

Aquatic Invasive Species Identification



July 2021



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Vermont Invasive Patrollers

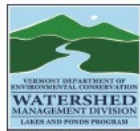


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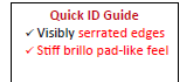
A Brittle naiad *Najas minor*

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



Quick ID Guide
 ✓ Visibly serrated edges
 ✓ Stiff brillo pad-like feel

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



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



Aquatic Invasive Species of Concern

In Vermont

- Brittle naiad
- Curly-leaf pondweed
- Eurasian watermilfoil
- European frogbit
- Starry stonewort
- Variable-leaved watermilfoil
- Water chestnut

- Asian clam
- Spiny waterflea
- Zebra, quagga mussel

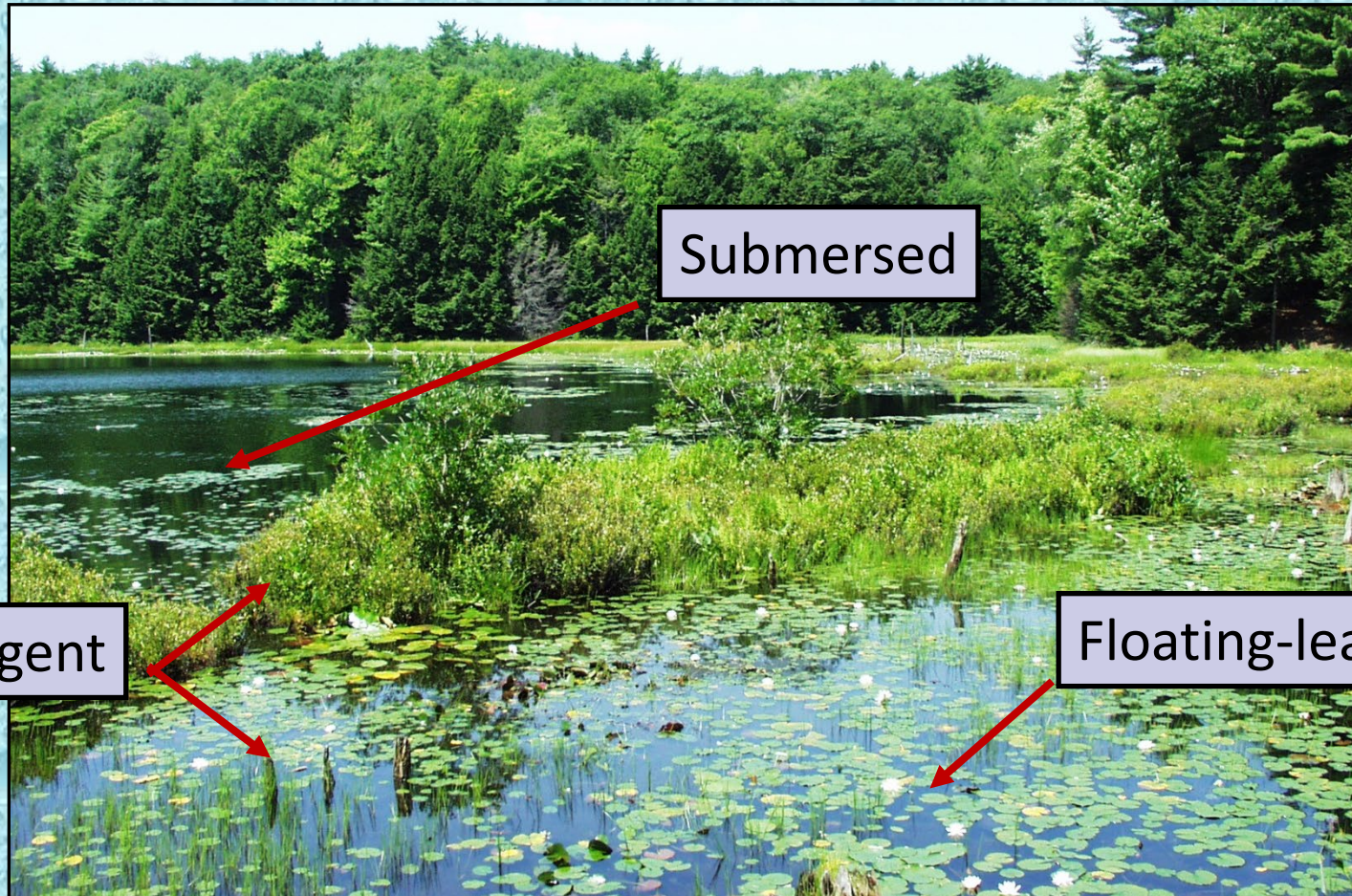


In Neighboring States

- Brazilian elodea
- Fanwort
- Hydrilla
- Parrot feather

Aquatic Plants – Identifying Characteristics

Aquatic plants are grouped into *three* general types:



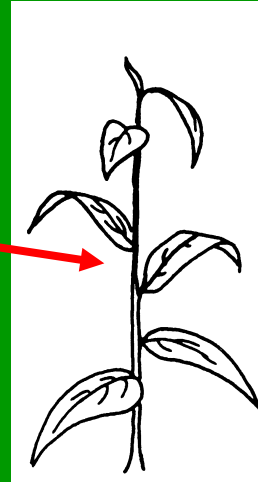
How is the leaf arranged on the stem?

Leaves emerge from a single point near the bottom

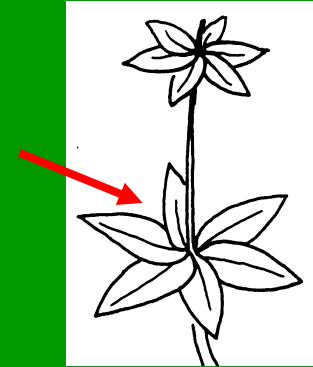


Basal

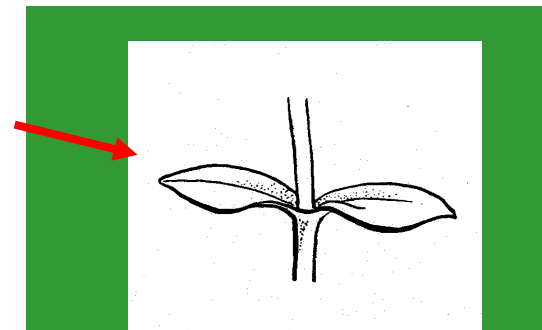
Leaves attached to a stem



Alternate

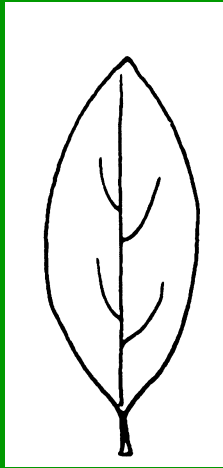


Whorled

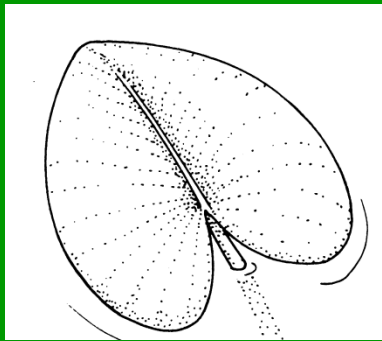


Opposite - Pairs

Elliptical

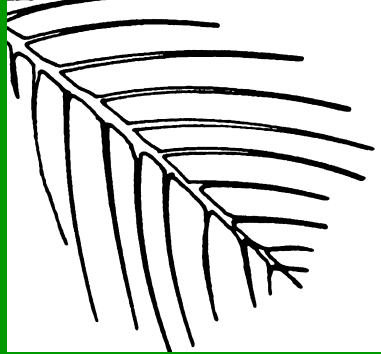


"ENTIRE"

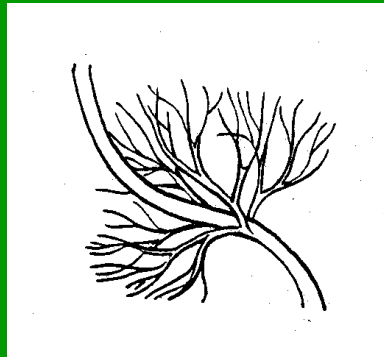


Heart Shaped

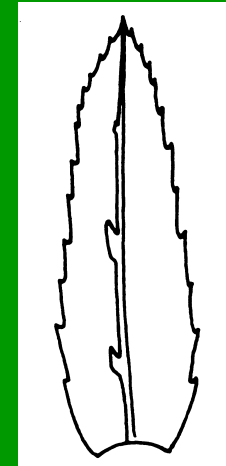
**How are the
leaves shaped?**



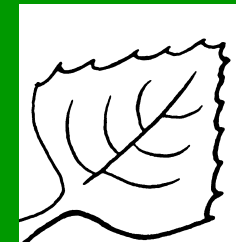
"DISSECTED"



Lance shaped

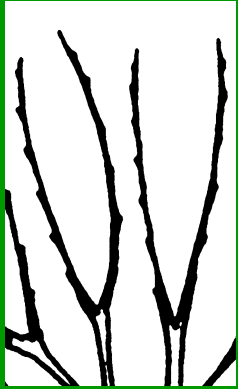


"TOOTHED"
or
"SERRATED"

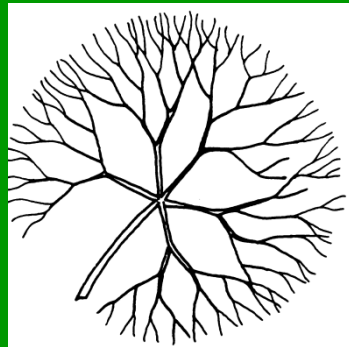


Triangular

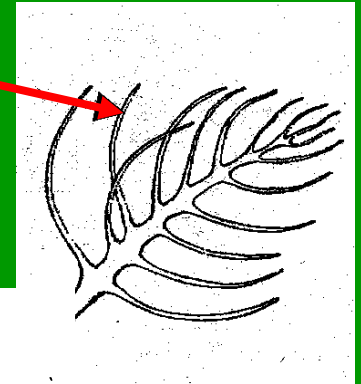
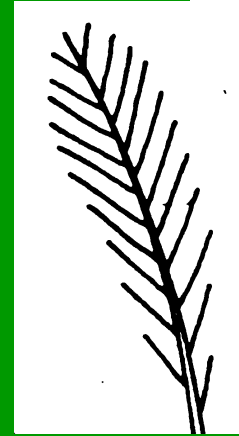
Dissected Leaf Patterns



Forked



Branched



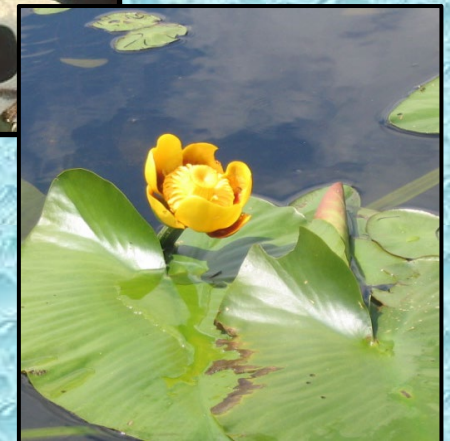
*Feather
Dissected*

Other Plant ID Characteristics

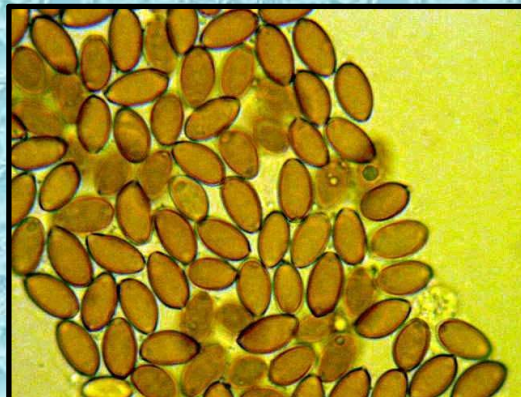
Roots



Flowers



Seeds



Eurasian watermilfoil (*Myriophyllum spicatum*)

- Rooted, perennial native to Europe/Asia.
- Confirmed: 67 lakes or ponds and 30 other water bodies (one new in 2016 and 2017)



Eurasian watermilfoil

reddish tips

inconspicuous flowers

Flower stalk

leaf

leaflet, 12+ pairs

feather-dissected, whorled leaves



Variable-leaved watermilfoil (*Myriophyllum heterophyllum*)

- Rooted, perennial, native to southern U.S. and Europe.
- Confirmed: Lake Champlain (2011) and Halls Lake (2008)
- Also confirmed: CT, MA, ME, NH, NY.

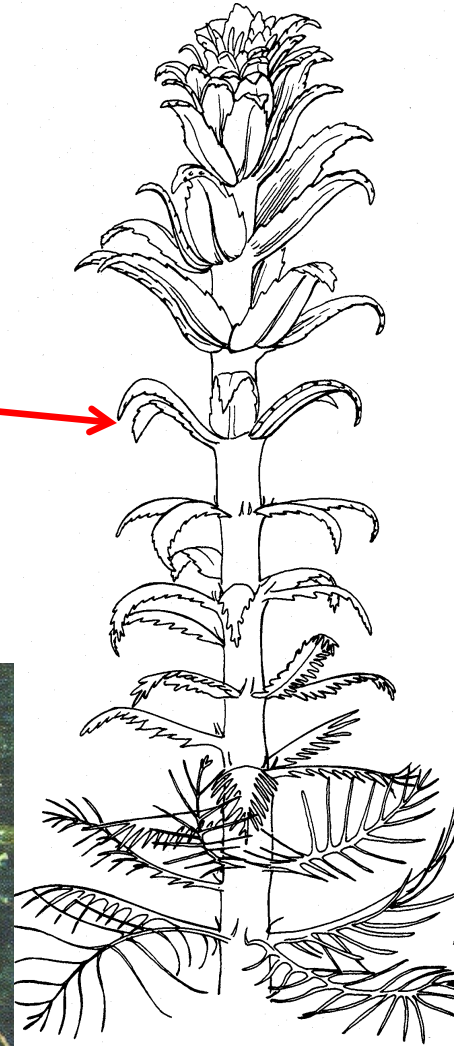
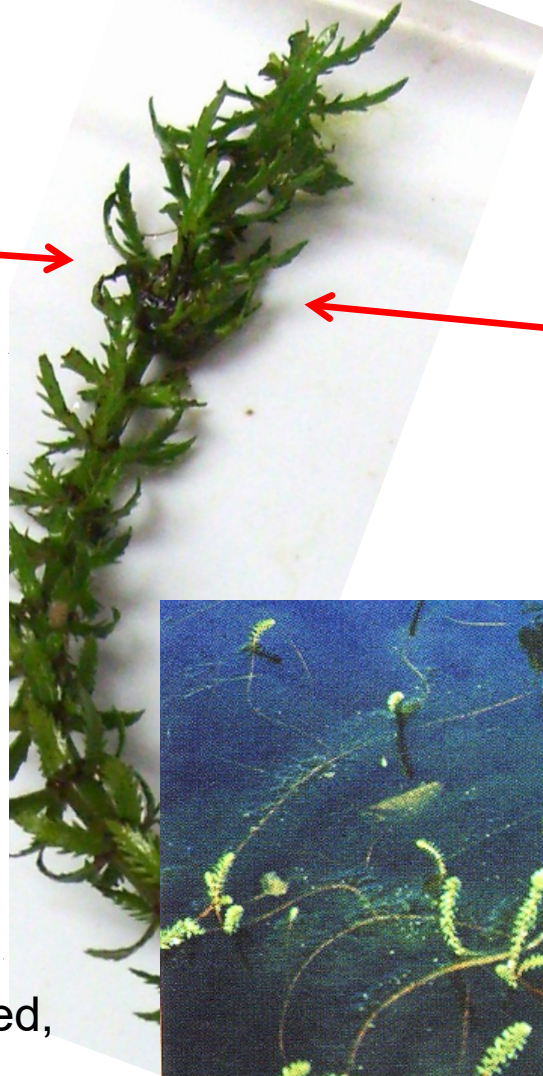
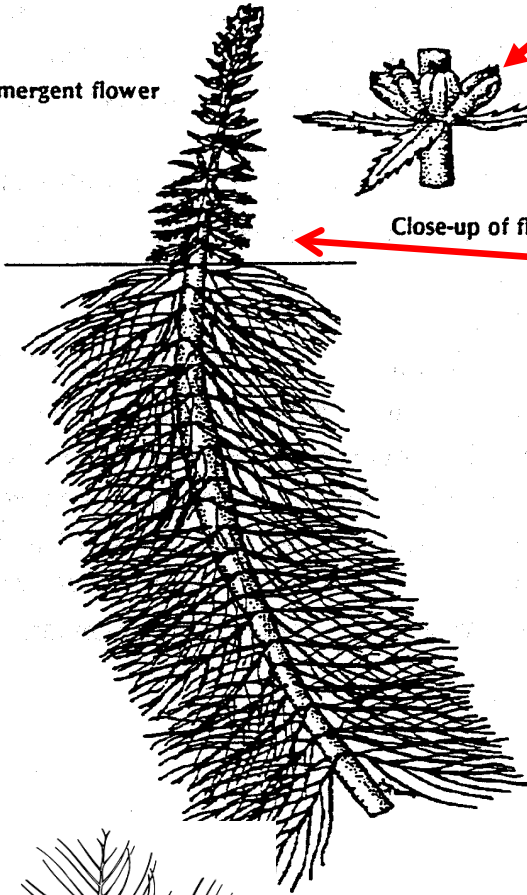


Variable-leaved watermilfoil

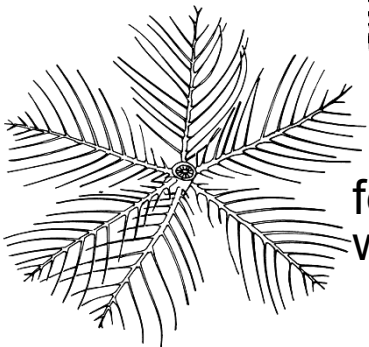
Emergent flower



Close-up of flower



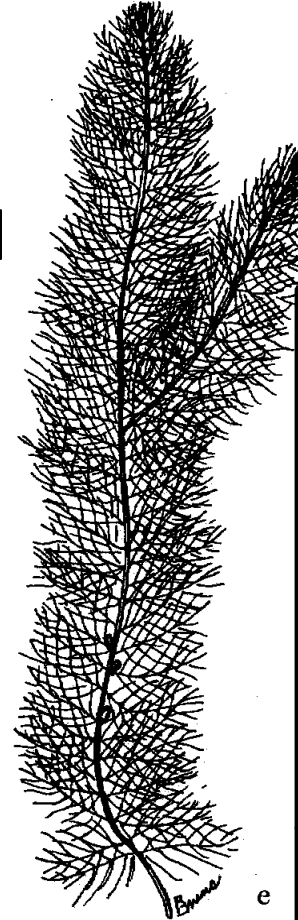
feather-dissected,
whorled leaves



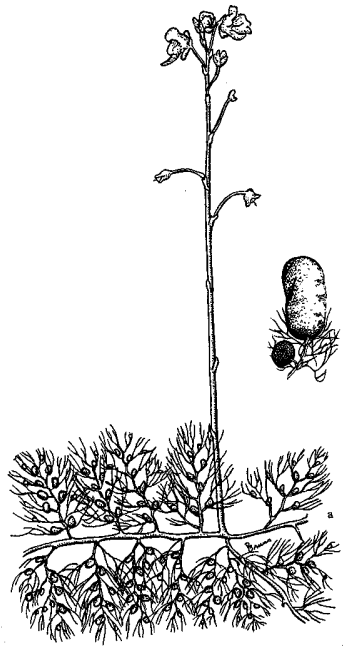
Vermont's Native Watermilfoils

Feather-dissected, Whorled or Alternate leaves

- ☺ Alternate flower watermilfoil
- ☺ Farwell's watermilfoil
- ☺ Low watermilfoil
- ☺ Northern watermilfoil
- ☺ Slender watermilfoil
- ☺ Whorled watermilfoil

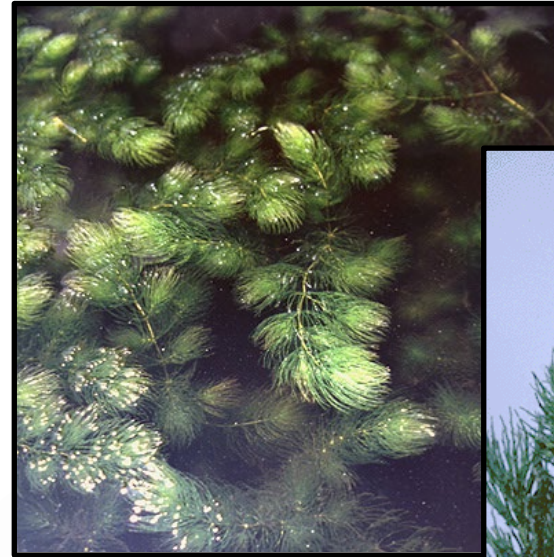


Native Submersed Look-a-likes to watermilfoils



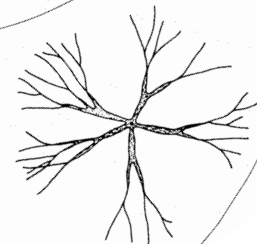
Bladderworts
(*Utricularia* sp.)

branch-dissected,
alternate leaves



Coontail
(*Ceratophyllum* sp.)

forked-dissected,
whorled leaves

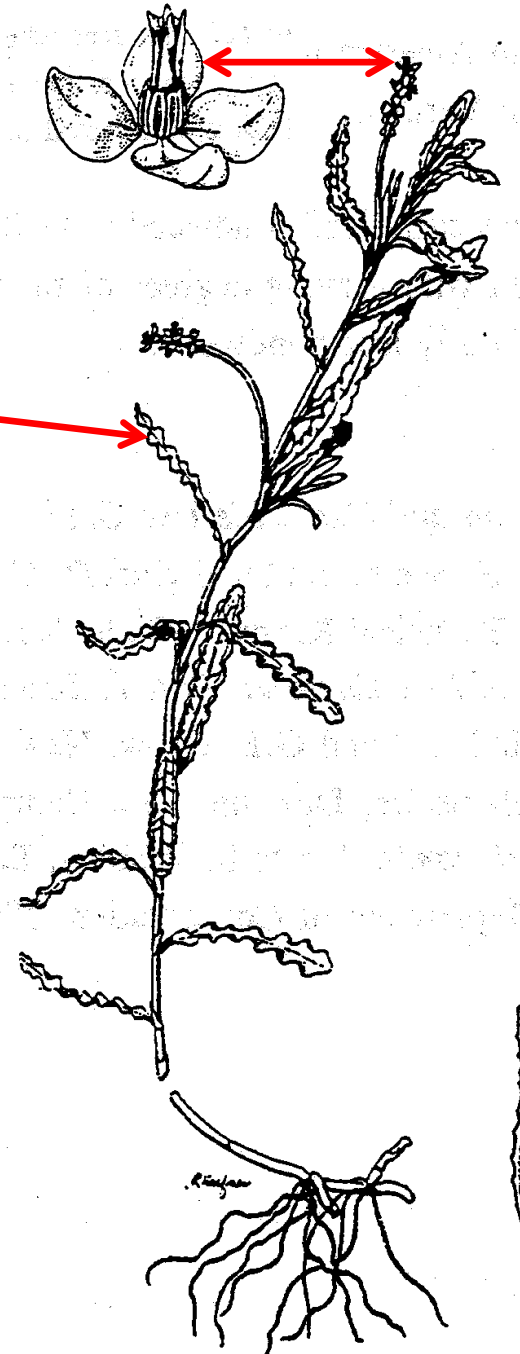


Curly leaf Pondweed (*Potamogeton crispus*)

- Rooted, perennial, native to Europe.
- Member of large family of diverse aquatic plants, only *invasive* member.
- Confirmed: numerous VT water bodies



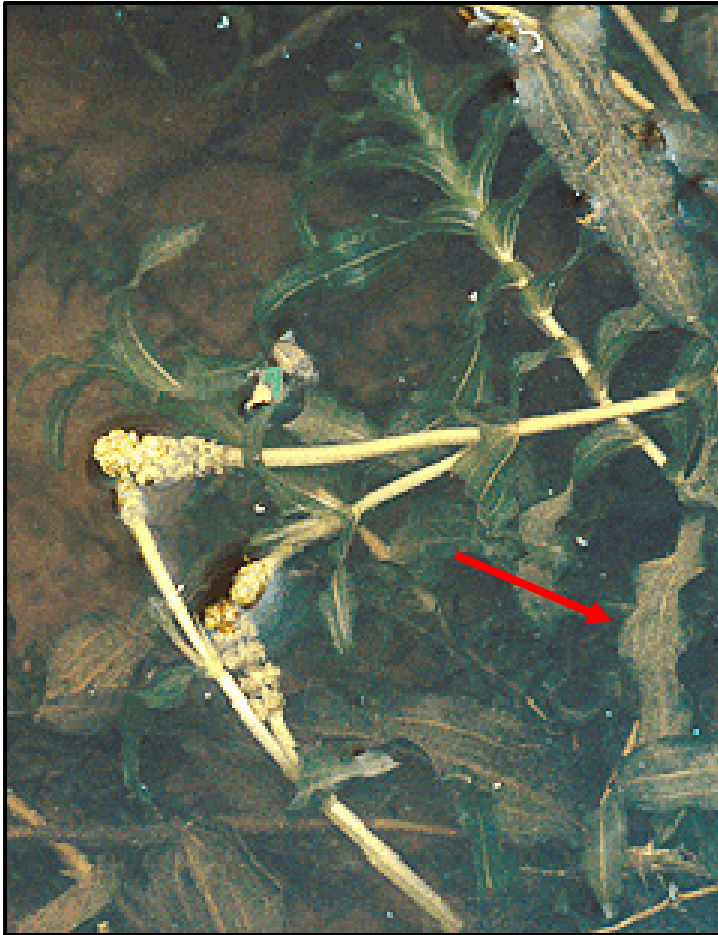
Curly leaf pondweed



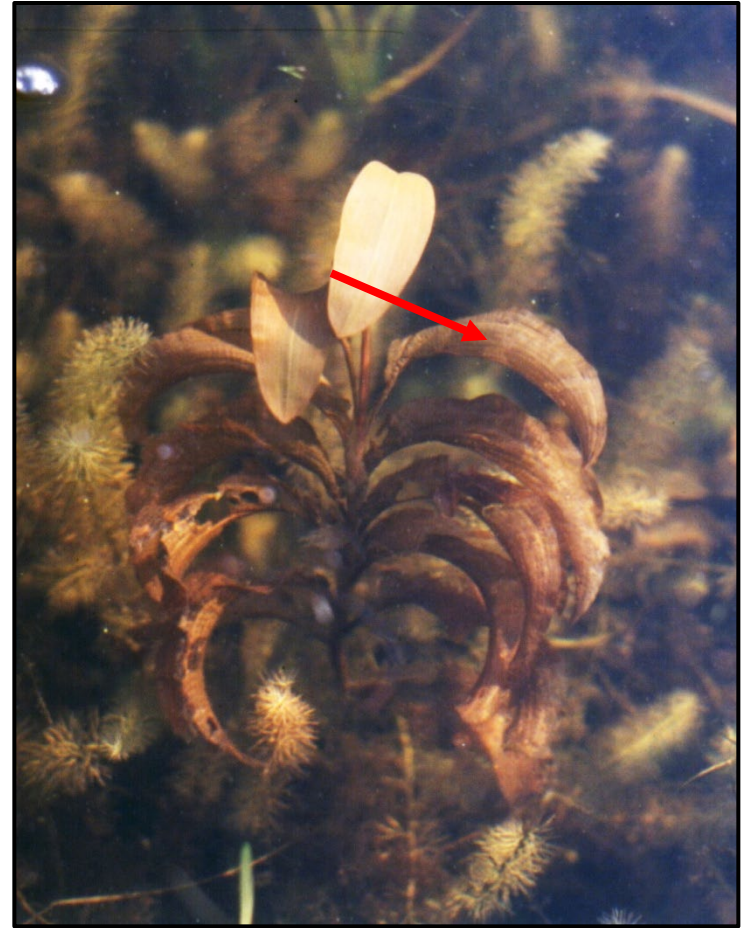
Lance shaped, serrated leaf

Native Submersed Look-a-likes to Curly leaf pondweed

Pondweeds (*Potamogeton* spp.)



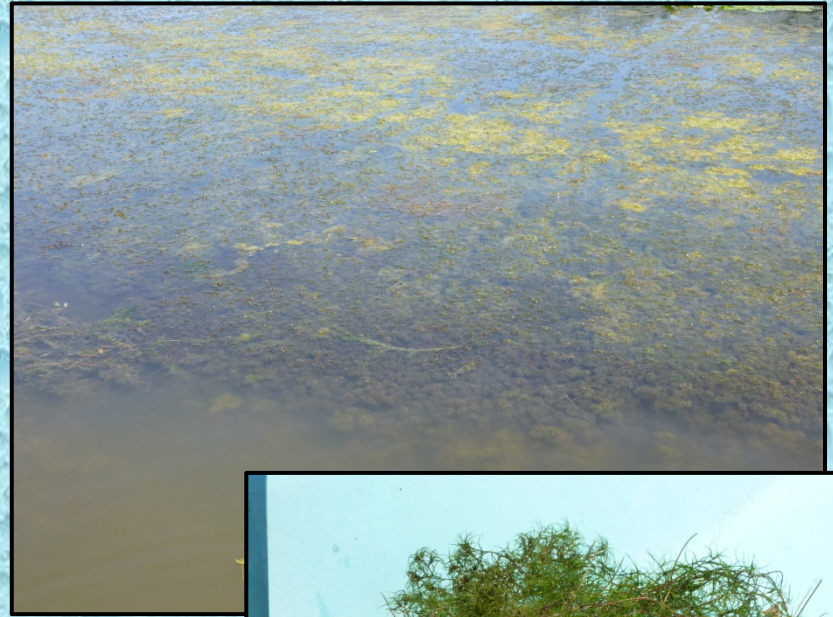
Clasping-leaf pondweed
(*Potamogeton perfoliatus*)

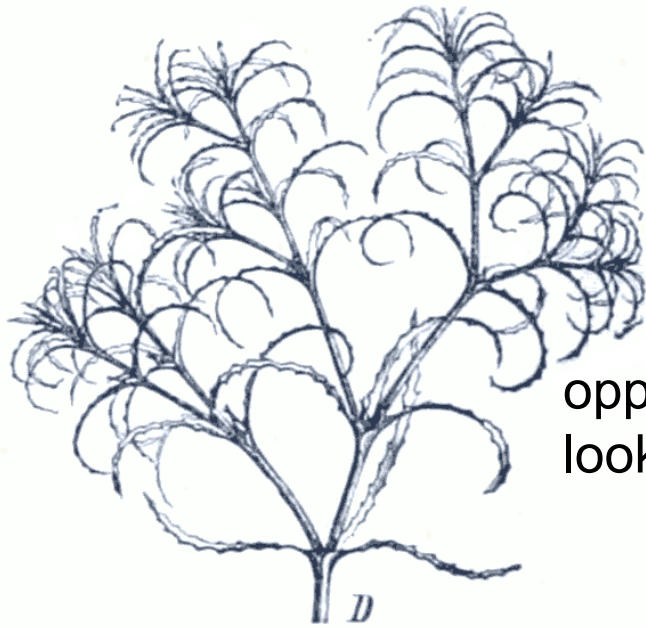


Big-leaf pondweed
(*Potamogeton amplifolius*)

Brittle naiad (*Najas minor*)

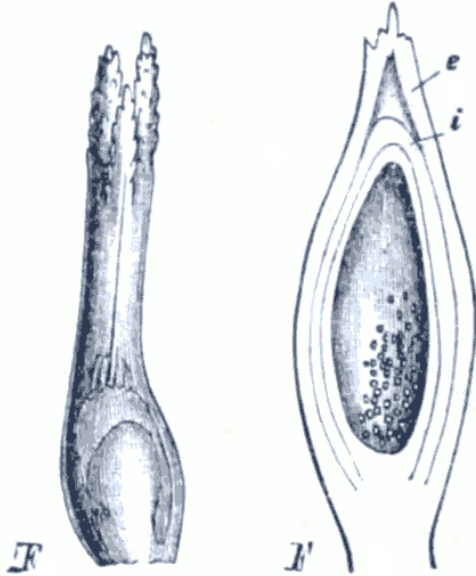
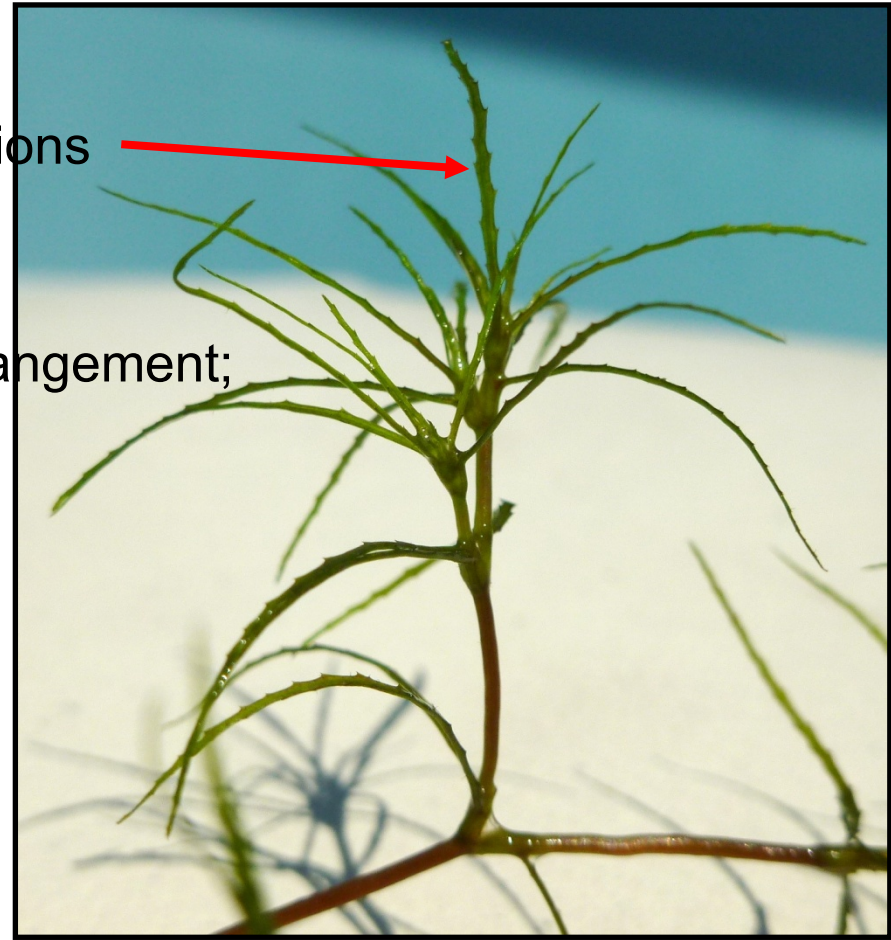
- Weakly rooted, annual, native to southeast U.S. and South America.
- Confirmed: Lake Champlain, Sunset Lake, Sunrise Lake, Waterbury Reservoir
- Also confirmed: CT, MA, ME, NH, NY





minor serrations

opposite leaf arrangement;
looks whorled



seeds in leaf axils – where leaf attaches to
the stem

Native Submersed Look-a-likes

Brittle naiad – Native naiads

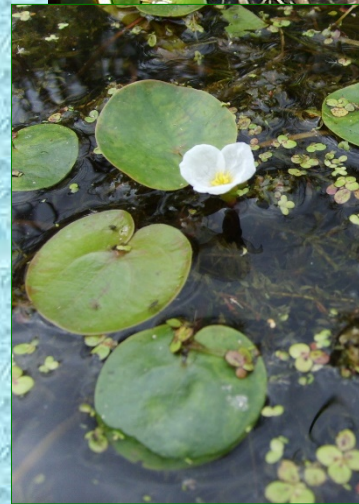


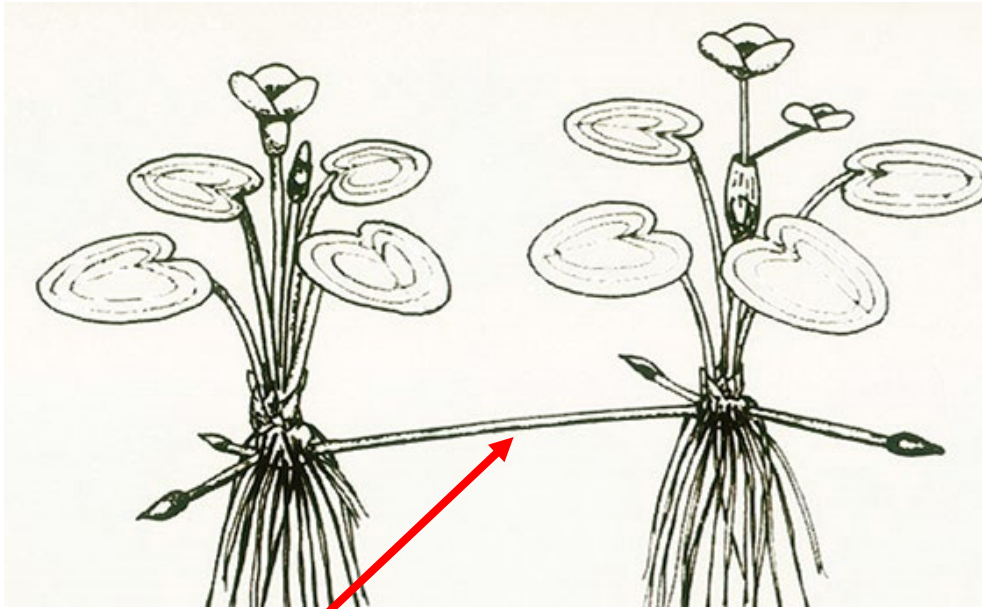
bushy pondweed
(*Najas flexilis*)

slender naiad
(*Najas gracillima*)

European frogbit (*Hydrocharis morsus-ranae*)

- Perennial, native to Europe.
- Confirmed: Lake Champlain, 8 other water bodies
- Also confirmed: CT, MA, NH, NY, RI, Quebec





stolon (stems)

flower white

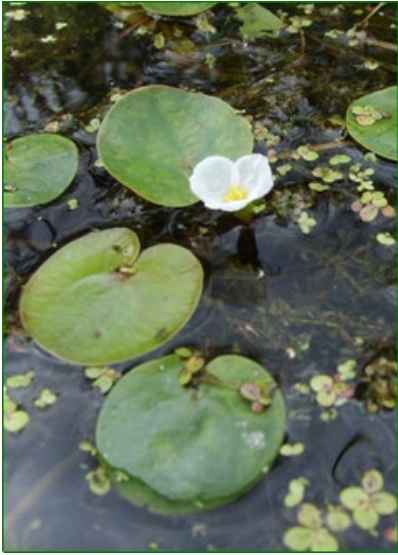
European frogbit

leaf entire, heart-shaped

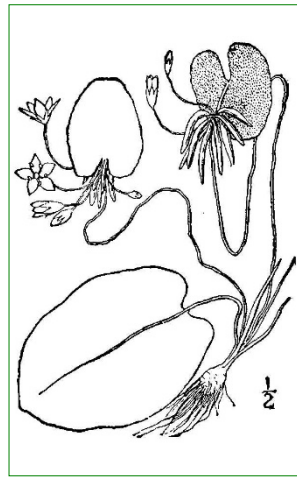
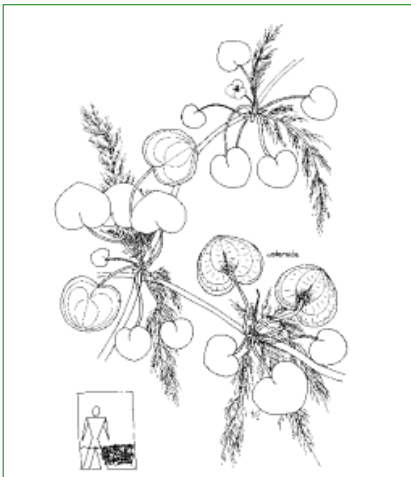


Native Floating-leaved Look-a-likes

To European frog-bit



Little floating heart
(*Nymphoides cordata*)



Fragrant water lily
(*Nymphaea odorata*)

Starry stonewort (*Nitellopsis obtusa*)

- Macro algae - perennial, native to Europe
- Confirmed: Lake Memphremagog 2015, Lake Derby 2016



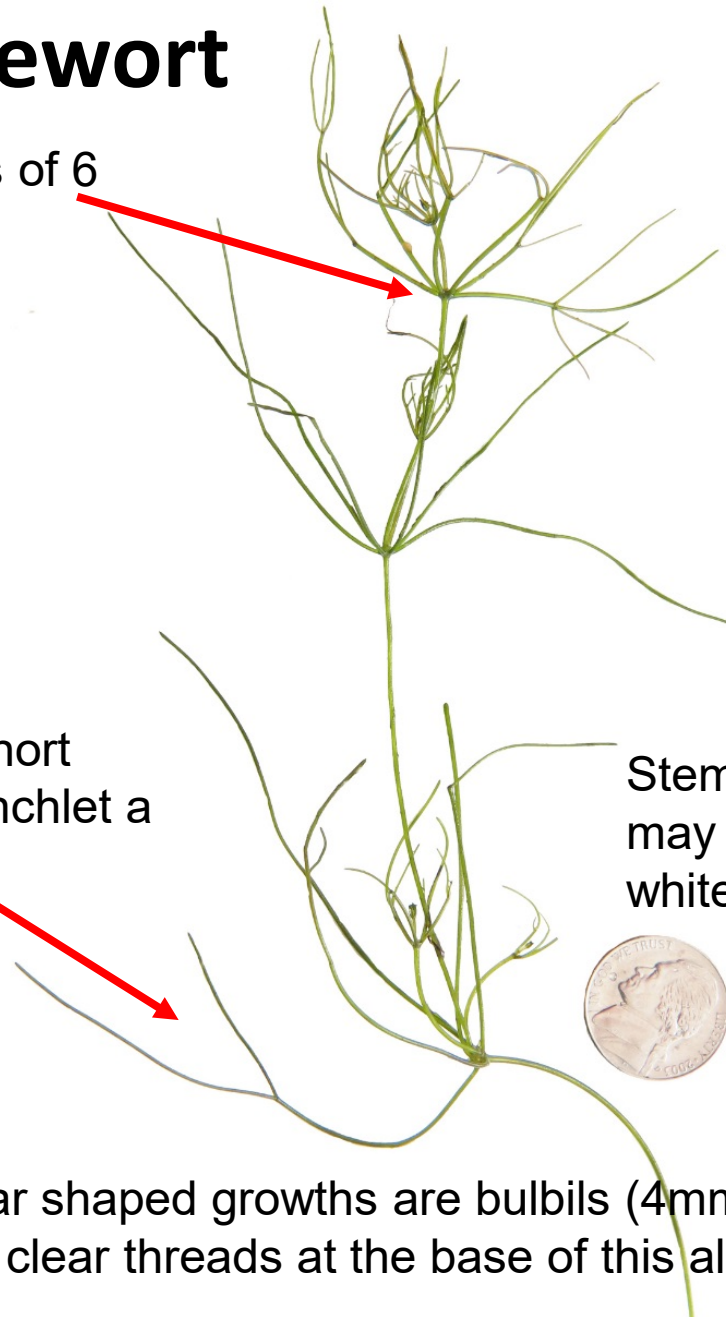
Starry stonewort

Branchlets in whorls of 6

Branchlets have 1+ short bracts, giving the branchlet a forked appearance

Stems are smooth and green; may be covered with a white/gray coating of minerals

Star shaped growths are bulbils (4mm), produced on clear threads at the base of this algae



Courtesy of:

Native Submersed Look-a-likes

Starry stonewort – Muskgrass a.k.a. Stonewort



Muskgrass
(*Chara* sp.)

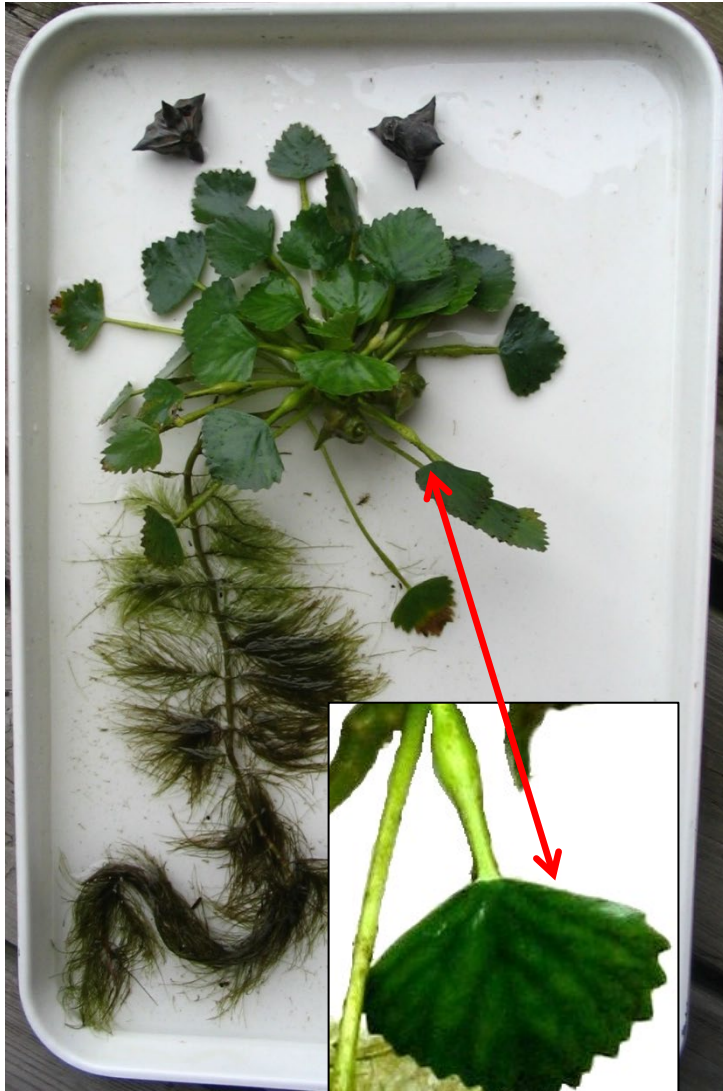
Water chestnut (*Trapa natans*)

- Rooted, annual, native to Europe
- Confirmed: Lake Champlain in 1940s; now known from 29 other water bodies



Water chestnut

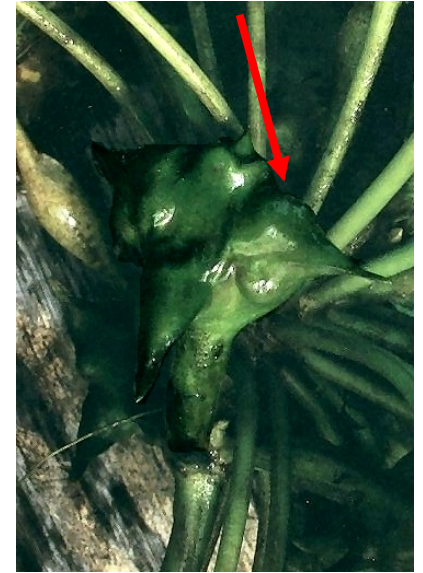
green - viable



triangular leaves



flower, white

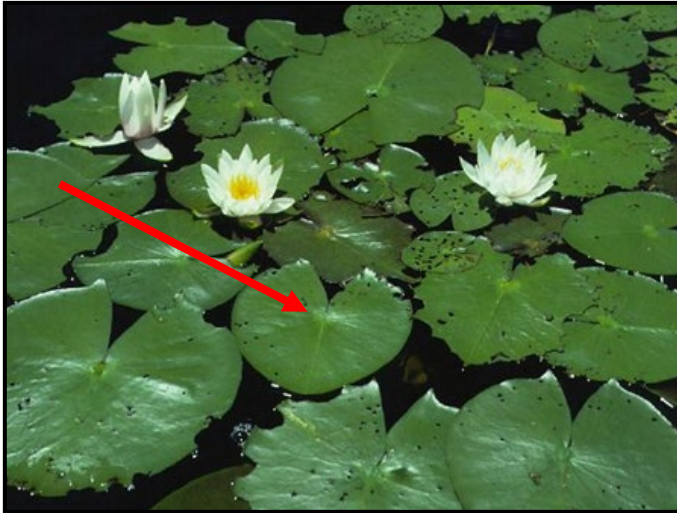


Seeds: black (dry) – not viable



Native Floating-leaved Look-a-likes

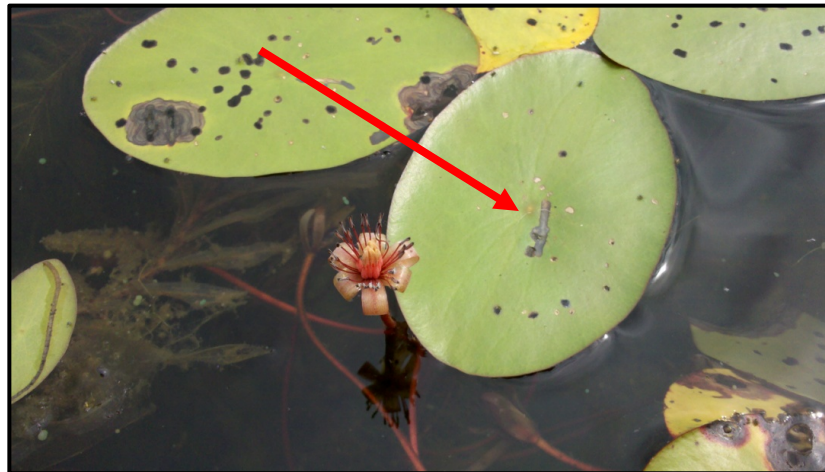
To Water Chestnut



Fragrant water lily
(*Nymphaea odorata*)



Spatterdock
(*Nuphar variegata*)



Water shield
(*Brasenia schreberi*)

Priority Invasive Species of Concern



In Neighboring States

- Brazilian elodea/waterweed
- Fanwort
- Hydrilla
- Parrot feather

Hydrilla (*Hydrilla verticillata*)

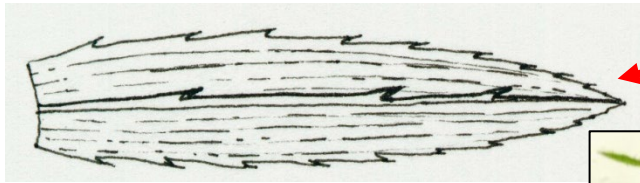
- Rooted, native to Africa, Australia and Asia.
- Confirmed: NY, MA, CT



MEDEP



Hydrilla



lance shaped, toothed margins



turions (buds)



whorled leaves



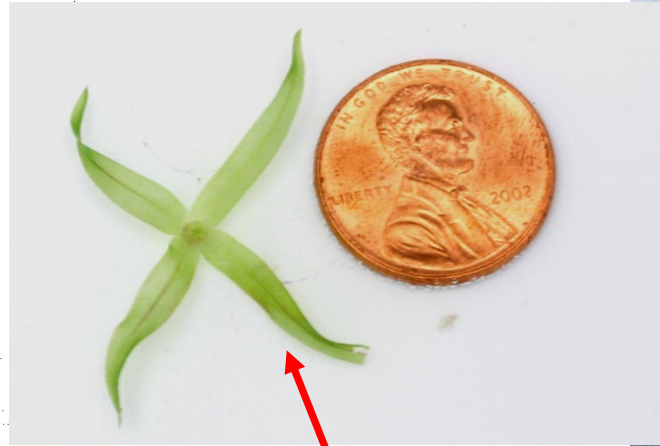
tubers (underground)

Brazilian elodea (*Egeria densa*)

- Rooted, perennial, native to South America.
- Confirmed: NY, NH, MA, CT



Brazilian elodea



Lance shaped leaves, whorls of 3-6
Leaf entire

Native Submersed Look-a-likes



Left to right:

Slender waterweed
Brazilian elodea
Hydrilla
Common waterweed



Common waterweed
(Elodea canadensis)



Slender waterweed
(Elodea nutallii)

- whorls of 3 leaves
- margins entire
- No tubers or turions

Fanwort (*Cabomba caroliniana*)

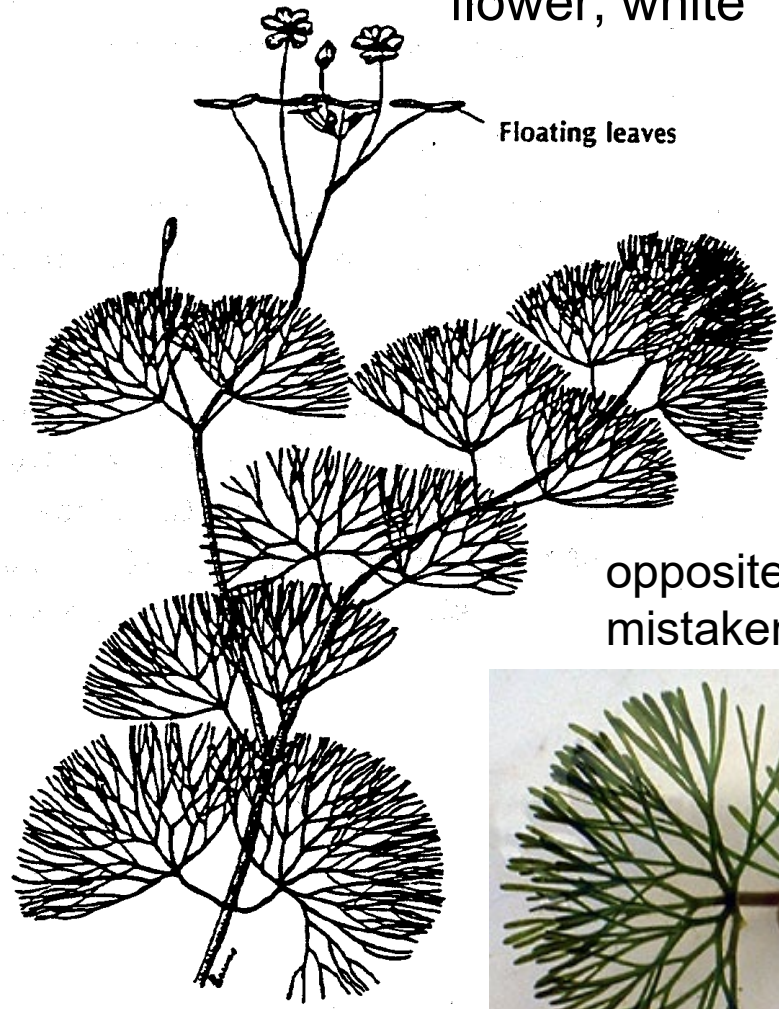
- Rooted, perennial, native to southeast U.S. and South America.
- Confirmed: NY



Fanwort

flower, white

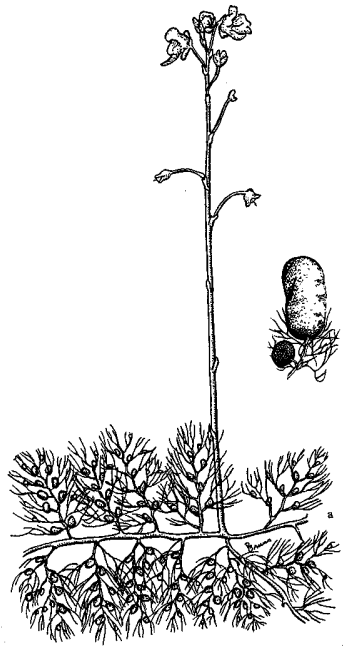
Floating leaves



opposite leaves, can be mistaken for whorled

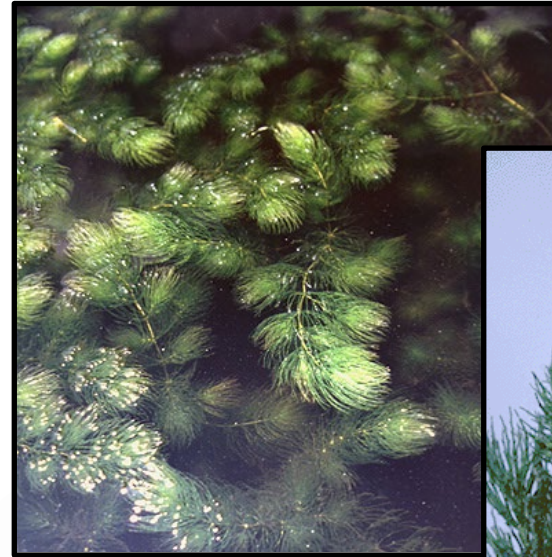


Native Submersed Look-a-likes to watermilfoils



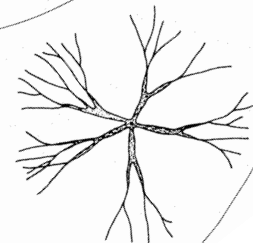
Bladderworts
(*Utricularia* sp.)

branch-dissected,
alternate leaves



Coontail
(*Ceratophyllum* sp.)

forked-dissected,
whorled leaves



Vermont's Aquatic Invasive Animals



Emily DeBolt NGA

Zebra and Quagga Mussels

Basic Biology and ID

- Variable color patterns
- Both species D-shaped
 - Zebra – triangular
 - Quagga – rounded
- Live 2-5 years, depending on conditions

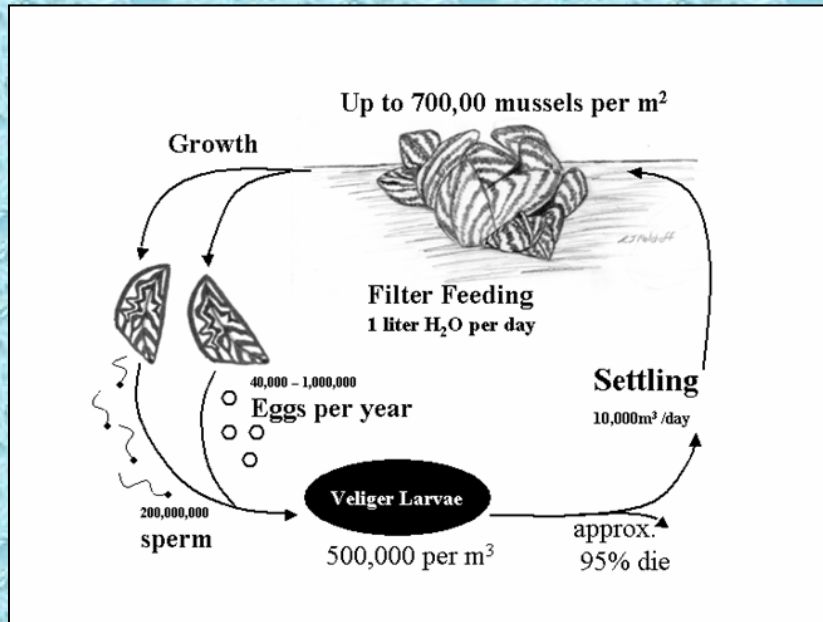


Dreissena polymorpha



Dreissena rostriformis bugensis

Zebra and Quagga Mussels



Life Cycle

- Eggs laid when temp > 50°F
- Eggs -> juveniles (veligers)
- Veligers are free-floating before settling on hard and semi-soft surfaces, then grow rapidly
 - Can remain viable up to a month in standing water
- After settlement, can reach 700,000 per m²
- Settled adults and juveniles can survive up to 30 days out of water in ideal conditions

Zebra and Quagga Mussels



Byssal Threads

- Enables attachment to most surfaces
- Allows clogging of infrastructure
- Smother benthic organisms
- Fouls watercraft equipment



Spiny & Fish Hook Waterflea

Basic Biology and ID

- Predacious crustacean native to Eurasia
- Less than 1/2 in, mostly tail (1-4 barbs)
- Introduced into Great Lakes in the mid 80's
- Confirmed in Lake George, NY in 2012
- Confirmed in Lake Champlain in 2014

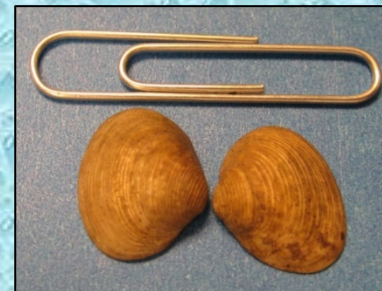


Asian Clam

(*Corbicula fluminea*)

Basic Biology and ID

- Bivalve native to tropical Asia, the Mediterranean, and Australia
- Greenish-yellow to brown, thick, symmetrical w/ concentric rings
- Cardinal tooth distinguishes from most natives



Native fingernail clam
(Sphaeriidae)

Vermont's Aquatic Animals of Concern



Chinese mysterysnail
(*Cipangopaludina chinensis*)



Banded mysterysnail
(*Viviparus georgianus*)

Lakes AIS Program Website

www.dec.vermont.gov/watershed

The screenshot shows the Vermont Department of Environmental Conservation website. The header includes the state logo and navigation links for Air and Climate, Land, Waste, and Water. The main content area features a news item titled "Zebra Mussels Identified in Aquarium Product, Moss Balls" and a section for the "Aquatic Invasive Species Program". Below this, there are several image-based links: "Aquatic Plants & Animals in Vermont", "Aquatic Species Laws & Regulations", "Early Detection & Spread Prevention", "Grants & Funding Opportunities", "Aquatic Invasive Species Control", and "Report an Invasive Species Found". A sidebar on the left lists various departmental services.

The screenshot displays the "Gallery of Invaders" website. It features a grid of 16 images of various aquatic plants and animals. The species shown include Eurasian Water-milfoil, Water Chestnut, Starry Stonewort, Curly Leaf Pondsage, Variable-leaved Water-milfoil, Brittle Naiad, European Frobit, Yellow Floating Heart, Purple Loosestrife, Phragmites, Yellow Flag Iris, and Flowering Rush. The website also includes a search bar and navigation links for different categories like Plants and Animals.

The screenshot shows the USGS Nonindigenous Aquatic Species (NAS) website. The header features the USGS logo and the text "science for a changing world". The main content area includes a welcome message, a navigation menu with links for Home, Alert System, Database & Queries, Taxa Information, and Report a Sighting, and a list of taxa categories: Invertebrates (Bryozoans, Coelenterates, Crustaceans, Mollusks), Vertebrates (Amphibians, Fishes, Mammals, Reptiles), and Plants. The website provides information on how to report sightings and access data.

USGS NAS website www.usgs.gov