issued baitfish transportation receipt.



Cover page for the Baitfish of Vermont Identification Guide. A digital copy can be found at the VTF&W website.

Contacts

***Vermont Aquatic Invasive Species Program
Aquatic Nuisance Control Grant-in-Aid Grant Program
Vermont Invasive Patrollers***

Ann Bove

Email: ann.bove@vermont.gov

Phone: (802) 490-6120

Website: <http://dec.vermont.gov/watershed/lakes-ponds/aquatic-invasives/monitoring/vips>

Vermont Boat Access Greeter Program

Josh Mulhollem

Email: josh.mulhollem@vermont.gov

Phone: (802) 490-6121

Website: <http://dec.vermont.gov/watershed/lakes-ponds/aquatic-invasives/spread-prevention/greeters>

Aquatic Nuisance Control Permit Program

Misha Cetner

Email: Misha.Cetner@vermont.gov

Phone: (802) 490-6133

Website: <http://dec.vermont.gov/watershed/lakes-ponds/permit/control>

Aquatic Invasive Species Management
Lakes and Ponds Management and Protection Section
Department of Environmental Conservation
Watershed Management Division
1 National Life Drive, Main 2, Montpelier, VT 05620-3522
Phone: (802) 828-1535
Fax: (802) 828-1544
dec.vermont.gov/watershed/lakes-ponds

The Vermont Department of Environmental Conservation is an equal opportunity agency and offers all persons the benefits of participation in each of its programs and competing in all areas of employment regardless of race, color, religion, sex, national origin, age, disability, sexual preference, or other non-merit factors.

This document is available upon request in large print, Braille, or audio cassette.

VT Relay Service for the Hearing Impaired 1-800-253-0191 TDD>Voice – 1-800-253-0195 Voice>TDD