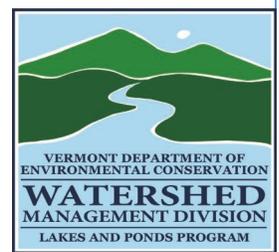


*V*ermont  
*I*nvasive   
*P*atrollers



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# Vermont Invasive Patrollers Program

## Overview

The Vermont Invasive Patrollers (VIP) program was established by the Vermont Department of Environmental Conservation (VTDEC) in 2007 to focus on early detection of all known and potential aquatic invasive species (AIS). 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.



## Program Goals

Through hands-on workshops, lakeshore residents and lake users learn what aquatic invasive species are, how to prevent the spread of AIS, and how to identify the species that pose the greatest threats to Vermont lakes and ponds. Workshop participants are encouraged to survey a body of water regularly, and check in with VTDEC. As such, the VIP program has three primary goals:

1. To increase AIS knowledge of lakeshore residents and lake users.
2. To create an early detection volunteer network with a primary focus on aquatic invasive species, including plants and animals.
3. To increase VTDEC's knowledge of new infestations and the spread of AIS 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 submit samples or photos of unknown native species for positive identification to VTDEC staff.
- Attend a workshop or participate in a practice survey with VTDEC staff at least once every 3 years.

### VTDEC staff 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.
- Identify submitted samples and inform VIP of species.

# 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.

Aquatic Invasive Plant Species (As of 2019)		# Vermont Waterbodies Species is Located
Brittle naiad	<i>Najas minor</i>	10
Curly-leaf pondweed	<i>Potamogeton crispus</i>	37
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>	103
European frogbit	<i>Hydrocharis morsus-ranae</i>	13
Starry stonewort	<i>Nitellopsis obtusa</i>	2
Variable-leaf watermilfoil	<i>Myriophyllum heterophyllum</i>	3
Water chestnut	<i>Trapa natans</i>	33
Aquatic Invasive Animal Species		
Asian clam	<i>Corbicula fluminea</i>	1
Spiny waterflea	<i>Bythotrephes longimanus</i>	1
Zebra mussel	<i>Dreissena polymorpha</i>	3

Aquatic Invasive Plant Species		Neighboring States Species is Located
Brazilian waterweed	<i>Egeria densa</i>	CT, NH, NY, MA
Fanwort	<i>Cabomba caroliniana</i>	CT, NH, NY, MA, ME
Hydrilla	<i>Hydrilla verticillata</i>	CT, NY, MA, ME
Parrot feather	<i>Myriophyllum aquaticum</i>	CT, NY, MA



## Brittle naiad *Najas minor*

There are several naiad species in Vermont, but only one that is invasive. Brittle naiad prefers primarily alkaline waters of streams, ponds, and lakes and is tolerant of eutrophic conditions and high turbidity. The plant stems and parts are very brittle and fragments easily, attributing to its spread. This plant can be differentiated from its native relatives by its easily visible serrations along the leaf margin.

### Identification

- Submersed annual plant
- Leaf margins have minor serrations visible to the naked eye
- Leaves appear opposite, but are not quite aligned
- Leaves are often recurved, stiff and bristly
- Leaves are 0.3-0.5 mm wide, finely pointed
- Flowers grow along the leaf axils
- Fragments easily when handled

### Distribution

- Native to South America
- 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

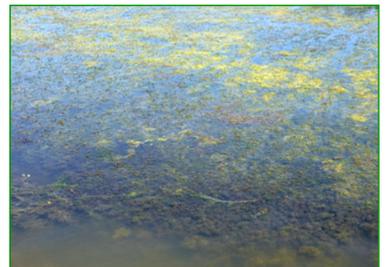
### Spread

- 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



**Quick ID Guide**

- ✓ Visibly serrated edges
- ✓ Stiff brillo pad-like feel



### Similar Native Species



#### Slender naiad *Najas flexilis*

Leaves are paired with hard-to-see serrations

#### Northern naiad *Najas gracillima*

Leaves are opposite with hard-to-see serrations



**Curly-leaf pondweed *Potamogeton crispus***

Curly-leaf pondweed is a distinct plant that is 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 jumpstart 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, no floating leaves
- **Alternate leaf arrangement along the stem**
- **Serrated leaf margin**
- **Leaf has a wavy curling edge and a blunt tip**
- Each leaf is approximately 0.5" wide and 2-3" long



**Quick ID Guide**

- ✓ Visibly serrated edges
- ✓ Lasagna-like leaf edges

**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



**Similar Native Species**

**Clasping-leaf pondweed *Potamogeton richardsonii***

- ✓ Wavy edged leaves come to a sharp point
- ✓ Smooth edges (no serrations) along leaves



**Fern pondweed *Potamogeton robbinsii***

- ✓ Finely serrated edges along leaves
- ✓ Frondlike two ranked leaves





## Eurasian watermilfoil *Myriophyllum spicatum*

Eurasian watermilfoil is one of eight watermilfoil species in Vermont and six of these are native and very similar in appearance. Therefore, the best manner to identify the species is to observe a segment of a whorled leaf, and count the leaf divisions. Its ability to survive throughout cold temperatures provides a quick growth start in spring.

### Identification

- Submersed though often branches near surface
- **Whorls of 4-6 finely divided, featherlike leaves**
- **Each leaf contains 12 - 21 leaflets along the stem**
- Bottlebrush appearance underwater
- Grows in up to 20 feet of water



### Distribution

- Native to Europe and Asia
- Introduced to North America in the mid-1900s and has spread 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 its distribution in Vermont steadily increased since then

### Spread

- Reproduces almost exclusively by fragments which can drift, sink, develop roots, and grow into new plants
- Fragments can occur both naturally and as a result of human activity - within a lake, wind and waves may break plants loose; and boating activity through dense watermilfoil beds also contributes to fragmentation and spread

### Quick ID Guide

- ✓ 12-21 leaflets
- ✓ Limp when out of water
- ✓ Red-tipped in spring and fall



### Similar Native Species

#### Northern watermilfoil *Myriophyllum sibiricum*

- ✓ Normally is smaller in growth overall
- ✓ Has between 5 and 15 leaflets
- ✓ Plant remains stiff out of water



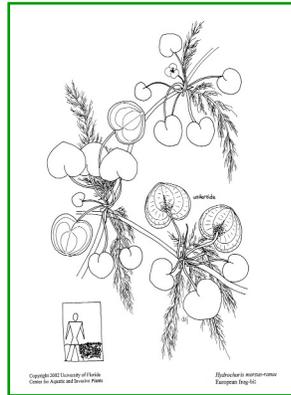


## European frogbit *Hydrocharis morsus-ranae*

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 perennial; 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, **purplish underside**
- Plants are often connected to each other by irregular underwater runners



### Quick ID Guide

- ✓ Free floating kidney shaped leaves with purple-red underside
- ✓ Small white flower with three petals

### Distribution

- Native to Eurasia and Africa
- 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



### Similar Native Species

#### Little floating heart *Nymphoides cordata*

- ✓ Small heart-shaped leaves
- ✓ Delicate white flower, five petals
- ✓ Each stem produces a single leaf
- ✓ A whorl of tuberous roots resemble a banana-like bunch





## Starry stonewort *Nitellopsis obtusa*

Starry stonewort is 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, often encrusted with lime deposits
- **Branchlets 5-8 per whorl, each with 1-2 long bracts**, giving the branchlet the appearance of being forked
- **White, star-shaped bulbils**, 1-2 mm long, produced on colorless rhizoids



### Quick ID Guide

- ✓ Visibly serrated edges
- ✓ Stiff brillo pad-like feel
- ✓ White star-shaped bulbil

### Distribution

- Native to Europe and western Asia
- First reported in the St. Lawrence River in 1978, now found in lakes throughout Michigan, northern Indiana, western New York, and more recently in Massachusetts, Pennsylvania, Wisconsin and Minnesota
- As of 2018, the only locations in Vermont are Lake Memphremagog and Lake Derby



### Spread

- Fragmentation
- Star-shaped bulbils are seed-like in that they are the reproductive vegetative material



### Similar Native Species

#### Muskgrass *Chara globularis*

- ✓ Skunky odor
- ✓ Dark green, ridged stems that are rough to the touch

#### Nitella sp.

- ✓ Smooth, green translucent branches





## Variable-leaf watermilfoil *Myriophyllum heterophyllum*

Variable-leaf watermilfoil is a freshwater rooted perennial plant not native to Vermont. Like Eurasian watermilfoil, variable-leaf watermilfoil grows aggressively and rapidly in a wide variety of environmental conditions. It is a rooted plant that can grow in water up to five meters deep. When left on land it develops “terrestrial morphs”, which look like small trees, to allow the plant to survive out of water.



### Identification

- Rooted, submersed, perennial aquatic plant
- Underwater leaves are finely divided into segments giving them a feather-like appearance
- **Densely packed whorls of 4-6 leaves with 7 to 11 paired leaflets**
- On more mature plants, blade-like leaves with serrated edges appear above the water’s surface; flowers develop at the base of these emergent leaves forming a stiff spike

### Quick ID Guide

- ✓ **Bottle brush** appearance
- ✓ Feather-like leaves in a whorl around the stem

### Distribution

- Native to Southeast US, non-native in New England
- In October 2008, VTDEC confirmed presence in Halls Lake, Newbury
- The following year, a well established population was found in Missisquoi and South bays in Lake Champlain



### Spread

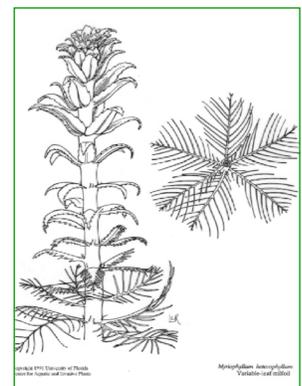
- Spread of variable-leaved watermilfoil occurs via stem fragments, winter buds, roots, and, to a lesser extent, seeds
- Plant parts can easily hitchhike on recreational equipment if not removed
- It is also a popular aquarium trade species



### Similar Native Species

#### Northern watermilfoil *Myriophyllum sibiricum*

- ✓ Normally is smaller in growth overall
- ✓ Leaflets number 5-15
- ✓ Plant remains stiff out of water





## Water chestnut *Trapa natans*

Water chestnut is one of the few invasive plant species that only reproduces by seed (as opposed to fragmentation). If the plant is harvested before it drops mature seeds, it can be eradicated. However, if it becomes established in a water body, it rapidly reproduces. Water chestnut grows on and below the water's surface, but is not a rooted aquatic plant. It thrives at the water's edge, making it a nuisance at boat launches.

### Identification

There are two types of leaves:

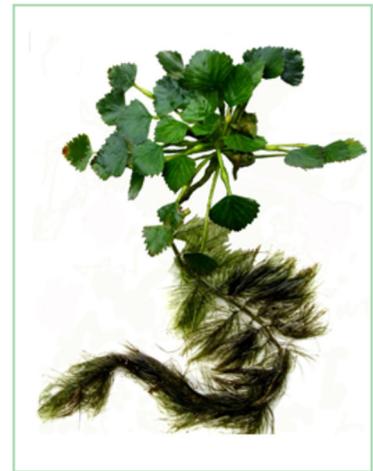
- Submerged leaves are feather-like and oppositely paired along the stem
- The floating leaves on the water's surface collectively form a **circular rosette**; each surface leaf is triangular in shape and has a serrated margin; the petiole of a floating leaf has a bladder-like swelling filled with air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

### Distribution

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

### Spread

- After maturing if left unharvested, seeds drop to the sediment bottom or are carried to new locations by currents where they remain viable for five or more years, although viability of up to 12 years has been reported. The velcro-like seeds can also be dispersed as they cling to ropes, to feathers and webbed feet of wildfowl, and to the fur of animals



#### Quick ID Guide

- ✓ Floating circular rosette of **triangular leaves**
- ✓ Leaves have serrated margin
- ✓ Submerged leaves are feather-like



#### Similar Native Species

There are no native species that resemble Water chestnut



## Watch List

### Brazilian waterweed *Egeria densa*

Brazilian waterweed is impressively much larger than native look-alikes. Attributing to its species name, the leaves on the top grow densely around the stem. 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, where it can grow in waters up to 6.5 meters deep. can



#### Identification

- Submersed plant
- Leaves arranged in whorls around the stem
- Short internodes give the plant a full appearance
- Typically **4 leaves per whorl**, but can range from 3-6
- **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

#### Distribution

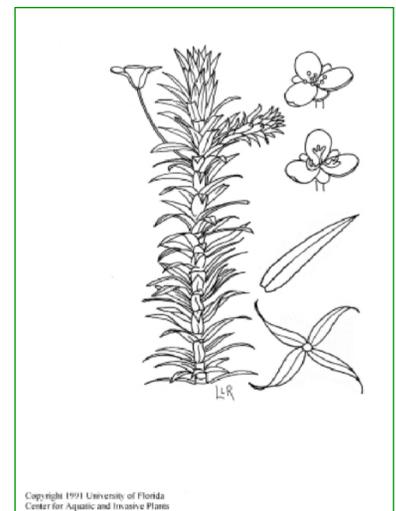
- Not yet found in Vermont
- Native to South America
- First recorded in Long Island, New York in 1893
- Widespread distribution throughout the U.S.

#### 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

#### Quick ID Guide

- ✓ **Leaves arranged in whorls of 4-6**
- ✓ **Blade shaped leaves are 1-3cm long and finely serrated**
- ✓ **Short internodes**



#### Similar Native Species

##### Common waterweed *Elodea canadensis*

- ✓ Leaves are more firm and stouter than slender waterweed, blunt tip, strictly whorls of 3 leaves, very fine serrations



##### Slender waterweed *Elodea nutallii*

- ✓ Leaves are less firm and longer than common waterweed, strictly whorls of 3 leaves, very fine serrations



## Watch List

### Carolina fanwort *Cabomba caroliniana*

Carolina fanwort is a perennial aquatic plant that looks fairly similar to several native species though the double fan-like submersed leaves are an instant identifier. More closely related to Water shield (*Brasenia schreberi*), it shares the characteristic mucous covering of the Cabombaceae Family. This species that is typically found in freshwater lakes, ponds, and slow moving streams.

#### Identification

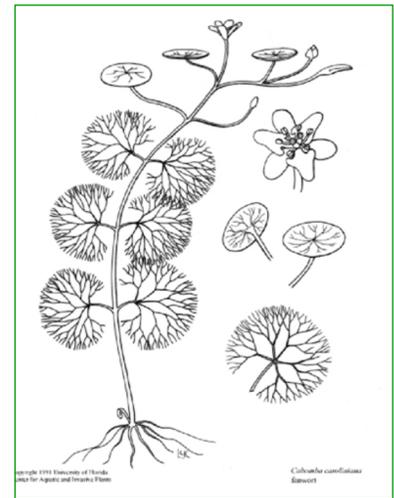
- Mostly a submersed species, also produces floating leaves
- Underwater leaves are branched divided and opposite along the stem which creates a **fan shaped appearance**
- Each underwater leaf has a distinct leaf stem (petiole)
- White flower with 6 petals

#### 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



#### Quick ID Guide

- ✓ Finely divided **fan shaped** submersed leaves
- ✓ White flower

#### Similar Native Species

##### Water marigold *Bidens beckii*

- ✓ Underwater leaves are whorled around the stem
- ✓ Yellow flower with 6 petals





## Watch List

### Hydrilla *Hydrilla verticillata*

Hydrilla is characteristically similar to another Watch List species, Brazilian waterweed (*Egeria densa*) as both contain whorled, finely-serrated leaves growing around the stem. One of the most invasive species internationally, it tolerates a wide range of environmental conditions, including low light, high or low nutrient levels, and temperate or tropical temperatures.



#### Identification

- Submersed perennial
- Typically **5-8 leaves per whorl**
- Each strap-like leaf is **visibly serrated**
- Pointed tip on leaf
- Distinct tubers and turions are produced



**Quick ID Guide**  
 ✓ 5-8 leaves per whorl  
 ✓ Serrated edges

#### 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 and overwintering potential

#### Similar Native Species

##### Common waterweed *Elodea canadensis*

- ✓ 3 (rarely 4) leaves per whorl
- ✓ Leaves entire, no serrations, blunt tip on leaf

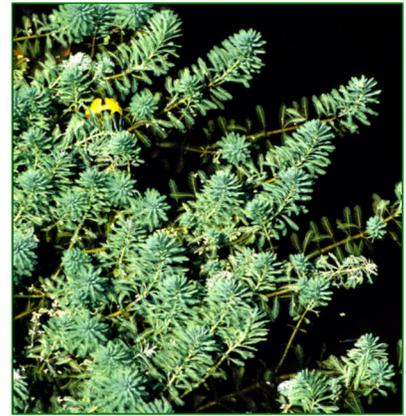




## Watch List

### Parrot feather *Myriophyllum aquaticum*

Parrot feather is a perennial aquatic plant with both submersed and emergent leaves. When emergent, the plant's growth may appear like small fir trees or club mosses. 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.



#### Identification

- 4-6 leaves per whorl around the stem
- Each leaf is finely 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

#### Quick ID Guide

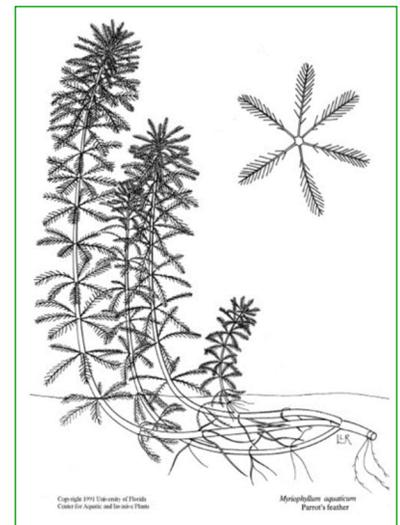
- ✓ 4-6 feather-like leaves whorled around stem
- ✓ Grows above water level

#### 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
- 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



#### Similar Native Species

##### Water-mermaid

*Proserpinaca palustris*

- ✓ 2 distinct leaf types, both alternate
- ✓ Submersed leaves divided, feather-like; emergent leaves lance shaped with serrations



## Helpful Resources

### Aquatic Invasive Species Guides

Borman, Susan, and Robert Korth, and Jo Temte. 2014. *Through the Looking Glass: A Field Guide to Aquatic Plants*. 2nd ed. Wisconsin Lakes Partnership. University of Wisconsin-Extension Lakes, College of Natural Resources, Stevens Point, Wisconsin. Reindl Printing Inc., Merrill, WI.

Maine Volunteer Lake Monitoring Program. 2007. *Maine Field Guide to Invasive Aquatic Plants and Their Common Native Look Alikes*. Maine Center for Invasive Aquatic Plants, Auburn, Maine. J.S. McCarthy Printers, Augusta Maine.

Skawinski, M. Paul. 2018. *Aquatic Plants of the Upper Midwest*. 3rd ed. Wisconsin, USA.

### Websites

USGS Nonindigenous Aquatic Species <https://nas.er.usgs.gov/>  
Lists known threats of nonindigenous species, their characteristics, known locations, maps, and species profile.

Vermont Department of Environmental Conservation Aquatic Invasives Species  
<http://dec.vermont.gov/watershed/lakes-ponds/aquatic-invasives>  
Provides information on the aquatic invasive species found in and threatening Vermont. The page also provides information on the monitoring and surveying, a map of locations where AIS are found, VIPs, and information on the Vermont Public Access Greeter Program.

Vermont Invasives <https://www.vtinvasives.org/gallery-of-aquatic-invasives>  
Provides information on all invasive species found in and threatening Vermont. Gallery of Invasives contains information on the regulations, species, impacts, resource hub, and how to slow the spread.

### Contacts

#### ***Vermont Aquatic Invasive Species Management Program***

Kimberly Jensen  
Kimberly.jensen@vermont.gov  
(802) 490-6120

#### ***Vermont Aquatic Nuisance Control Permit Program***

<http://dec.vermont.gov/watershed/lakes-ponds/permit/control/aquatic-nuisance-control>  
(802) 828-1535



## Asian clam *Corbicula fluminea*

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

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

### Distribution

- Native to temperate and tropical southern Asia, west to the Mediterranean
- Discovered in Lake George, NY in 2010, which is a part of the Lake Champlain Basin
- In 2016, VTDEC confirmed the arrival of this species in Lake Bomoseen
- 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

### Similar Native Species

#### European fingernail clam *Sphaerium corneum*

- ✓ Oval shaped and flatter in comparison
- ✓ Less prominent rings, smooth to the touch
- ✓ Shells are thin and brittle, easy to fracture



## Spiny waterflea *Bythotrephes longimanus*

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

- Native to Northern Europe and Asia
- 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

### 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





## Zebra mussels *Dreissena polymorpha*

The zebra mussel is a small freshwater mollusk. Adult zebra mussels attach themselves to firm surfaces with strong hair-like fibers called byssal threads. Extremely efficient filter-feeders, they consume large portions of microscopic life that forms the base of the food web. This 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, respiration, and threaten 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

- Native to southern Russia and the Ukraine
- First identified in the United States in 1988 in Lake St. Clair in the Great Lakes region
- Since then, they have spread throughout the interconnected waterways in the eastern U.S.
- Confirmed in Lake Champlain in 1993; since then they have been found throughout much of Lake Champlain and the lower reaches of many of the lake’s tributaries
- In 1998, they were discovered in Lake Bomoseen in Hubbardton and Castleton, Vermont; they have not been found in any other Vermont lakes

### Spread

- Each female 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

# Spread Prevention



## Stop the spread of aquatic invasive species! **Clean. Drain. Dry.**

- Clean** off mud, all plant material, and any animals from your kayak, including the rudder, hull, cockpit, and hatches, and associated gear. Dispose of it on dry land. If possible, wash kayak and gear with pressurized water.
- Drain** your hatches and cockpit away from water.
- Dry** anything that comes into contact with water.

For more information, visit:  
[www.watershedmanagement.vt.gov/lakes.htm](http://www.watershedmanagement.vt.gov/lakes.htm)



## Completing a VIP Plant Survey

VIPs who take the time to complete a plant survey provide a helpful service to the community, lake association, and Vermont as a whole. The information that is collected is used to inform if and where AIS are found, and how the AIS might be or is spreading. Most importantly the surveyors information provides a baseline of information for VTDEC scientists to use to discuss with lake managers on what methods might be best to pursue to manage future threats.

### Conducting a 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).

### Survey Equipment Checklist

<input type="checkbox"/> Boat, paddle, and life-vest	<input type="checkbox"/> Map of water body
<input type="checkbox"/> Survey data sheet	<input type="checkbox"/> Pencil and/or marker
<input type="checkbox"/> Magnifying lens	<input type="checkbox"/> White tray for samples
<input type="checkbox"/> Pocket knife or scissors	<input type="checkbox"/> Aquatic Plant Guide
<input type="checkbox"/> Clipboard (optional)	<input type="checkbox"/> View Scope (optional)
<input type="checkbox"/> Rake (optional)	<input type="checkbox"/> Zip-lock plastic bags (for plant samples)
<input type="checkbox"/> Polarized sunglasses (optional)	<input type="checkbox"/> Cooler (optional, for keeping plant samples)

## Vermont Invasive Patroller Survey Data Sheet



Waterbody: \_\_\_\_\_ Town: \_\_\_\_\_  
 Area Surveyed: \_\_\_\_\_  
 Latitude/Longitude (If possible): \_\_\_\_\_ Map with Location? \_\_\_\_\_  
 Survey Date: \_\_\_\_\_ Total Survey Hours: \_\_\_\_\_ # Surveyors: \_\_\_\_\_  
 Name: \_\_\_\_\_  
 Street Address: \_\_\_\_\_ Town: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
 Phone: \_\_\_\_\_ Email: \_\_\_\_\_  
 Additional Surveyor Names: \_\_\_\_\_

**Water Conditions:**

Relative Water Level (Check one)	Water Clarity (Check one)	Light Conditions (Check all that apply)	Surface Conditions (Check all that apply)
<input type="checkbox"/> High	<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"/> Low	<input type="checkbox"/> Poor	<input type="checkbox"/> Overcast	<input type="checkbox"/> Choppy

**Survey of Aquatic Invasive Species:**

*Please check the box for species that were already known to exist in the waterbody and observed during the survey.*

<b>Aquatic Plants</b>	<input type="checkbox"/> Brittle naiad (BN)	<input type="checkbox"/> Curly-leaf pondweed (CLP)	<input type="checkbox"/> Eurasian watermilfoil (EW)
<input type="checkbox"/> European frogbit (EF)	<input type="checkbox"/> Starry stonewort (SS)	<input type="checkbox"/> Water chestnut (WC)	<input type="checkbox"/> Variable-leaf watermilfoil (VLM)
<b>Aquatic Animals</b>	<input type="checkbox"/> Asian clam (AC)	<input type="checkbox"/> Spiny waterflea (SWF)	<input type="checkbox"/> Zebra mussel (ZM)
<b>Watch List</b>			
<input type="checkbox"/> Hydrilla (H)	<input type="checkbox"/> Brazilian waterweed (BW)	<input type="checkbox"/> Fanwort (F)	<input type="checkbox"/> Parrot feather (PF)

*Please note if the species has reduced or expanded its location:* \_\_\_\_\_

**New Suspicious Species Observed?** - Indicate location (lat/long), approximate size of plant bed or colony, if applicable,

Native or Invasive Species Submission - Request for Confirmation	Sample Submitted to VT DEC (Y or N)	Location (indicate on Map of lake)
1a. Name:		
1b. Identifiable Features:		
2a. Name:		
2b. Identifiable Features:		
3a. Name:		
3b. Identifiable Features:		

## VIP Survey 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.
- *Latitude/Longitude or Map:* If a map was used as a reference to indicate plant locations, please copy and send with this form. If plants were identified in particular locations (Lat/Long) note these on the map or on the form.
- *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.
- If a plant is submitted for review, check the appropriate box regarding plant sample submission, and list the letter code in the name if applicable.
- Follow the directions when submitting a specimen submission form (see *next page*). Make sure the sample is in a moist paper towel in the plastic zip-lock bag.
- 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.

## Aquatic Specimen Submission Form

Keep the sample in a cool place until it is mailed, then follow the directions below to mail this completed form with the sample (Monday – Wednesday only) at the address below. Questions? Call (802) 828-1535.

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

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Email Address: \_\_\_\_\_

Are you a:  VIP  Greeter  Other **Waterbody:** \_\_\_\_\_ **Town:** \_\_\_\_\_

If a Greeter, was this sample collected during a boat inspection?  Yes  No

If **yes**, name of previously visited water body: \_\_\_\_\_

If **no**, description of the location of collection: \_\_\_\_\_

Suspected Species ID: \_\_\_\_\_ Date Collected: \_\_\_\_\_

Have you contacted VTDEC?  Yes  No If **yes**, with whom did you speak: \_\_\_\_\_

### Sample Packaging Directions:

- 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 water body, 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: Aquatic Specimen**

VTDEC – Watershed Management Division

1 National Life Drive, Main 2

Montpelier, VT 05620-3522

Are you a:  VIP  Greeter  Other

## Handling and Submitting an Aquatic Specimen

### If you find a suspicious plant:

- Mark the location on a map, noting any nearby landmarks. If a map for your waterbody 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:

### If you find a suspicious animal:

- Mark the location on a map, noting any nearby landmarks. If a map for your waterbody is not available, draw a sketch.
- For mussels, collect two or three animals in a zip-lock bag. Place in freezer upon return home. Alternatively, mussels can simply be removed from the bag and placed in a safe place where they can air dry. Call VTDEC to report the finding and await further instructions. Do not mail suspected zebra or quagga mussels without first consulting VTDEC.
- If you suspect spiny waterflea, collect specimens in a small container of water, refrigerate, and notify VTDEC as soon as possible.
- 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.

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## Quick Reference to Vermont Laws for 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.

### 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.

<b>List of Vermont water bodies known with an aquatic invasive species</b>  Updated January 2018	Key:											
	AL - alewife						SS - starry stonewort					
	AC - Asian clam						SWF - spiny waterflea					
	BN - brittle naiad						VLM - variable-leaved watermilfoil					
	CLP - curly-leaf pondweed						WC - water chestnut					
	EF - European frogbit						ZM - zebra mussel					
	EWM - Eurasian watermilfoil											
	These species are considered the most problematic in Vermont											
Water body	Town	AL	AC	BN	CLP	EF	EWM	SWF	SS	VLM	WC	ZM
Arrowhead Mountain Lake	Milton						X					
Austin Pond	Hubbardton						X					
Beaver Pond	Proctor						X					
Beaver Wetland	Mendon						X					
Beebe Pond	Hubbardton				X		X					
Berlin Pond	Berlin						X					
Big Marsh Slough	Highgate					X	X			X	X	
Black Pond	Hubbardton				X		X					
Black River	Springfield						X					
Blissville Wetland Pond	Blissville										X	
Bomoseen, Lake	Castleton		X	X	X	X	X				X	X
Broad Brook	Vernon						X					
Brookside Pond	Orwell					X					X	
Brownington Pond	Brownington						X					
Bullis Pond	Franklin				X						X	
Burr Pond	Sudbury				X		X					
Cabot Clark Marsh	Highgate										X	
Carmi, Lake	Franklin	X			X		X					
Castleton River	Castleton						X					
Cedar Lake	Monkton						X					
Champlain, Lake - Burlington Bay		X			X		X	X				X
Champlain, Lake - Isle LaMotte		X			X	X	X	X				X
Champlain, Lake - Main Lake		X			X	X	X	X			X	X
Champlain, Lake - Mallets Bay		X			X		X	X				X
Champlain, Lake - Missisquoi Bay		X			X	X	X			X	X	X
Champlain, Lake - Northeast Arm		X			X		X	X				X
Champlain, Lake - Otter Creek		X			X	X	X	X			X	X
Champlain, Lake - Port Henry		X			X	X	X	X			X	X
Champlain, Lake - Shelburne Bay		X			X	X	X	X				X
Champlain, Lake - South Lake		X		X	X	X	X	X		X	X	X
Champlain, Lake - St. Albans Bay		X			X	X	X	X			X	X
Chipman Pond	Tinmouth						X					
Clay Brook	Warren						X					
Clyde Pond	Derby						X					
Coggman Creek											X	
Coggman Pond	West Haven				X		X				X	
Connecticut River	Brattleboro			X							X	
Connecticut River, Herricks Cove	Rockingham						X					
Connecticut River, Hoyts Landing	Springfield				X		X					
Connecticut River, TransCanada launch	Concord						X					
Connecticut River, Wilder Dam	Hartford						X					
Cranberry Pool	Highgate				X	X					X	
Crystal Lake	Barton						X					
Daniels Pond	Glover				X							
Dead Creek	Ferrisburgh										X	
Dead Creek	Highgate						X				X	

Water body	Town	AL	AC	BN	CLP	EF	EWM	SWF	SS	VLM	WC	ZM
Derby Lake	Derby						X		X			
Deweys Mill Pond	Hartford						X					
Dunmore, Lake	Salisbury						X					
East Creek	Orwell										X	
Echo Lake	Hubbardton						X					
Eligo, Lake	Greensboro						X					
Elmore, Lake	Elmore						X					
Fairfield Pond	Fairfield				X		X					
Fairfield Swamp Pond	Fairfield						X					
Fairlee, Lake	Thetford						X					
Fern Lake	Leicester			X	X		X					
Forest Lake	Calais				X							
Frog Pond	Orwell						X					
Gale Meadows Pond	Londonderry						X					
Glen Lake	Castleton				X		X					
Great Hosmer Pond	Craftsbury						X					
Half Moon Pond	Hubbardton				X							
Halls Lake	Newbury						X			X		
Hinkum Pond	Sudbury						X					
Horton Pond	Benson			X	X						X	
Hortonia, Lake	Hubbardton			X	X	X	X					
Hough Pond	Sudbury				X		X					
Indian Brook Reservoir	Essex						X					
Iroquois, Lake	Hinesburg				X		X					
Kent Pond	Killington						X					
Lake Memphremagog	Newport Town				X		X		X			
Lamoille River	Milton						X					
LaPlatte River	Shelburne				X	X	X					
Leicester River	Salisbury						X					
Lemon Fair River	Orwell										X	
Lewis Creek	Ferrisburgh						X					
Lily Pond	Poultney				X		X				X	
Line Pond	Barnard						X					
Little Pond	Wells				X		X				X	
Long Pond	Eden						X					
Lower Pond	Hinesburg					X	X					
McCabes Brook	Shelburne						X					
Metcalfe Pond	Fletcher						X					
Mill Pond	Windsor						X					
Mill Pond (Parson's Mill)	Benson						X				X	
Mill River	St. Albans					X						
Missisquoi River	Highgate						X					
Morey outlet brook	Fairlee						X					
Morey, Lake	Fairlee						X					
North Hartland Reservoir	Hartland						X					
North Montpelier Pond	East Montpelier						X					
North Springfield Reservoir	Springfield						X				X	
Old Marsh	Fair Haven				X							
Ompompanoosuc River	Norwich						X					
Otter Creek	Ferrisburgh						X				X	
Paran, Lake	Bennington				X		X				X	
Pelkeys Swamp	Benson					X	X				X	
Phillips	Benson			X	X						X	
Pinneo, Lake	Hartford						X					

Water body	Town	AL	AC	BN	CLP	EF	EWM	SWF	SS	VLM	WC	ZM
Porter Lake	Ferrisburgh				X		X				X	
Poultney River	Poultney						X					
private pond	Arlington						X					
private pond	Hinesburg						X					
private pond	St. Albans						X					
Rescue, Lake	Ludlow						X					
Richville Pond	Shoreham				X		X				X	
Rock River	Highgate					X	X				X	
Root Pond	Benson				X						X	
Round Pond	Newbury						X					
Rutland City Reservoir	Rutland Town						X					
Sadawga Pond	Whitingham				X		X					
Salem Lake	Derby						X					
Shadow Lake	Glover						X					
Shaftsbury	Shaftsbury										X	
Shelburne Pond	Shelburne				X	X	X					
Singing Wetland	Bennington				X		X				X	
Spectacle Pond	Brighton			X								
St. Catherine, Lake	Wells	X			X		X				X	
Star Lake	Mount Holly						X					
Stevens Brook	Maidstone						X					
Stoughton Pond	Weathersfield						X					
Sunrise Lake	Benson						X					
Sunset Lake	Benson			X	X		X					
Ticklenaked Pond	Ryegate						X					
Vergennes Watershed (Norton Brook)	Bristol						X					
Waterbury Reservoir	Waterbury			X								
West River	Brattleboro						X					
Whitney Creek	Addison						X				X	
Williams River	Rockingham						X					
Willoughby, Lake	Westmore						X					
Winona, Lake	Bristol					X	X					
Winooski River	Colchester						X					

Species	Total Number of Water Bodies
AL - alewife	3
AC - Asian clam	1
BN - brittle naiad	10
CLP - curly-leaf pondweed	35
EF - European frogbit	13
EWM - Eurasian watermilfoil	103
SS - Starry Stonewort	2
SWF -spiny water flea	1
VLM - variable-leaved watermilfoil	3
WC - water chestnut	32
ZM - zebra mussel	2

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](http://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