

# Connecticut's Invasive Aquatic Plant, Clam, and Mussel Identification Guide

4TH EDITION



**Gregory J. Bugbee, Summer E. Stebbins,  
Martha E. Barton, and Jordan A.G. Wostbrock**

The Connecticut Agricultural Experiment Station  
Department of Environmental Science & Forestry  
123 Huntington Street  
New Haven, CT 06511



The Connecticut Agricultural Experiment Station was founded in 1875. It is chartered by the General Assembly to make scientific inquiries and conduct experiments regarding plants and their pests, insects, soil and water, and to perform analyses for state agencies. Station laboratories or research farms are located in New Haven, Windsor, Hamden, and Griswold.



# CAES

The Connecticut Agricultural Experiment Station

*Putting Science to Work for Society since 1875*

Equal employment opportunity means employment of people without consideration of age, ancestry, color, criminal record (in state employment and licensing), gender identity or expression, genetic information, intellectual disability, learning disability, marital status, mental disability (past or present), national origin, physical disability (including blindness), race, religious creed, retaliation for previously opposed discrimination or coercion, sex (pregnancy or sexual harassment), sexual orientation, veteran status, and workplace hazards to reproductive systems unless the provisions of sec. 46a-80(b) or 46a-81(b) of the Connecticut General Statutes are controlling or there are bona fide occupational qualifications excluding persons in one of the above protected classes. To file a complaint of discrimination, contact Dr. Jason White, Director, The Connecticut Agricultural Experiment Station, 123 Huntington Street, New Haven, CT 06511, (203) 974-8440 (voice), or [Jason.White@ct.gov](mailto:Jason.White@ct.gov) (e-mail). CAES is an affirmative action/equal opportunity provider and employer. Persons with disabilities who require alternate means of communication of program information should contact the Chief of Services, Michael Last at (203) 974-8442 (voice), (203) 974-8502 (FAX), or [Michael.Last@ct.gov](mailto:Michael.Last@ct.gov) (e-mail).

---

## Acknowledgements

The efforts of Dr. Robert Capers, Ms. Nancy Murray, Ms. Roslyn Reeps, Ms. Amy Weiss, Ms. Calanthe Cavadini, and Ms. Jennifer Fanzutti are gratefully acknowledged.

Funding provided by the Grants for the Control of Aquatic Invasive Species Program administered by the Connecticut Department of Energy and Environmental Protection (DEEP) as well as the Connecticut Federation of Lakes.

© 2022 The Connecticut Agricultural Experiment Station

Bulletin No.

## Table of Contents

<b>Introduction</b> .....	4
<b>How to Use This Guide</b> .....	4
<b>Table of Connecticut's Invasive or Potentially Invasive Aquatic Plants</b> .....	5
<b>What to Do if You Find a Species Discussed in This Guide</b> .....	5
<b>State Map of Locations of Invasive Aquatic Plants</b> .....	6
<b>Additional Plant Identification Resources</b> .....	6
<b>Plant Terms</b> .....	7
<b>Plant Species Descriptions:</b>	
<i>Butomus umbellatus</i> , <b>Flowering rush</b> .....	8
<i>Cabomba caroliniana</i> , <b>Fanwort</b> .....	9
<i>Callitriche stagnalis</i> , <b>Pond water-starwort</b> .....	10
<i>Egeria densa</i> , <b>Brazilian waterweed</b> .....	11
<i>Eichhornia crassipes</i> , <b>Common water-hyacinth</b> .....	12
<i>Hydrilla verticillata</i> , <b>Hydrilla</b> .....	13
<i>Iris pseudacorus</i> , <b>Yellow iris</b> .....	16
<i>Lythrum salicaria</i> , <b>Purple loosestrife</b> .....	17
<i>Marsilea quadrifolia</i> , <b>European watercress</b> .....	18
<i>Myosotis scorpioides</i> , <b>Forget-me-not</b> .....	19
<i>Myriophyllum aquaticum</i> , <b>Parrotfeather</b> .....	20
<i>Myriophyllum heterophyllum</i> , <b>Variable-leaf watermilfoil</b> .....	21
<i>Myriophyllum spicatum</i> , <b>Eurasian watermilfoil</b> .....	22
<i>Najas minor</i> , <b>Minor naiad</b> .....	23
<i>Nelumbo lutea</i> , <b>American water lotus</b> .....	24
<i>Nymphoides peltata</i> , <b>Yellow floating heart</b> .....	25
<i>Pistia stratiotes</i> , <b>Water lettuce</b> .....	26
<i>Potamogeton crispus</i> , <b>Curly leaf pondweed</b> .....	27
<i>Rorippa microphylla</i> , <b>Onerow yellowcress</b> .....	28
<i>Rorippa nasturtium-aquaticum</i> , <b>Watercress</b> .....	29
<i>Salvinia molesta</i> , <b>Giant salvinia</b> .....	30
<i>Trapa natans</i> , <b>Water chestnut</b> .....	31
<b>Commonly Confused Aquatic Plants</b> .....	32
<b>Invasive Aquatic Plant Identification Key</b> .....	35
<b>Introduction and Dispersal of Aquatic Invasives</b> .....	37
<b>Managing Nuisance Aquatic Vegetation in Connecticut</b> .....	39
<b>Nuisance &amp; Purportedly Invasive Algae in Connecticut Waterways</b> .....	43
<b>Invasive Aquatic Clams and Mussels</b> .....	45
<b>Clam and Mussel Species Descriptions:</b>	
<i>Corbicula fluminea</i> , <b>Asian clam</b> .....	46
<i>Dreissena bugensis</i> , <b>Quagga mussel</b> .....	47
<i>Dreissena polymorpha</i> , <b>Zebra mussel</b> .....	48
<b>Commonly Confused Aquatic Mussels</b> .....	49
<b>Literature Cited</b> .....	50

## Introduction to Aquatic Plants

Aquatic plants are essential components of healthy ecosystems in lakes and ponds. They cleanse water and provide habitat for beneficial aquatic organisms. Because invasive species are not native, they have few natural enemies. Their dramatic growth rates can degrade native ecosystems, decrease recreational opportunities, and reduce local real estate values (Connecticut Aquatic Nuisance Species Working Group 2006, Fishman et al. 1998, Les and Mehrhoff 1999). Recent vegetation surveys of 256 lakes and ponds by the Connecticut Agricultural Experiment Station Invasive Aquatic Plant Program (CAES IAPP) found invasive plants in nearly 60 percent of the waterbodies (CAES IAPP 2022).

Approximately three-quarters of the invasive aquatic plant species in southern New England were introduced as cultivated plants (Les and Mehrhoff 1999). These introductions come from dumping of aquariums and water gardening. Further spread is caused by recreational boating and plant fragments mixed with live bait used by fishermen (Couch and Nelson 1985). Spread of invasive plants from one lake to another also occurs naturally by wildlife and downstream flow. Once established, eradication of invasive aquatic plants is extremely difficult. Preventing introductions by inspections, public education, early detection, and rapid response is critically important.

This guide is intended to provide information on the identification and distribution of the 22 aquatic plants listed as invasive or potentially invasive (Table 1) by the Connecticut General Statute (Sec. 22a-381d). The Connecticut Invasive Plants Council has identified which invasive species in the General Statute are considered aquatic plants. The sale of these plants, with the exception of common water-hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*), is also banned by State Statute, and their transport is limited to activities associated with control and education. Fines of up to one hundred dollars can be imposed for each violation. Also included in this edition is information on the identification and distribution of the invasive algae *Didymo* and invasive clams and mussels.

## How to Use This Guide

Identifying Connecticut's freshwater aquatic plants is challenging. CAES IAPP surveys have found over 100 native species and 13 invasive species (Figure 1). We use many references when plant identification is questionable including Crow and Hellquist (2000) and Fassett (1957), other recognized experts, and molecular identification using DNA sequencing. Some of the potentially invasive plants discussed here have never been documented in Connecticut and may be unfamiliar to readers. Certain invasive aquatic plants can be easily confused with native or other invasive plants so care must be taken to ensure accuracy. The places where plants are found are often related to their means of dispersal (Table 1), and sometimes this gives a clue to their identification.

This guide has many parts. Each plant has a summary page containing pictures, a list of key features, and a map of where the plant has been found by either CAES IAPP or the Invasive Plant Atlas of New England (IPANE, 2022). Other sources may have found some of the plants elsewhere, and the maps are not meant to suggest the plants are limited to the locations shown. There is a series of comparative pictures that help differentiate the invasive species from similar native plants, and there is a plant identification key that provides a step-by-step method for narrowing plants to their species. This key also includes native plants that are commonly mistaken for invasive species. A section is included on aquatic plant prevention and control. New to this edition is a section on invasive aquatic clams and mussels.

Table 1. Invasive and potentially invasive aquatic plants listed in the Connecticut General Statutes (Sec. 22a-381d).

#	Scientific Name	Common Name	Dispersal
1	<i>Butomus umbellatus</i>	Flowering rush	Water Gardening
2	<i>Cabomba caroliniana</i>	Fanwort	Aquariums, Boats/Trailers, Bait
3	<i>Callitriche stagnalis</i>	Pond water-starwort	Water Gardening
4	<i>Egeria densa</i>	Brazilian water-weed, Anacharis, Egeria	Aquariums, Boats/Trailers, Bait
5	<i>Eichhornia crassipes*</i>	Common water hyacinth	Water Gardening
6	<i>Hydrilla verticillata</i>	Hydrilla	Aquariums, Boats/Trailers, Bait
7	<i>Iris pseudacorus</i>	Yellow iris, Yellow flag iris	Nursery Stock, Water Gardening
8	<i>Lythrum salicaria</i>	Purple loosestrife	Nursery Stock, Water Gardening
9	<i>Marsilea quadrifolia</i>	European waterclover, Water shamrock	Water Gardening, Boats/Trailers
10	<i>Myosotis scorpioides</i>	Forget-me-not, Water scorpion-grass	Water Gardening
11	<i>Myriophyllum aquaticum</i>	Parrotfeather	Aquariums, Boats/Trailers
12	<i>Myriophyllum heterophyllum</i>	Variable-leaf watermilfoil	Aquariums, Boats/Trailers
13	<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Aquariums, Boats/Trailers
14	<i>Najas minor</i>	Brittle water-nymph, Minor naiad	Boats/Trailers
15	<i>Nelumbo lutea</i>	American water lotus	Water Gardening
16	<i>Nymphoides peltata</i>	Yellow floating heart	Water Gardening
17	<i>Pistia stratiotes*</i>	Water lettuce, Tropical duckweed	Water Gardening
18	<i>Potamogeton crispus</i>	Curlyleaf pondweed, Crispy-leaved pondweed	Boats/Trailers
19	<i>Rorippa microphylla</i>	Onerow yellowcress	Water Gardening
20	<i>Rorippa nasturtium-aquaticum</i>	Watercress	Water Gardening
21	<i>Salvinia molesta</i>	Giant salvinia	Water Gardening
22	<i>Trapa natans</i>	Water chestnut	Water Gardening, Boats/Trailers

\*Plants that are not banned

## What to Do if You Find a Species Discussed in This Guide

Early detection and rapid response are important for preventing invasive aquatic species from becoming future problems. Before taking action, however, it is important that the plant be positively identified and the location accurately recorded. Latitude and longitude coordinates taken with a global positioning system (GPS) are best. Plant samples requiring further identification need to be mailed or taken to the CAES IAPP, 123 Huntington Street, New Haven, CT 06511, or another qualified entity such as the Connecticut Department of Energy and Environmental Protection (CT DEEP). You can call CAES IAPP at (203) -8512 with questions.

## Locations of Invasive Plants Found by CAES IAPP 2004-2022

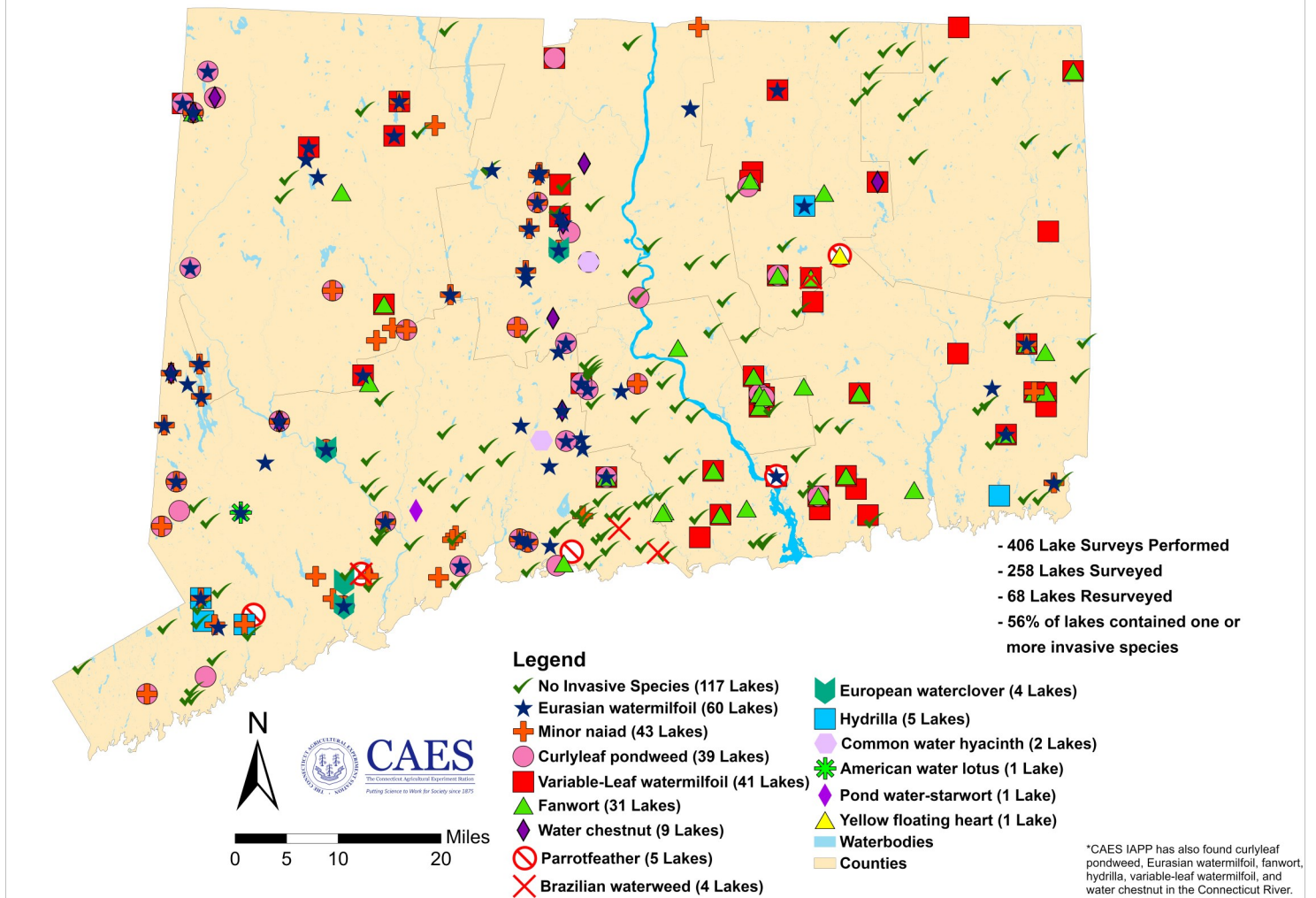


Figure 1. Locations of invasive aquatic plants found by CAES IAPP surveys from 2004-2022.

### Additional Resources for Plant Identification

CAES IAPP web page, aquatic plant survey requests, online herbarium, and reprints of this guide

<https://portal.ct.gov/caes-iapp>

The Invasive Plant Atlas of New England

<https://www.eddmaps.org/ipane/>

Invasive Plants of the United States

<http://www.invasiveplantatlas.org/>

University of Florida, Center for Aquatic and Invasive Plants

<http://plants.ifas.ufl.edu/>

USDA National Invasive Species Information Center

<http://www.invasivespeciesinfo.gov/>

## Definitions of Plant Terms

**Alternate:** leaves not directly across from each other on the stem, one per node

**Compound:** leaf containing many individual leaflets

**Dissected:** leaf divided into many narrow segments; appear feathery, branched or forked

**Entire:** leaf not divided and margins not toothed

**Forked:** leaf divided into two or more equal segments

**Lanceolate:** lance-shaped, long, wider in the middle foliage

**Leaflet:** one of many leaf-like structures that make up a leaf

**Margin:** the edge or border of a leaf

**Opposite:** leaves are directly across from each other on the stem, two per node

**Petiole:** leaf stalk; stem-like structure that attaches a leaf to the stem

**Rhizome:** horizontal underground stem often sending out roots and shoots from its nodes

**Rosette:** a dense cluster of leaves that are all at a single height, like petals of a rose

**Stolon:** horizontal above ground stem often sending out roots and shoots at nodes, also termed “runner”

**Spike:** unbranched continuation of the stem where flowers are located, usually located above the water

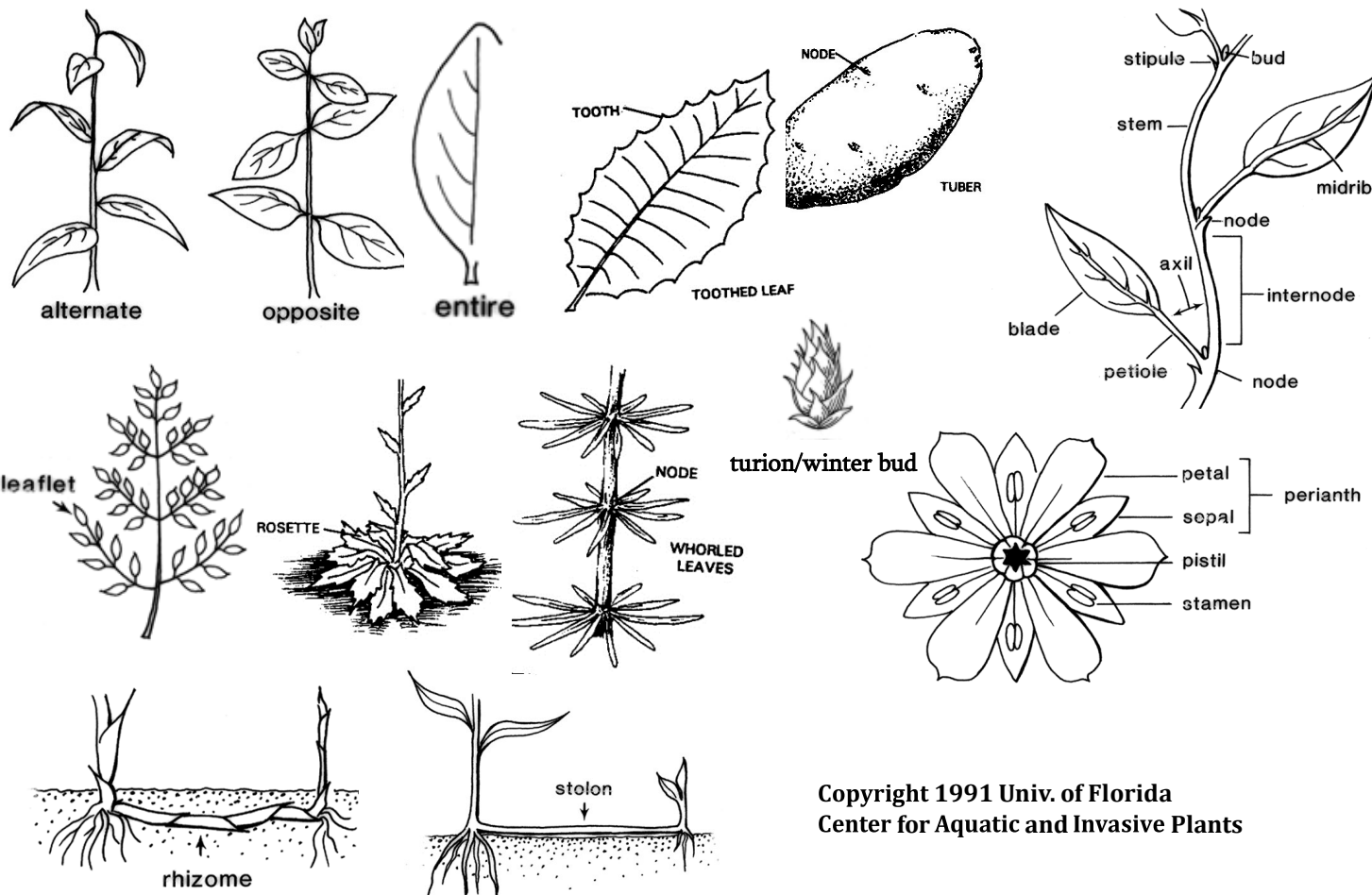
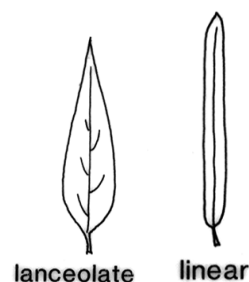
**Tooth:** points or projections along a leaf margin

**Tuber:** modified, underground stem for starch storage and a form of vegetative reproduction

**Turion:** a modified leaf bud on a stem or shoot, a form of vegetative reproduction

**Whorled:** three or more leaves at the same node, forming a ring-like arrangement

**Winter Bud:** a modified leaf bud that survives the winter and facilitates vegetative reproduction



Copyright 1991 Univ. of Florida  
Center for Aquatic and Invasive Plants

# *Butomus umbellatus*

## Common name:

Flowering rush

## Origin:

East Asia

## Key features:

**Stems:** Can be found along shorelines and into water 9 feet (3 m) deep

**Leaves:** Long, narrow, sword shaped leaves up to 3 feet (1 m) tall that originate at base. Leaves are fleshy with twisted ends, grass-like, cross section of leaves are triangular

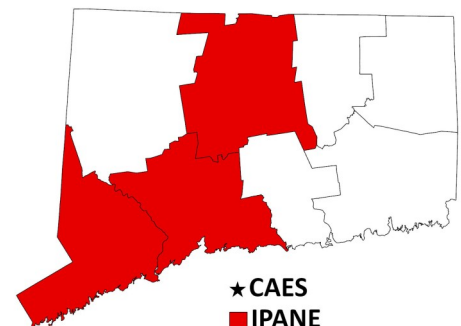
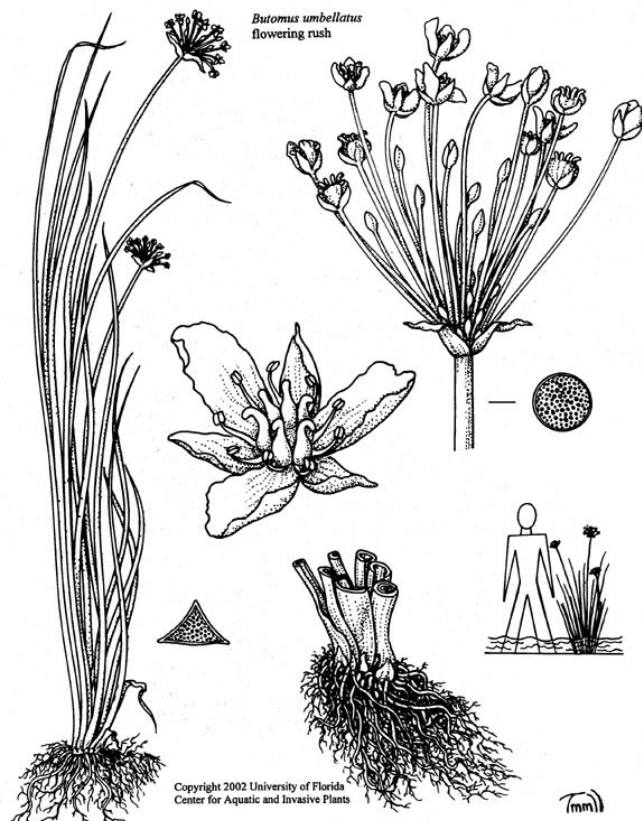
**Flowers:** Inflorescence contains pink to white flowers 0.8-1.2 inches (2-3 cm) across with 3 petals and 3 sepals on a stalk that can be 3 feet (1 m) tall

**Fruits/Seeds:** Fruit is a follicle

**Reproduction:** Seeds and rhizomes

## Easily confused species:

Bur-reeds: *Sparganium* spp.





# *Cabomba caroliniana*

## Common names:

Fanwort

Carolina fanwort

## Origin:

Southeast United States

South America

## Key features:

Plants are submersed

**Stems:** Can be 6 feet (2 m) long

**Leaves:** Dissected, opposite leaves 0.8-2 inches (2-5 cm) are fan-like and made up of forked leaflets attached to the stem by a petiole.

Floating leaves 0.2-0.8 inches (6-20 mm) wide are oblong and produced on flower shoots

**Flowers:** Small, solitary flowers are usually white to pinkish

**Fruits/Seeds:** Flask shaped

**Reproduction:** Seed and fragmentation

## Easily confused species:

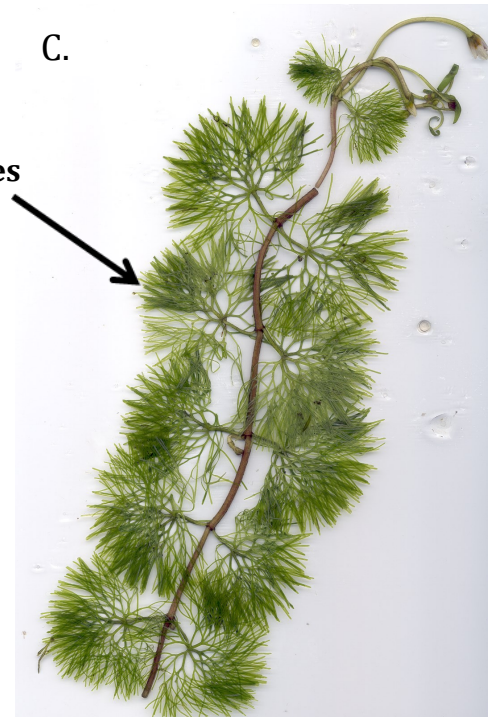
Watermilfoils: *Myriophyllum* spp.

White water crowfoot: *Ranunculus longirostris*

Water marigold: *Megalodonta beckii*



C.



Opposite Leaves

A.



Copyright 1991 University of Florida  
Center for Aquatic and Invasive Plants

*Cabomba caroliniana*  
fanwort

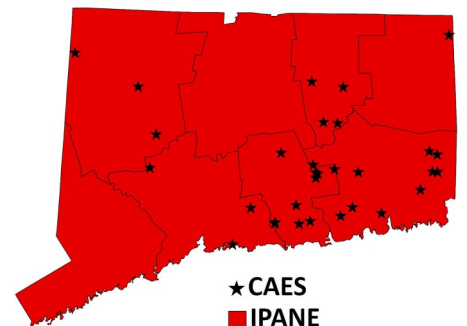
B.



A. Copyright 1991 Univ. of Florida,  
Center for Aquatic and Invasive  
Plants

B. Copyright 2002 Univ. of  
Florida, Photo by A. Murray

C. Photo by A. Smagula



# *Callitriche stagnalis*

## **Common name:**

Pond water-starwort

## **Origin:**

Europe  
North Africa

## **Key features:**

Plants are submersed with floating rosettes

**Stems:** 4-12 inches (10-30 cm) long

**Leaves:** Floating leaves are opposite and oval or spoon shaped 0.8 × 0.1-0.3 inches (2 cm × 3-8 mm), submerged leaves are narrower and tend to be smaller

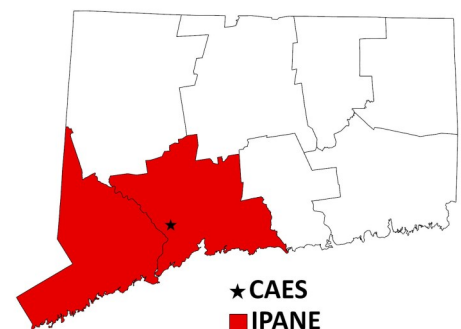
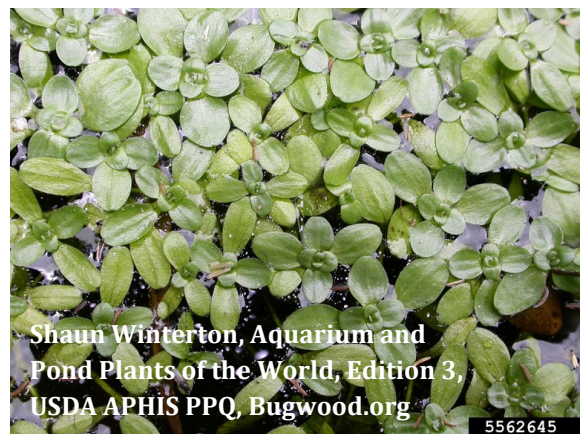
**Flowers:** Small with 2 small bracts at their base, flowers are close to each other at leaf bases for self-pollination

**Fruits/Seeds:** Round 0.06-0.08 inches (1.5-2 mm) thick forming 4 mericarps that have thin winged margins

**Reproduction:** Cloning and seeds

## **Easily confused species:**

Other *Callitriche* spp. (can only distinguish them by their fruit)



# *Egeria densa*

## Common names:

Brazilian waterweed  
Brazilian elodea  
South American waterweed

## Origin:

South America

## Key features:

Plants are submersed

**Stems:** Plant stems green, soft and typically 1-2 ft (0.3-0.6 m) long

**Leaves:** Leaves entire 0.4-1.2 inches (1-3 cm) long by 0.2 in (5 mm) wide, leaves toothed (need magnification), leaves are whorled with typically 4 leaves per whorl

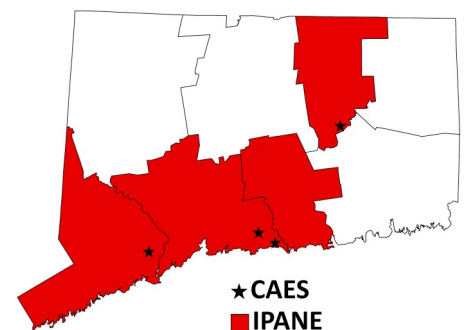
**Flowers:** Small white flowers with three petals, only staminate (male) flowers found in the US

**Reproduction:** Fragmentation

## Easily confused species:

Waterweeds (Native): *Elodea nuttallii* and *E. canadensis*

Hydrilla: *Hydrilla verticillata*



# *Eichhornia crassipes*\*

## Common names:

Common water-hyacinth

Floating water-hyacinth

## Origin:

Brazil

## Key Features:

**Stems:** Free floating plant

**Leaves:** Leaves are oval 1.6-4.7 inches (4-12 cm), thick, waxy and form a rosette, petioles are inflated which helps with floatation

**Flowers:** Flowers are light purple with one petal having a darker blotch with a yellow center 2.0-2.8 inches (5-7 cm)

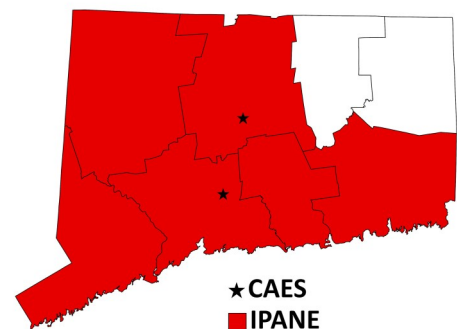
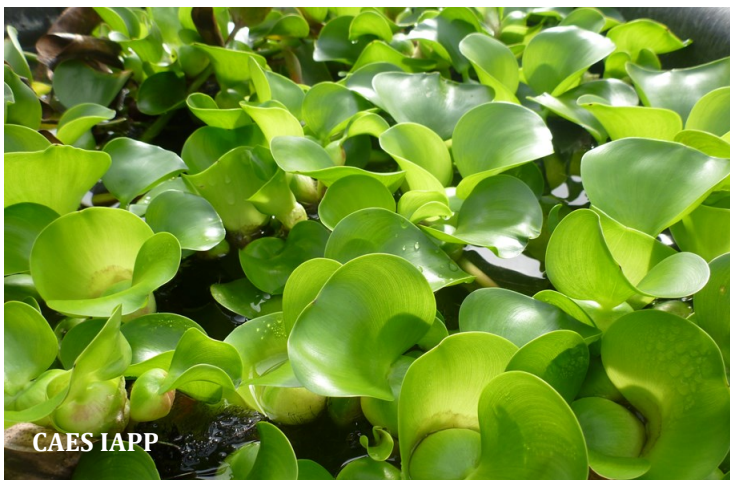
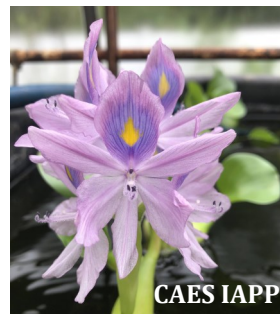
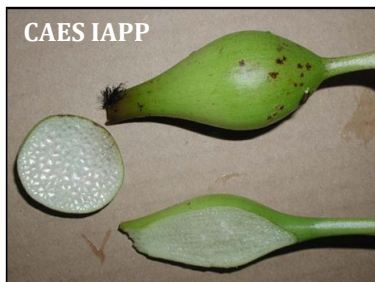
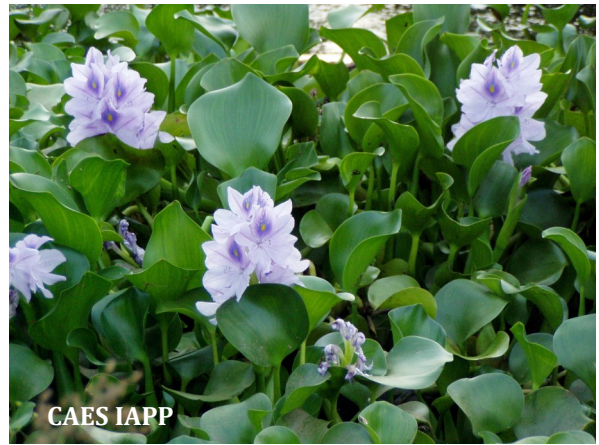
**Fruits/Seeds:** Fruit is a capsule with ribbed seeds

**Reproduction:** Seeds and stolons

## Easily confused species:

None

\*Not banned for sale in Connecticut



# Hydrilla verticillata

## Common name:

Hydrilla

## Origin:

Asia

## Key features:

Plants are submersed

**Stems:** Slender, branched and up to 25 feet (7.5 m) long

**Leaves:** Whorled leaves approx. 0.7 inches (1.5 cm) long, whorls often have 5 leaves (range 4-8); leaf margins are visibly toothed

**Flowers:** Female flowers have three translucent petals that have reddish streaks; male flowers have three petals and can be white to red in color

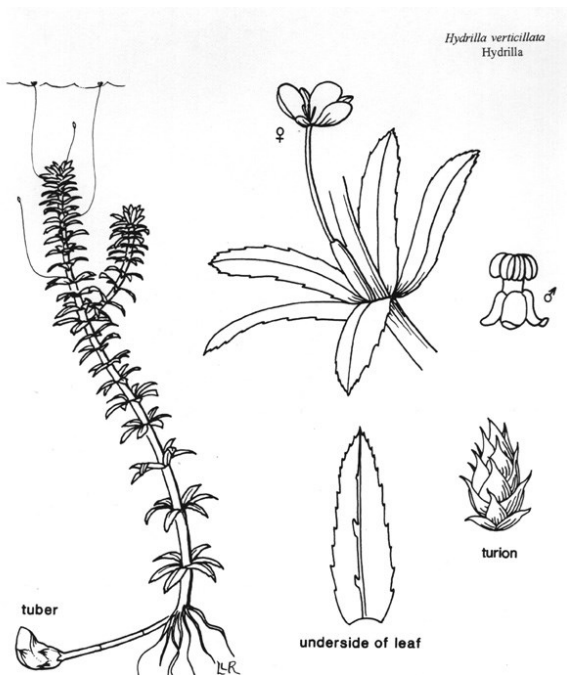
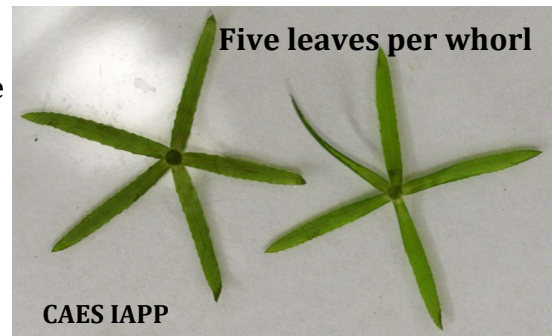
**Fruits/Seeds:** Small tubers (key feature) can be found in the sediment, turions form along the stem

**Reproduction:** Fragmentation, turions, tubers and seeds

## Easily confused species:

Waterweeds (Native): *Elodea nuttallii* and *Elodea canadensis*

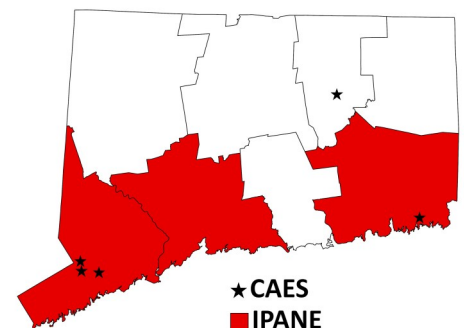
Brazilian waterweed: *Egeria densa*



Copyright 1991 Univ. of Florida

Center for Aquatic and Invasive Plants

Illustration provided by:  
J.P. Lynch, University of Florida  
D. R. S. Gainesville, 1990



# Hydrilla in the Connecticut River

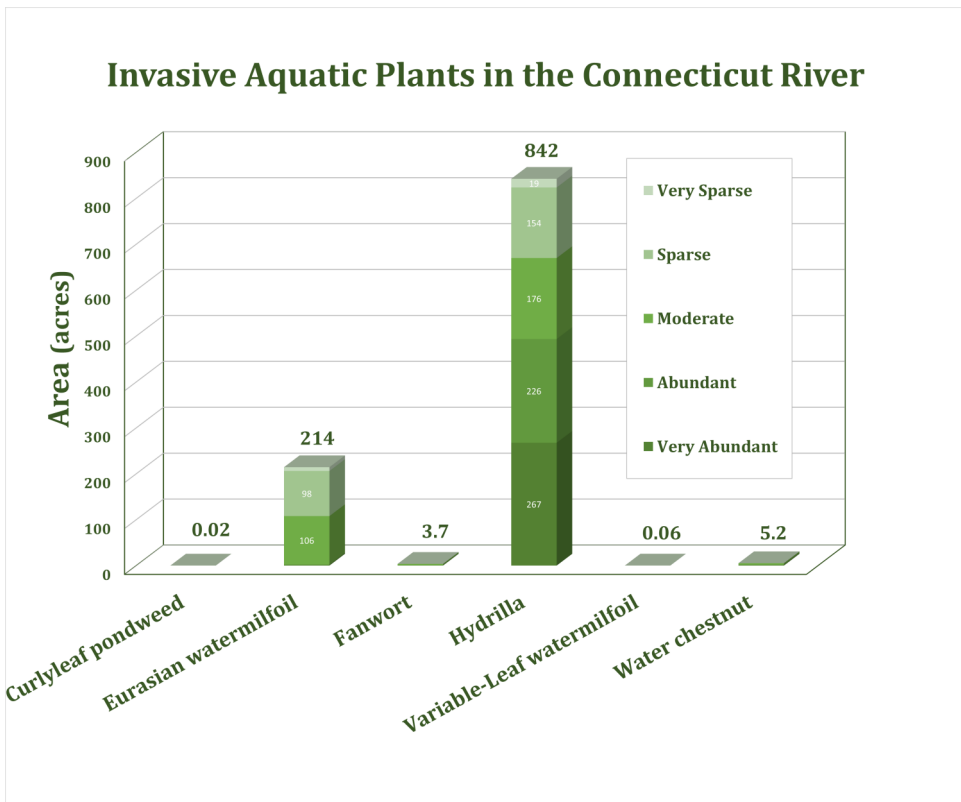
The Connecticut Agricultural Experiment Station Invasive Aquatic Plant Program (CAES IAPP) discovered a new strain of hydrilla the Connecticut River in 2016. Hydrilla is among the most troublesome invasive aquatic plants in Florida and other southern states. It crowds out native vegetation, harms fisheries, sickens wildfowl, impedes recreation, and reduces property values. CAES IAPP surveys from 2019 - 2022 found 842 acres of hydrilla from Agawam, MA to a mile or so of Long Island Sound. Large dense patches were common in most coves, tributaries, and shallows along the river's mainstem. In some areas, hydrilla spread out over the surface making



**Drone image of dense hydrilla in the Mattabeset River in Middletown, CT in 2020. CAES IAPP**

navigation nearly impossible. Finding such dense stands of hydrilla in a northern state is alarming. CAES IAPP has found small hydrilla populations in several CT lakes, but these do not compare to the extensive areas

in the Connecticut River. The Connecticut River hydrilla is far more robust than seen elsewhere in the State. This could be a result of river flow, nutrients, or genetics. The Connecticut River hydrilla is a distinct strain from that found anywhere else. Native eel grass beds are extensive throughout the river and create critical habitat for juvenile fish and other aquatic organisms. Hydrilla is encroaching on the eel grass beds with uncertain consequences.



The Connecticut River hydrilla is genetically distinct from hydrilla elsewhere. Unlike other hydrilla strains it has yet to be observed sprouting from potato-like tubers. Turions, fragments, and possible perennial root systems appear to be its mode of reproduction. This may offer an advantage since tubers can remain in the sediment for years and evade control.

There is great concern that the Connecticut River hydrilla could spread to other bodies of water by boats, canoes, kayaks, and other equipment that can transport fragments of the weed to new locations. Education efforts are underway to assure those using the Connecticut River are aware of the problem and take appropriate “Clean, Drain, and Dry” precautions. In addition, the United States Army Corps of Engineers has recently received funding to conduct hydrilla management demonstration projects with assistance from CAES IAPP and other stakeholders. The hope is a more comprehensive plan for addressing the Connecticut River hydrilla problem.

### **To Learn More**

- Explore a [map](https://caes.maps.arcgis.com/apps/webappviewer/index.html?id=007f6ee203b74bcbb1d6e68a953d8baf) of the Connecticut River Basin. <https://caes.maps.arcgis.com/apps/webappviewer/index.html?id=007f6ee203b74bcbb1d6e68a953d8baf>
- [Watch a video](https://vimeo.com/505384824) describing the hydrilla invasion on the Connecticut River. <https://vimeo.com/505384824>
- Read the Connecticut Agricultural Experiment Station’s [report](https://portal.ct.gov/-/media/CAES/DOCUMENTS/Publications/Bulletins/B1084.pdf) on hydrilla and other aquatic plants on the Connecticut River. <https://portal.ct.gov/-/media/CAES/DOCUMENTS/Publications/Bulletins/B1084.pdf>
- Visit the [Connecticut River Conservancy](https://www.ctriver.org/get-involved/stopping-an-invasive-species-water-chestnut-2/hyrilla-in-the-ct-river-watershed/) to find out more about hydrilla and the steps each of us can take to help slow its spread. <https://www.ctriver.org/get-involved/stopping-an-invasive-species-water-chestnut-2/hyrilla-in-the-ct-river-watershed/>

# *Iris pseudacorus*

## Common names:

Yellow iris

Yellow flag

## Origin:

Europe

Western Asia

Northwest Africa

## Key features:

**Leaves:** Lanceolate leaves are flattened with a raised mid rib and rise out of the soil, parallel venation, the tips of the leaves are pointed and arch over

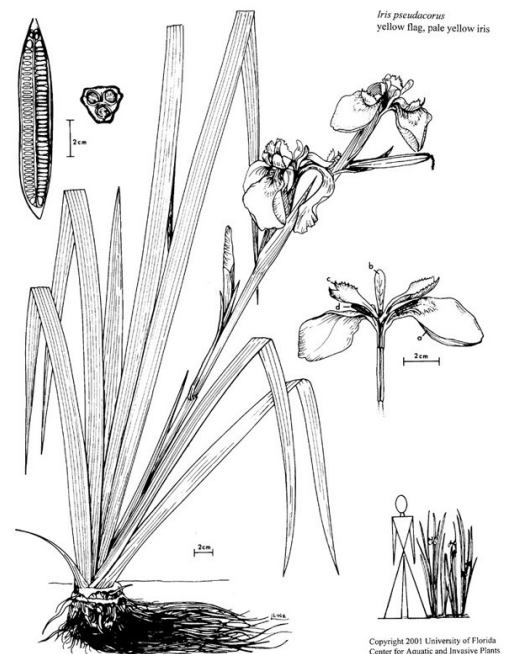
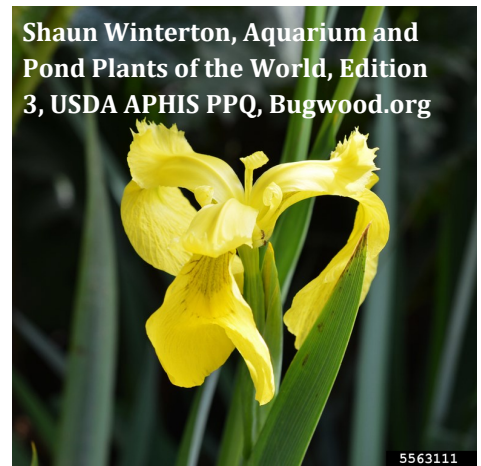
**Flowers:** Flowers are on peduncles 3-4 feet (1-1.3 m) tall. Several light to dark yellow flowers are on each stem with 3 small erect petals and 3 large downward sepals

**Fruits/Seeds:** Fruit is a capsule, seeds are brown

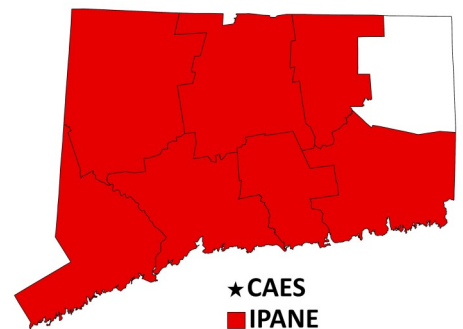
**Reproduction:** Seeds and rhizomes

## Easily confused species:

Northern blue flag iris: *Iris versicolor*



Copyright 2001 Univ. of Florida  
Center for Aquatic and Invasive Plants





# *Lythrum salicaria*

## **Common name:**

Purple loosestrife

## **Origin:**

Europe

## **Key features:**

**Stems:** Plants have herbaceous stems and can grow 1.5-5 feet (0.5-1.5 m) tall

**Leaves:** Opposite, or in whorls of 3, 1-4 inches (3-10 cm) long, linear, or lanceolate in shape, leaves can be smooth or hairy

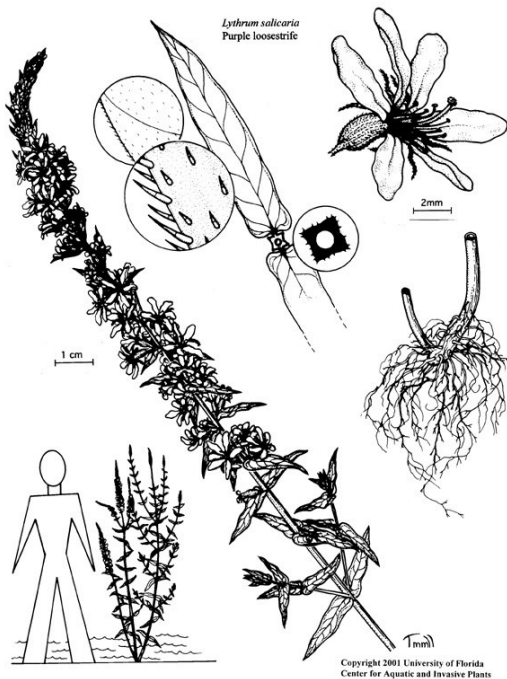
**Flowers:** Large, pink-purple flowers clustered on long terminal spikes 4-16 inches (10-40 cm) long, floral tube is twice as long as it is wide and typically has 6 petals

**Fruits/Seeds:** Fruit is a two cavity capsule with numerous reddish-brown seeds

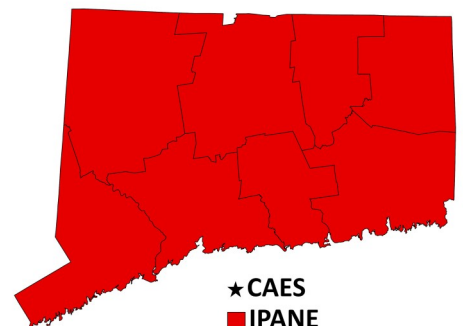
**Reproduction:** Seed

## **Easily confused species:**

Winged loosestrife: *Lythrum alatum*



Copyright 2001 Univ. of Florida  
Center for Aquatic and Invasive Plants



# *Marsilea quadrifolia*

## **Common names:**

European waterclover  
Water shamrock

## **Origin:**

Europe

## **Key features:**

Floating leaf plant

**Stems:** Smooth petioles 2-12 inches (5-30 cm)

**Leaves:** Comprised of 4 fan-shaped leaflets (similar to a four-leaf clover)

**Fruits/Seeds:** 2 or 3 dark brown sporocarps 0.2 inches × 0.2 inches (4-5.5 mm × 3-4 mm)

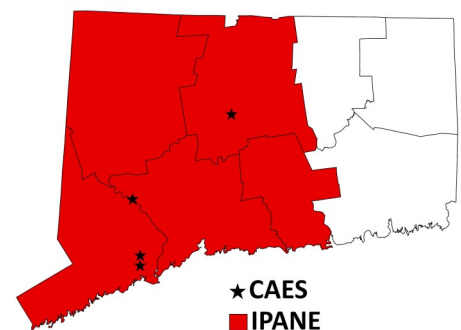
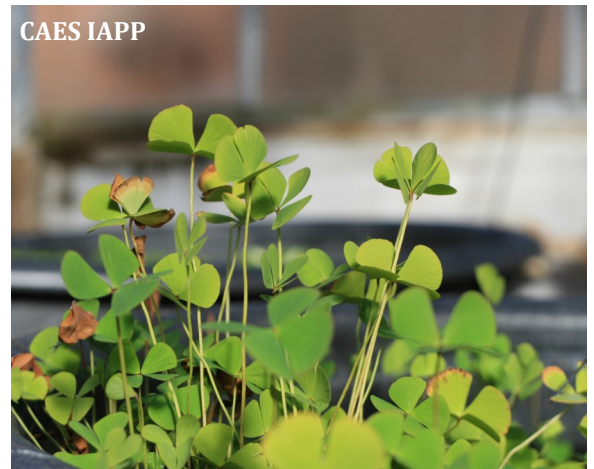
**Reproduction:** Cloning and sporocarps

## **Easily confused species:**

None



Britton, N.L., and A. Brown. 1913



# *Myosotis scorpioides*

## Common names:

Forget-me-not  
Yellow eye forget-me-not  
Water scorpion-grass

## Origin:

Europe  
Western Asia

## Key features:

Plants grow 8-24 inches (20-60 cm) in height

**Stems:** Stems are angled, often creeping

**Leaves:** Lower leaves are tapered to the base while the upper leaves are more oblong, leaves are alternate, with short hairs

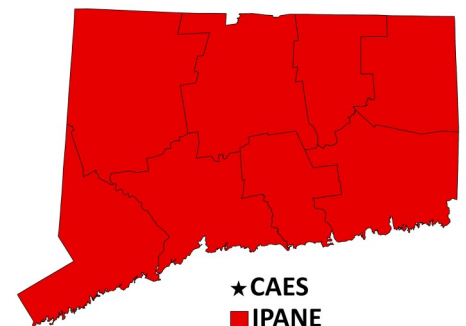
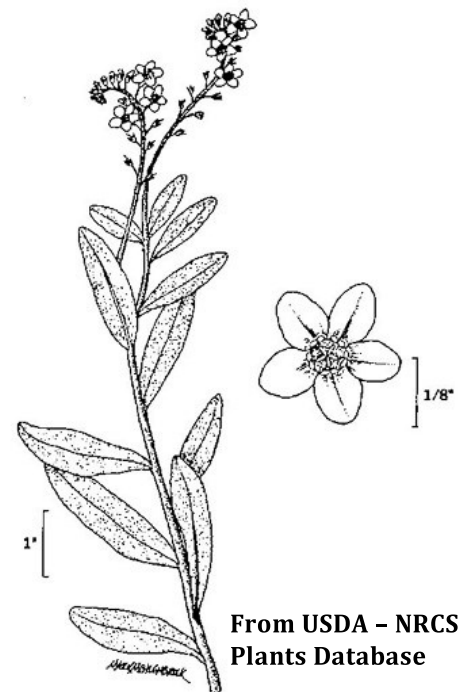
**Flowers:** Flowers are flat and are typically blue with a yellow center, 0.2-0.4 inches (6-9 mm) wide, along a simple inflorescence with a common axis

**Fruits/Seeds:** Seeds are contained in a nutlet that is angled and keeled on the inner side

**Reproduction:** Seeds

## Easily confused species:

Bay forget-me-not: *Myosotis laxa*



# *Myriophyllum aquaticum*

## Common names:

Parrotfeather  
Brazilian watermilfoil

## Origin:

Amazon River basin

## Key features:

Plants occur mostly above the water's surface

**Stems:** Thick red stems, sometimes green

**Leaves:** Leaves are a blue-green color and have a feathery appearance, leaves are whorled, dissected with rounded tips

**Flowers:** Flowers have white sepals and no petals (only females found in the US)

**Fruits/Seeds:** 0.06-0.08 inches (1.5-2 mm) long

**Reproduction:** Fragmentation

## Easily confused species:

Eurasian watermilfoil: *Myriophyllum spicatum*

Variable-leaf watermilfoil: *Myriophyllum heterophyllum*

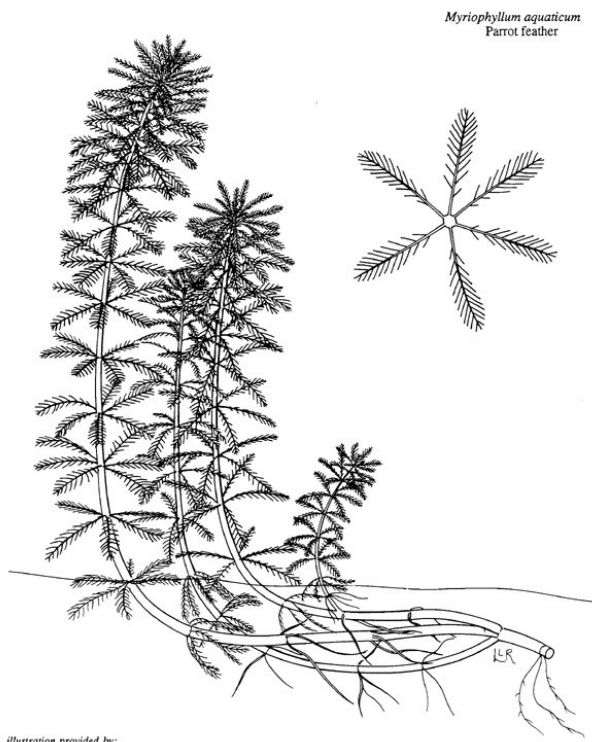
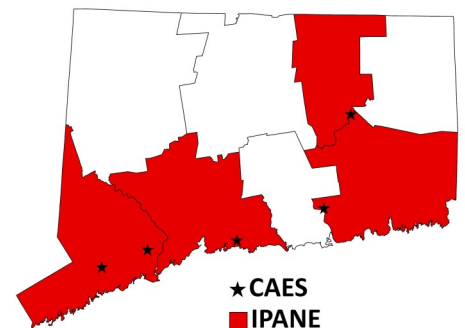


illustration provided by:  
IFAS, Center for Aquatic Plants  
University of Florida, Gainesville, 1990



# *Myriophyllum heterophyllum*

## Common names:

Variable-leaf watermilfoil  
Variable watermilfoil  
Two-leaf watermilfoil

## Origin:

Southern United States

## Key features:

Plants are submersed

**Stems:** Dark brown stems extend to the water's surface and spread to form large mats

**Leaves:** Triangular with  $\leq 11$  pairs of leaflets. Leaves are dissected and whorled (4-6 leaves/whorl) resulting in a feathery appearance with leaf whorls < 1 inch apart giving it a ropy appearance

**Flowers:** Inflorescence spike 2-14 inches (5-35 cm) long extend beyond the water's surface with flowers in whorls of four with reddish petals

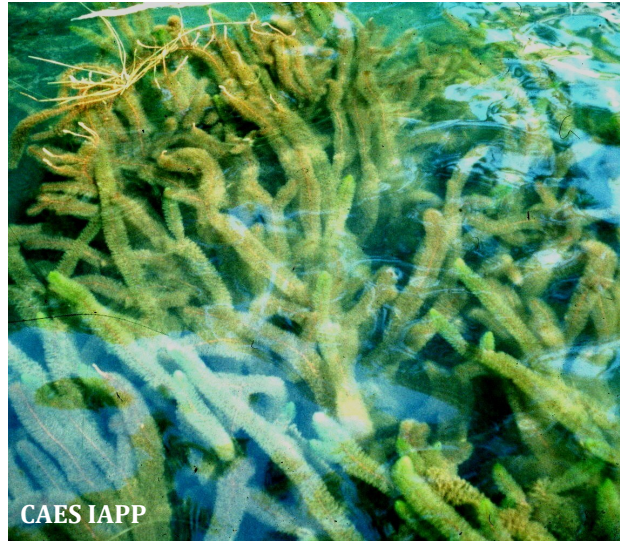
**Fruits/Seeds:** Fruits are almost round, with a rough surface

**Reproduction:** Fragmentation and seeds

## Easily confused species:

Eurasian watermilfoil: *Myriophyllum spicatum*

Low watermilfoil: *Myriophyllum humile*



*Myriophyllum heterophyllum*

*Myriophyllum heterophyllum*  
Variable-leaf milfoil

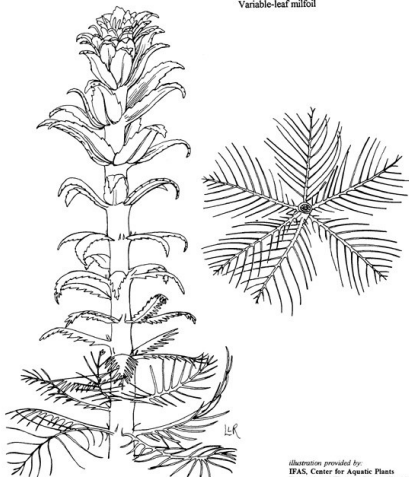
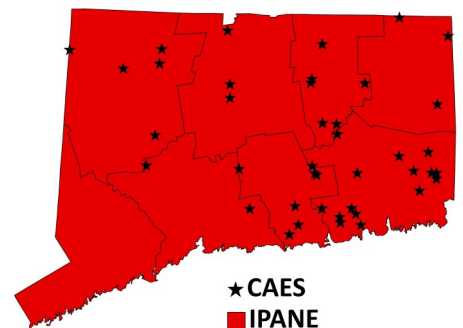
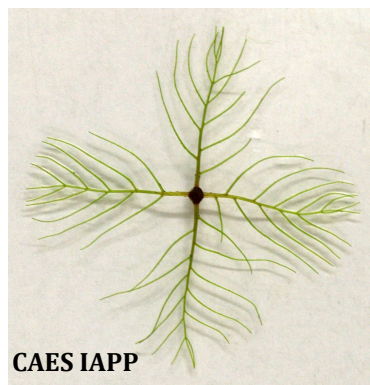


Illustration provided by:  
IFAS, Center for Aquatic Plants  
University of Florida, Gainesville, 1999



# *Myriophyllum spicatum*

**Common name:**  
Eurasian watermilfoil

**Origin:**  
Europe and Asia

**Key features:**  
Plants are submersed

**Stems:** Stem diameter below the inflorescence is greater with reddish stem tips

**Leaves:** Leaves are rectangular with  $\geq 12$  pairs of leaflets per leaf and are dissected giving a feathery appearance, arranged in a whorl, whorls are 1 inch (2.5 cm) apart

**Flowers:** Small pinkish male flowers that occur on reddish spikes, female flowers lack petals and sepals and have 4 lobed pistil

**Fruits/Seeds:** Fruit are round 0.08-0.12 inches (2-3 mm) and contain 4 seeds

**Reproduction:** Fragmentation and seeds

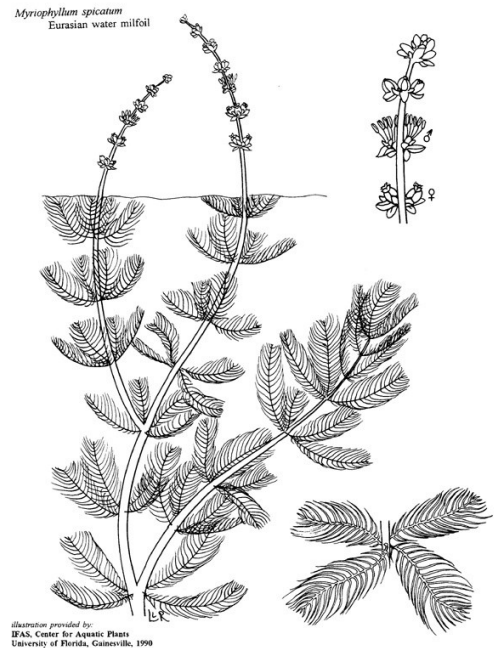
## **Easily confused species:**

Variable-leaf watermilfoil: *Myriophyllum heterophyllum*

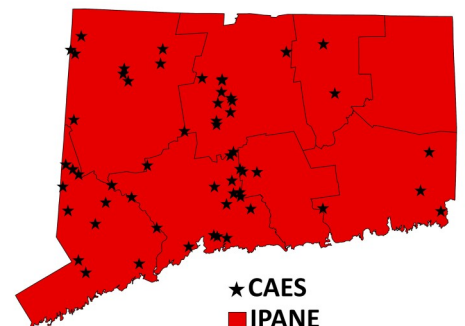
Low watermilfoil: *Myriophyllum humile*

Northern watermilfoil: *Myriophyllum sibiricum*

Whorled watermilfoil: *Myriophyllum verticillatum*



Copyright 1991 Univ. of Florida  
Center for Aquatic and Invasive Plants



# *Najas minor*

## Common names:

Minor naiad  
Brittle waternymph  
Spiny leaf naiad  
Eutrophic waternymph

## Origin:

Europe

## Key features:

Plants are submersed

**Stems:** Branched stems can grow up to 4-8 inches (10-20 cm) long

**Leaves:** Opposite and lance shaped on branched stems with easily visible toothed leaf edges and leaves appear curled under, basal lobes of leaf are also serrated, 0.01-0.02 inches (0.3-0.5 mm)

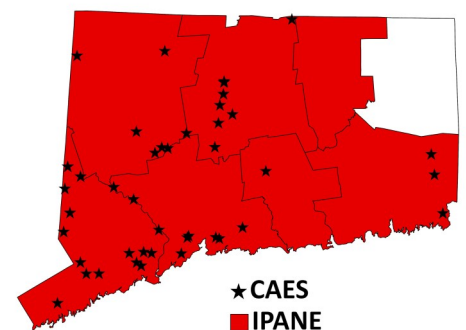
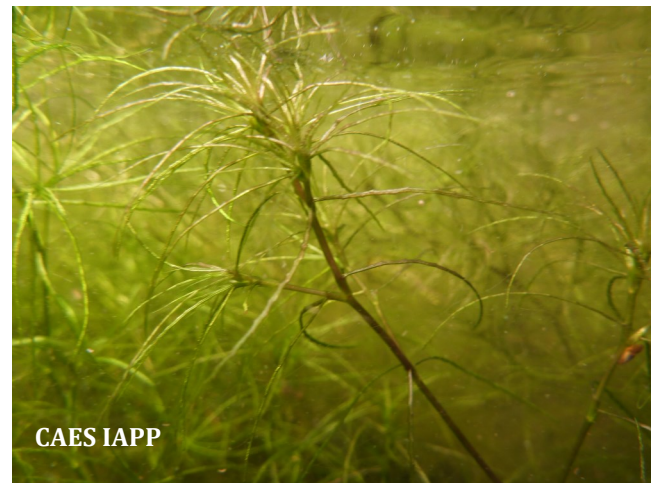
**Flowers:** Monoecious (male and female flowers on same plant)

**Fruits/Seeds:** Fruits are purple-tinged and seeds measure 0.03-0.06 inches (1.5-3 mm)

**Reproduction:** Seeds and fragmentation

## Easily confused species:

Other naiads (native): *Najas* spp.



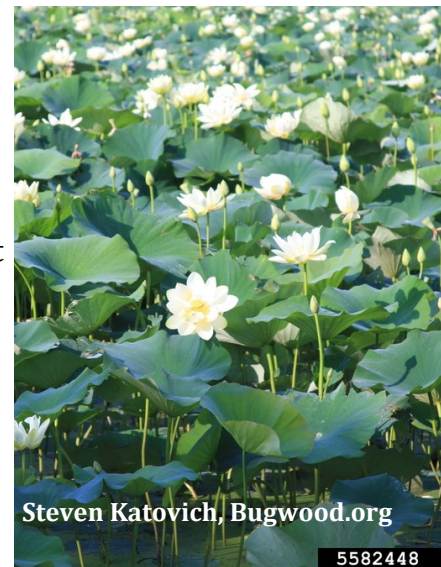
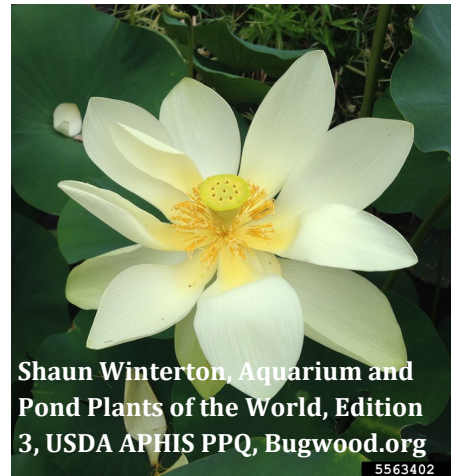
# *Nelumbo lutea*

**Common name:**  
American water lotus

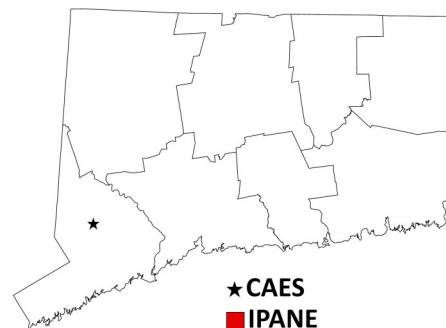
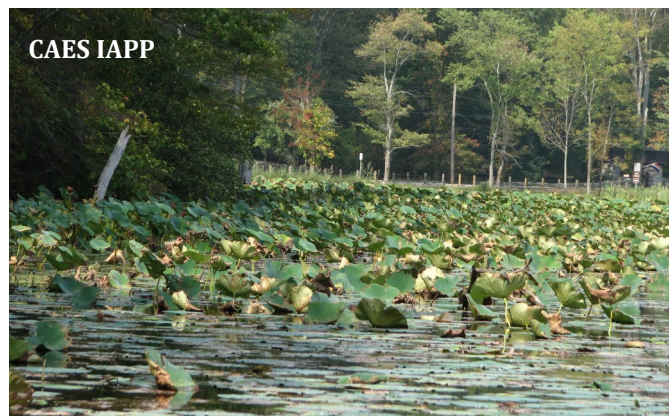
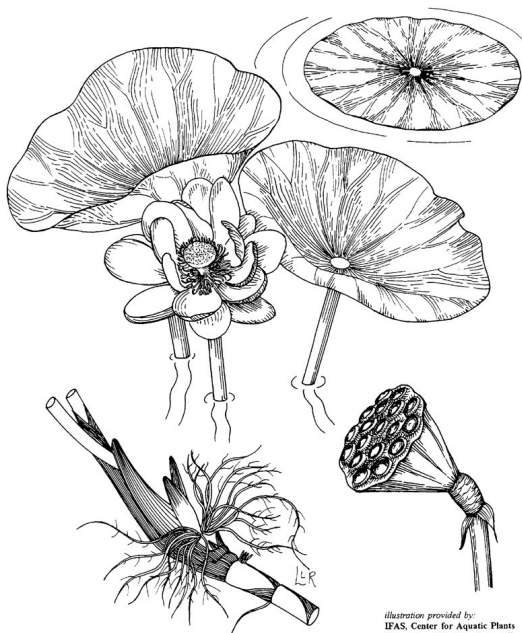
**Origin:**  
Southeastern United States, Mexico, Honduras,  
and the West Indies

**Key features:**  
Plants are on or above the water  
**Stems:** Stiff stalk attaches to the center of the leaf  
**Leaves:** Large, bluish-green, circular leaves with no “slit” like water lilies  
**Flowers:** White to yellowish flowers measure up to 8 inches (20 cm) wide  
**Fruits/Seeds:** Seeds are nut-like and contained in a structure that resembles the top of a watering can  
**Reproduction:** Seed

**Easily confused species:**  
None



*Nelumbo lutea*  
American lotus



Copyright 1991 Univ. of Florida  
Center for Aquatic and Invasive Plants



# *Nymphoides peltata*

**Common name:**  
Yellow floating heart

**Origin:**  
Europe, Japan, China, and India

**Key features:**  
Floating leaf plant

**Stems:** Branching stems spread over water's surface

**Leaves:** Floating leaves are round and heart-shaped at base, paired at each node

**Flowers:** Flowers are bright yellow on long peduncles with 5 fringed petals

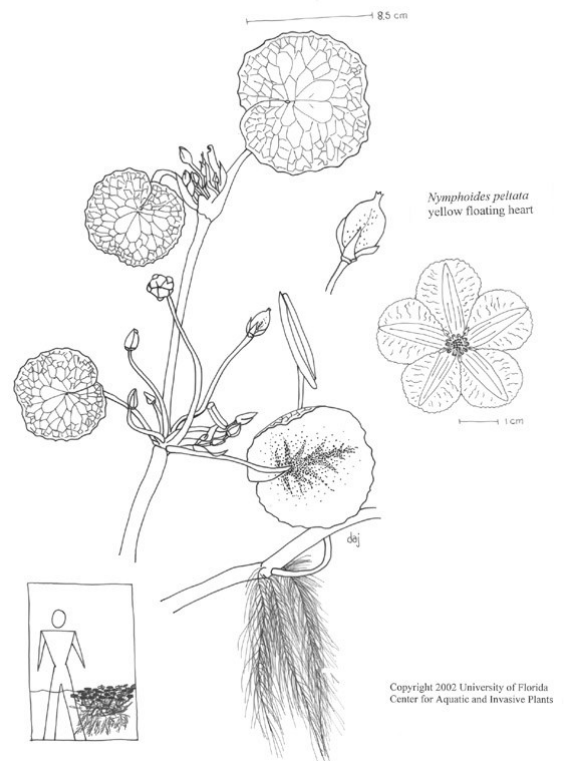
**Fruits/Seeds:** Seeds are flat and oval and are in capsules

**Reproduction:** Seeds and rhizomes

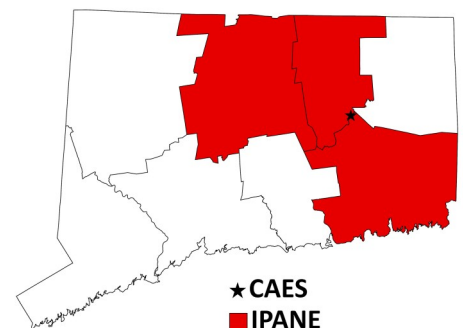
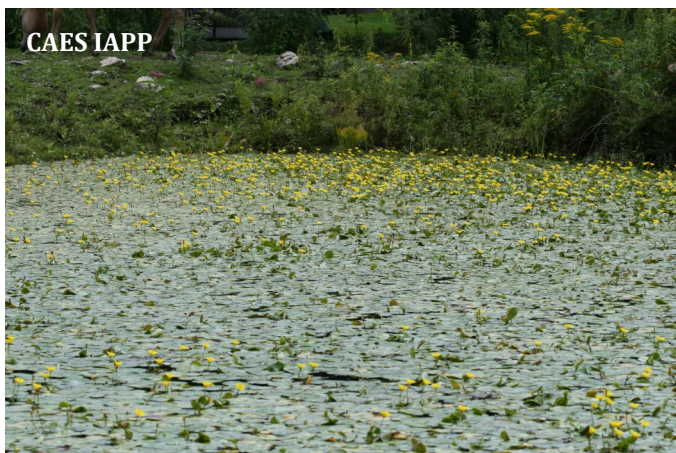
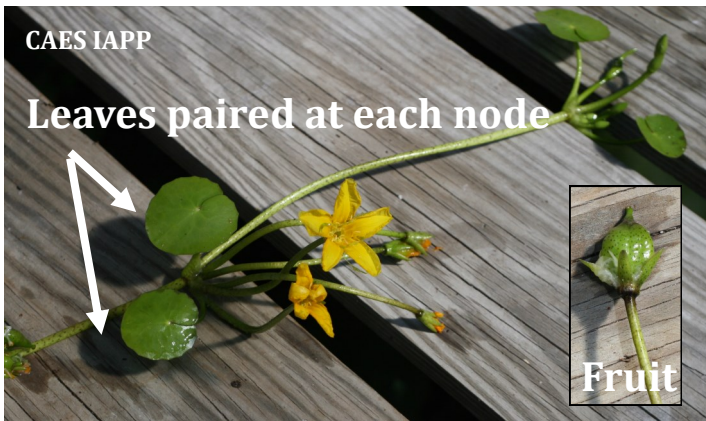
## **Easily confused species:**

Little floating heart: *Nymphoides cordata*

Yellow water lily: *Nuphar variegata*



Copyright 2002 Univ. of Florida  
Center for Aquatic and Invasive Plants



# *Pistia stratiotes*

## Common names:

Water lettuce

Tropical duckweed

## Origin:

Nativity unknown, but possibly

South America, Africa, Southeastern US

## Key features:

Free floating plant that resembles a head of lettuce

**Stems:** Roots are long and feathery

**Leaves:** Leaves are fleshy and covered with dense white hairs and have parallel venation

**Flowers:** Several male flowers form a whorl around a spike with one female flower below them

**Fruits/Seeds:** Fruit are light green berries that produce 0.04 inch (1 mm) brown seeds

**Reproduction:** Seeds and stolons

## Easily confused with:

None

*Pistia stratiotes*  
Water lettuce

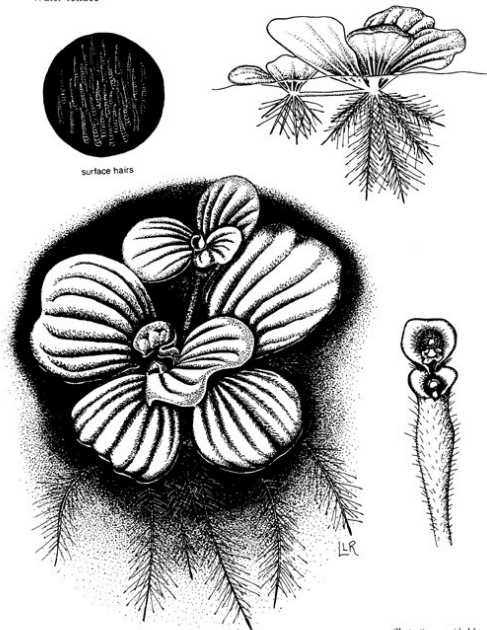
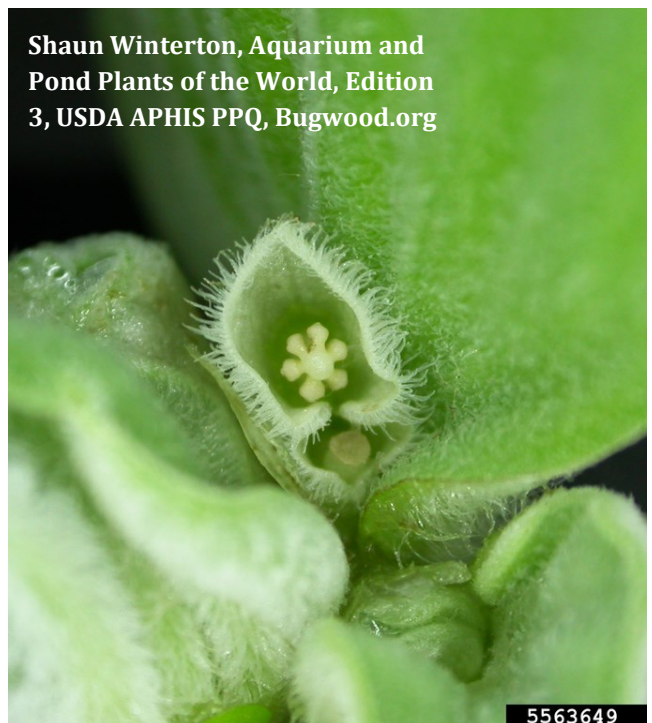


illustration provided by:  
IFAS, Center for Aquatic Plants  
University of Florida, Gainesville, 1990

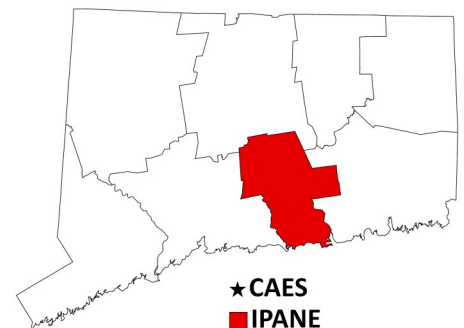
Copyright 1991 Univ. of Florida  
Center for Aquatic and Invasive Plants



Shaun Winterton, Aquarium and  
Pond Plants of the World, Edition  
3, USDA APHIS PPQ, Bugwood.org



Shaun Winterton, Aquarium and  
Pond Plants of the World, Edition  
3, USDA APHIS PPQ, Bugwood.org



# *Potamogeton crispus*

## Common names:

Curly leaf pondweed  
Crispy-leaved pondweed  
Crisped pondweed

## Origin:

Asia, Africa, and Europe

## Key features:

Plants are submersed

**Stems:** Stems are flattened, can form dense stands in water up to 15 feet (5 m) deep

**Leaves:** Alternate leaves 0.3-1 inches (3-8 cm) wide with wavy edges (similar to lasagna) with a prominent mid-vein

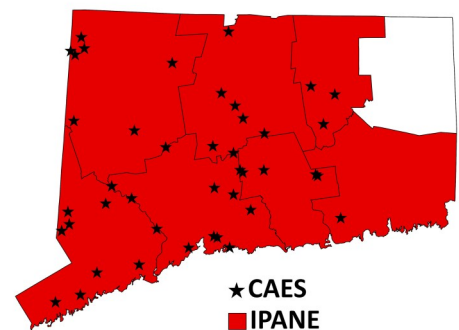
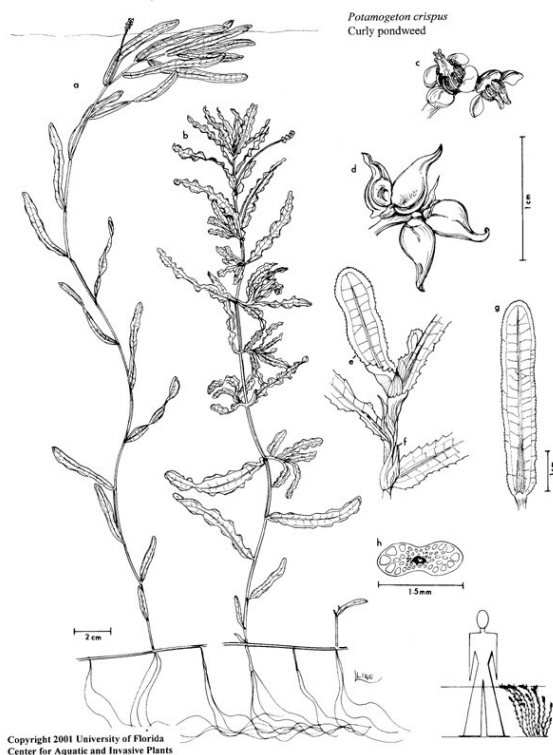
**Flowers:** Brown and inconspicuous

**Fruits/Seeds:** Fruit is oval 0.1 inches (3 mm) long

**Reproduction:** Turions (right) and seeds

## Easily confused species:

None



# *Rorippa microphylla*

## **Synonym:**

*Nasturtium microphyllum*

## **Common name:**

Onerow yellowcress

## **Origin:**

North Africa, Europe,  
and the Middle East

## **Key features:**

**Stems:** Grows flatly across the ground and roots at nodes, forming large mats, can be fully to partially submerged

**Leaves:** Pinnate leaves with 3-9 segments and the terminal leaf is the largest

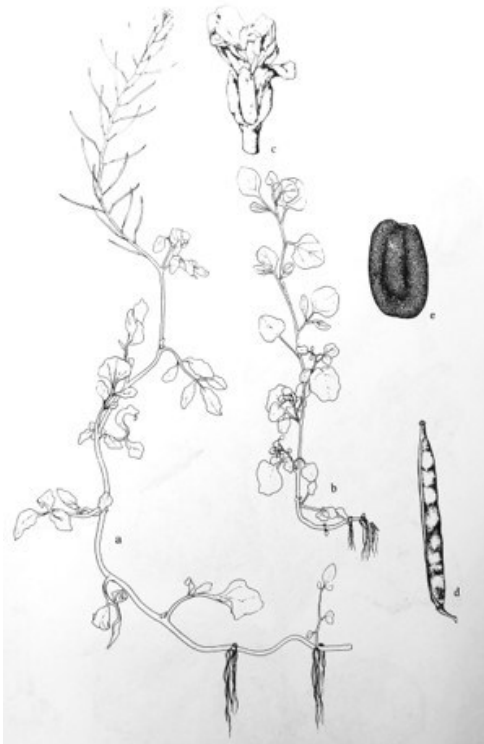
**Flowers:** White petals with 4 part perianth

**Fruits/Seeds:** Fruit is a long and slender silique, up to 1 inch (25 mm) long, with seeds in one row on each side

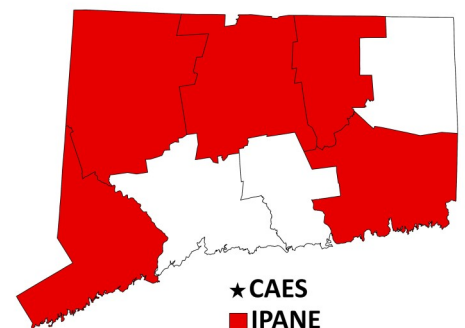
**Reproduction:** Seed

## **Easily confused species:**

Watercress: *Rorippa nasturtium-aquaticum*



Crow and Hellquist, 2000



# *Rorippa nasturtium-aquaticum*

## **Synonym:**

*Nasturtium officinale*

## **Common name:**

Watercress

## **Origin:**

North Africa, Europe, and the Middle East

## **Key features:**

**Stems:** Hollow stems can grow flat on mud or be fully or partially submersed

**Leaves:** Leaves are pinnately compound have 3-9 segments and vary in shape, the terminal leaf is the largest in each segment

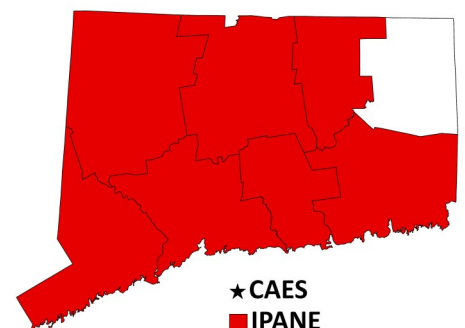
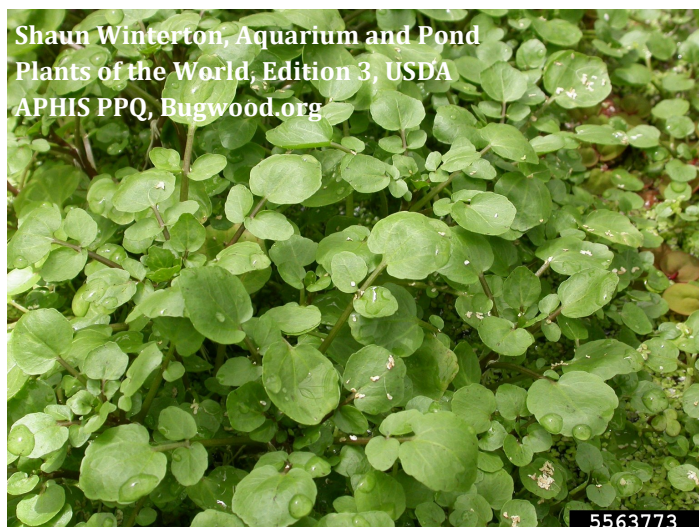
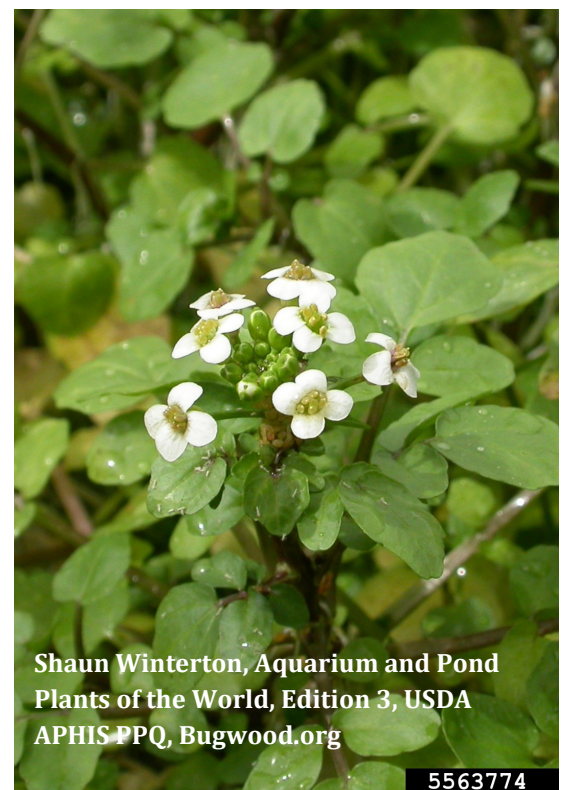
**Flowers:** Small white and green flowers; four white petals with four long and 2 short stamens

**Fruits/Seeds:** Fruit is pod-like silique, 0.4-0.6 in. (10-15 mm) long, with seeds in two rows per side

**Reproduction:** Fragmentation and seed

## **Easily confused species:**

Onerow yellowcress: *Rorippa microphylla*



# Salvinia molesta

## Common names:

Giant salvinia  
Water fern  
Salvinia  
Kariba weed  
Aquarium watermoss

## Origin:

Brazil

## Key features:

Free floating plant with no roots

**Stems:** Horizontal stems float below the surface

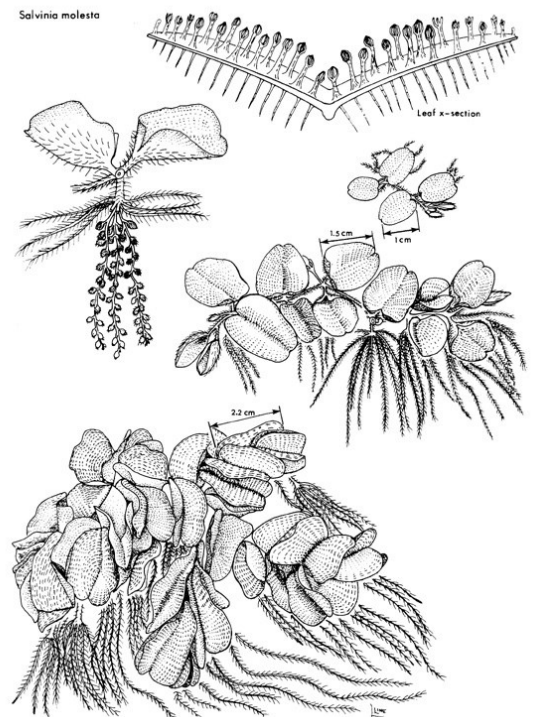
**Leaves:** Submersed leaves are brown and feather-like; surface leaves are folded at midrib and covered with many water repellent hairs that are split in the middle but rejoin at the tips; leaves become tightly packed into long chains as the plant grows

**Fruits/Seeds:** Egg shaped sporocarps

**Reproduction:** Fragmentation

## Easily confused species:

None



Copyright 2002 Univ. of Florida  
Center for Aquatic and Invasive Plants

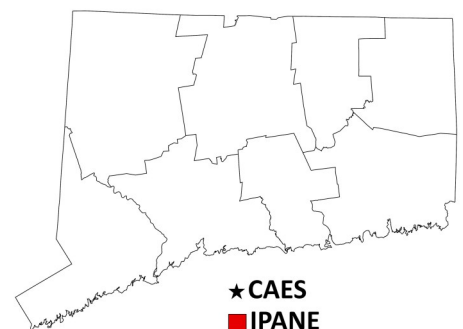


Photo Credit A: Mic Julien, Commonwealth Scientific and Industrial Research Org., Bugwood.org B: Vic Ramey  
Copyright 2000 University of Florida

# *Trapa natans*

## **Common names:**

Water chestnut  
European water chestnut

## **Origin:**

Asia and Europe

## **Key features:**

Plants are rooted to substrate and float

**Stems:** Stem is submersed, flaccid and can be up to 15 feet (5 m) long

**Leaves:** Leaves 0.8-0.16 inches (2-4 cm) long are triangular and toothed along the front edge with inflated petioles, leaves float in a rosette pattern

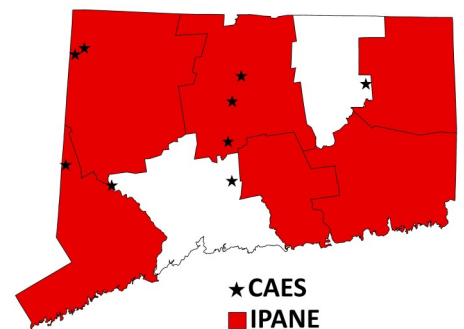
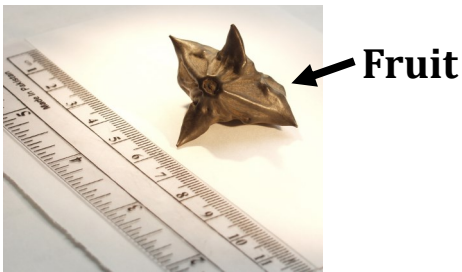
**Flowers:** Flowers are located in the center of the rosette and have four white petals

**Fruits/Seeds:** Fruit is hard and has four sharp spines

**Reproduction:** Seeds and fragmentation

## **Easily confused species:**

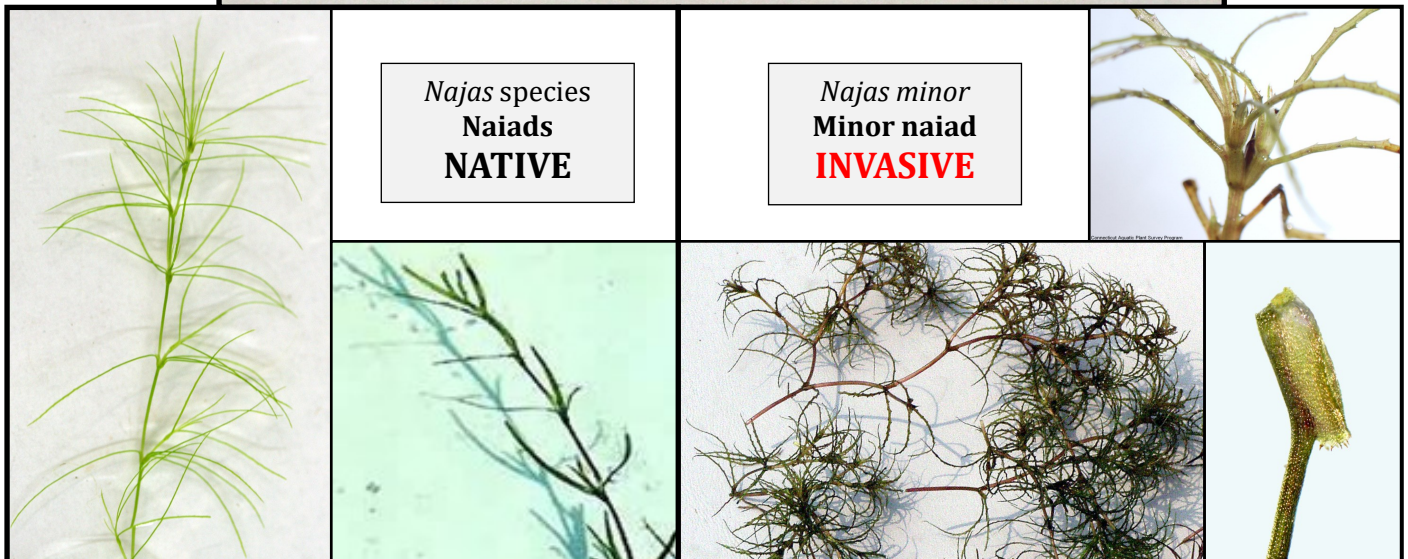
None



# Commonly Confused Aquatic Plants

## Submersed plants with non-dissected leaves

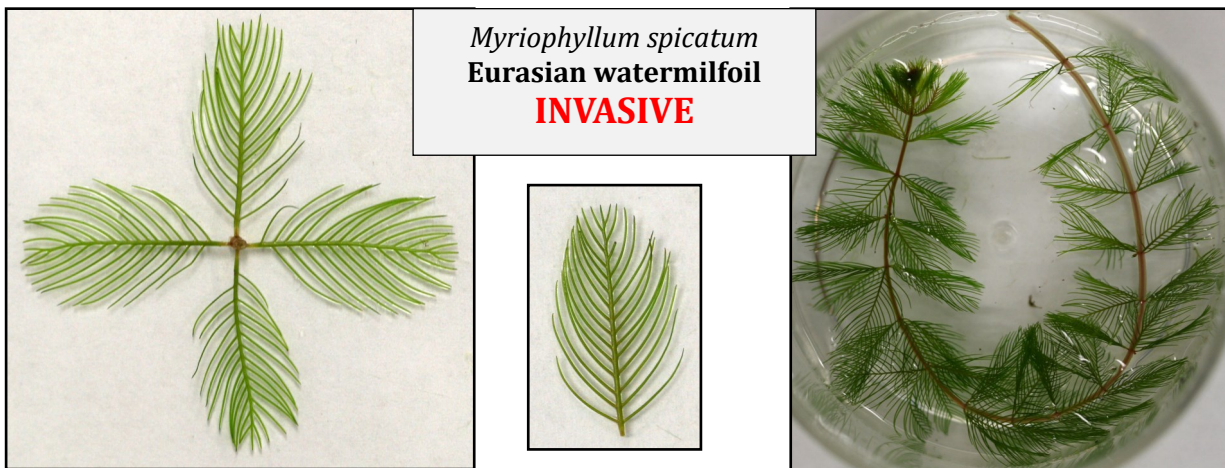
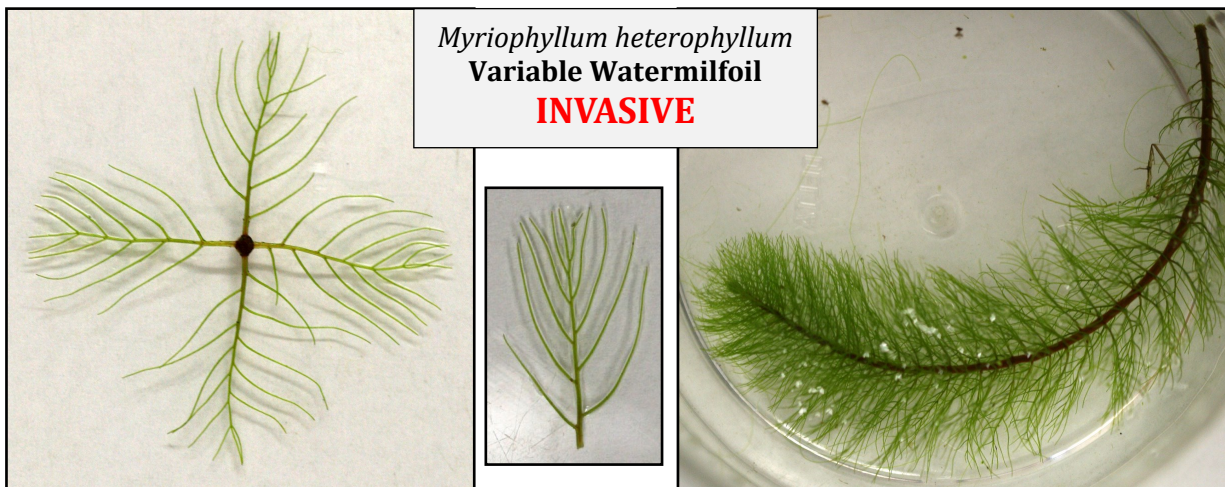
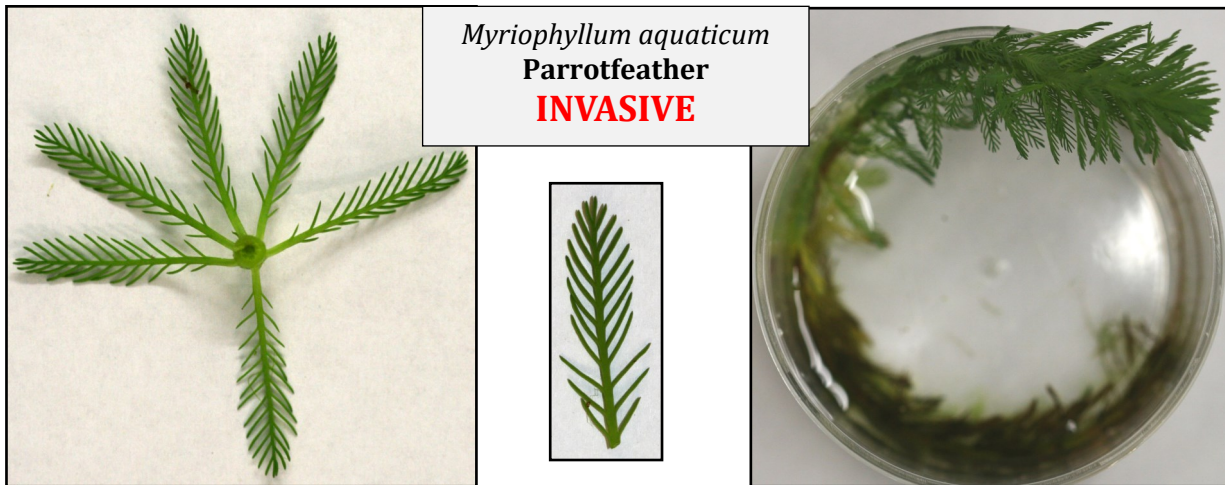
(all photos by CAES IAPP)





## Submersed plants with feathery dissected leaves

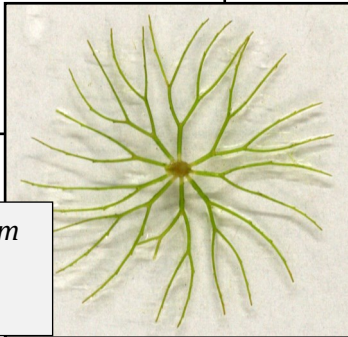
(all photos by CAES IAPP)



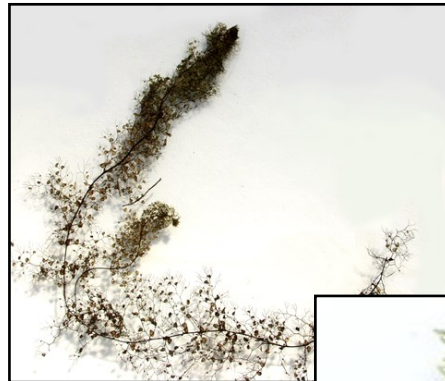
**NOTE:** *Myriophyllum sibiricum*, Northern Watermilfoil, is a threatened native species that is easily confused with *M. spicatum*. *M. sibiricum*'s distinguishing features include less than 12 leaflet pairs per leaf, winter buds, and stem tips that are usually green instead of red.

## Submersed plants with forked and branched dissected leaves

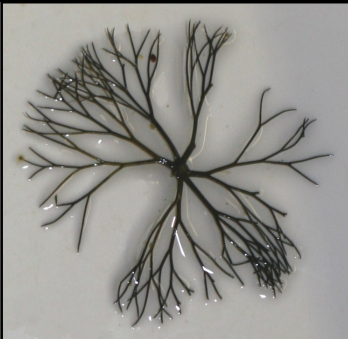
(all photos by CAES IAPP except where noted)



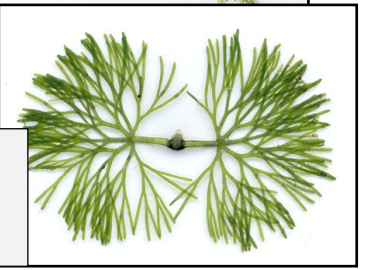
*Ceratophyllum demersum*  
**Coontail**  
**NATIVE**



*Utricularia* species  
**Bladderwort**  
**NATIVE**



*Megalodonta beckii*  
**Water marigold**  
**NATIVE**



*Cabomba caroliniana*  
**Fanwort**  
**INVASIVE**

*Ranunculus* species  
**Water-crowfoot**  
**NATIVE**



# Key to Invasive or Potentially Invasive Aquatic Plants of Connecticut

*Key also includes commonly confused native species*

## Floating-Leaf Plants (field characteristics)

- 1. Plants free-floating on water's surface, not rooted to the substrate\*
  - 2. Leaves folded along midrib, surface covered with hairs.....**Salvinia molesta (Giant Salvinia)**
  - 2. Leaves not folded, surface smooth
    - 3. Petioles inflated; oval leaves in a rosette; light purple flowers .....  
.....**Eichhornia crassipes (Water Hyacinth)**
    - 3. Petioles not inflated; broad, fleshy leaves in a rosette, covered with dense white hairs.....  
.....**Pistia stratiotes (Water Lettuce)**
- 1. Plants rooted in substrate
  - 4. Leaves forming a rosette; leaves triangular, toothed; petioles inflated; spiny fruit.....  
.....**Trapa natans (Water Chestnut)**
  - 4. Leaves not forming rosette
    - 5. Leaves compound, cut into several leaflets
      - 6. Leaves comprised of four leaflets, like a four-leaf clover.....  
.....**Marsilea quadrifolia (European Waterclover)**
      - 6. Leaves pinnately compound with 3-9 leaflets, terminal leaflet is largest; hollow stems floating; small white and green flowers in clusters
        - 7. Pod-like fruit 0.4-0.6 inches (10-15 mm) long, 2 rows of seeds per side.....  
.....**Rorippa nasturtium-aquaticum (Watercress)**
        - 7. Pod-like fruit 0.7-1 inches (17-26 mm) long, 1 row of seeds per side.....  
.....**Rorippa microphylla (Onerow Yellowcress)**
    - 5. Leaves entire or lobed
      - 8. Leaves entire (no slit), circular, bluish green, on stiff stalk above water.....  
.....**Nelumbo lutea (Water Lotus)**
      - 8. Leaves lobed, heart shaped
        - 9. Yellow flowers
          - 10. Flowers with five, fringed petals.....**Nymphoides peltata (Yellow Floating Heart)**
          - 10. Flowers ball shaped, petiole flattened.....**Nuphar variegata (Yellow Water Lily)** (native)
        - 9. White flowers with five, fringed petals; roots close to the floating leaves, near the surface of the water.....**Nymphoides cordata (Little Floating Heart)** (native)

\*Plants such as yellow and little floating heart and water chestnut can become free-floating when dislodged from sediment or detached from a rooted plant.

## Submersed Plants (field characteristics)

1. Leaves entire, sometimes toothed
  2. Leaves alternate, with wavy edges (lasagna-like); turions may be present; prominent leaf mid vein.....  
..... **Potamogeton crispus (Curly Leaf Pondweed)**
  2. Leaves whorled, opposite, or clustered
    3. Leaf bases wider than the leaf blade, appearing opposite, whorled or clustered
      4. Toothed leaf edges visible without magnification..... **Najas minor (Minor Naiad)**
      4. Magnification needed to see toothed edge..... **Najas species (Other Naiads)** (native)
    3. Leaf base not distinct from rest of leaf blade, leaves strictly whorled
      5. Whorls of 3 leaves; leaf margins not toothed..... **Elodea species (Waterweeds)** (native)
      5. Whorls of 4 or more leaves; leaf margins toothed (magnification sometimes needed)
        6. Leaves 4 per whorl (rarely up to 6 leaves/whorl), 0.5-1.5 inches (1.2-4 cm) long, toothed leaf margins (need magnification)..... **Egeria densa (Brazilian Waterweed)**
        6. Leaves 5 per whorl (rarely 2-6 leaves/whorl), 0.2-0.7 inches (0.6-1.7 cm) long, toothed leaf margins; mid-vein may be toothed; tubers present; may have turions.....  
..... **Hydrilla verticillata (Hydrilla)**
1. Leaves dissected
  7. Leaves feathery in appearance (pinnate)
    8. Leaves concentrated above the water; thin, rounded-tipped, blue-green leaves.....  
..... **Myriophyllum aquaticum (Parrotfeather)**
    8. Leaves concentrated below the water, except for emergent flower spikes
      9. Leaf whorls less than 1 inch (2.5 cm) apart, giving the plant a ropy look; triangular shaped leaves, with less than or equal to 11 pairs of leaflets; thick spike with entire toothed leaves.....  
..... **Myriophyllum heterophyllum (Variable Watermilfoil)**
      9. Leaf whorls 1 inch (2.5 cm) apart; rectangular shaped leaves, with greater than or equal to 12 pairs of leaflets; thin spike with leaves smaller than flowers.....  
..... **Myriophyllum spicatum (Eurasian Watermilfoil)**
      9. Leaves rounded in whorls with less than 12 pairs of leaflets; winter buds.....  
..... **Myriophyllum sibiricum (Northern Watermilfoil)** (native, threatened)
  7. Leaves forked
    10. Leaves with numerous small bladders, not rooted... **Utricularia species (Bladderworts)** (native)
    10. Leaves lacking bladders
      11. Leaves alternate; petioles sheathing stem; flowers usually solitary.....  
..... **Ranunculus species (Water-crowfoot)** (native)
      11. Leaves opposite or whorled
        12. Leaves whorled; leaf divisions fork in pairs, forking a total of 1-4 times, leaves often toothed; no roots or flower spike..... **Ceratophyllum species (Hornworts)** (native)
        12. Leaves opposite, fan-shaped; leaf divisions fork into either 2 or 3 segments
          13. Leaves attached to the stem with petioles; small floating leaves; flowers white.....  
..... **Cabomba caroliniana (Fanwort)**
          13. Leaves not attached to the stem by a petiole, leaves opposite but appearing whorled; emersed leaves on spike entire to toothed; flowers yellow.....  
..... **Megalodonta beckii (Water Marigold)** (native, threatened)

# Introduction and Dispersal of Aquatic Invasives

(all photos by CAES IAPP)

## Aquariums and Water Gardens

Most of the invasive aquatic plants in Connecticut are thought to have been introduced via the release from aquariums or water gardens (Les and Mehrhoff 1999). Although setting these plants “free” rather than disposing of them sounds like a good idea, it should be avoided. Because it is difficult to know what species you have and the designation of “non-invasive” is not always accurate, all aquarium and water gardening plants should be treated as invasive and disposed of properly. This includes, returning to a retailer, giving to well-informed aquarist or water gardener, or sealing in plastic bags for disposal in the trash. Also be aware that water gardens that are upstream from waterbodies are prone to releasing aquatic plants, fish and other species downstream during flooding events.



## Clean, Drain, Dry

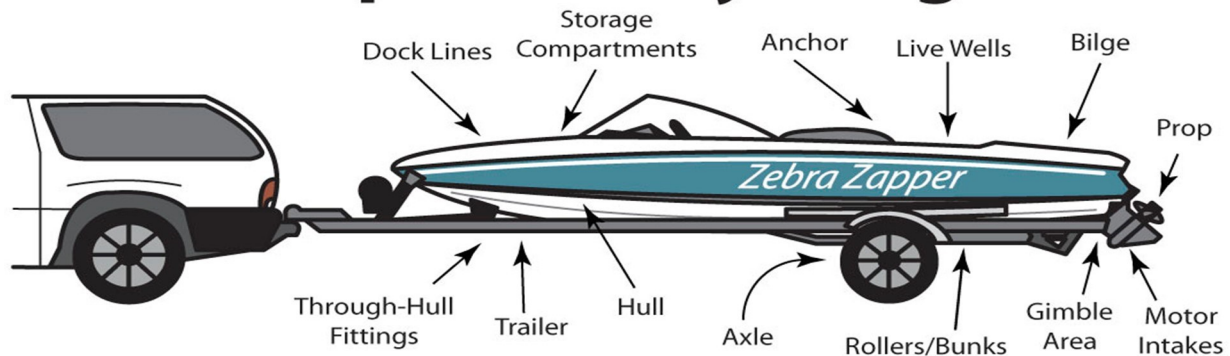
Proper boat and trailer cleaning is an important way to prevent the spread of aquatic invasive species. Many plants spread through fragmentation, so even a small piece stuck to a trailer can create an infestation in a waterbody. Zebra mussels and other aquatic animals can also hitch a ride on boats and trailers to new locations. Best practices for boat and trailer cleaning include the Clean, Drain, Dry technique and disinfection. **Clean** all equipment, removing any visible mud, plants, fish or animals before leaving the launch site. **Drain** all water from boats and live

wells at the launch site. **Dry** anything that comes into contact with water for a minimum of five days or wash with hot water that is at least 140 degrees F for a minimum of 30 seconds (preferably at high pressure). Boats, trailers, and equipment can be sprayed with a bleach solution (3 oz. per gallon) allowing ten minutes of contact time prior to rinsing. Equipment can also be dipped into 100% vinegar for 20 minutes. The CT DEEP has more information on aquatic hitchhikers (<https://portal.ct.gov/DEEP/Fishing/General-Information/Aquatic-Invasive-Species>).

## The "Clean, Drain, Dry" technique can prevent the spread of invasive species.

(Credit - <https://portal.ct.gov/DEEP/Fishing/General-Information/Aquatic-Invasive-Species>)

### Before leaving and before launching... **inspect everything!**



#### **Clean:**

- Inspect and remove all visible plant, fish, and animals as well as mud or other debris at the launch. Do not transport them home.
- Check trailer, including axle and wheel areas - in and around the boat itself: anchor, props and jet engines, ropes, boat bumpers, paddles, and anything else that came in contact with the water.

#### **Drain:**

- Eliminate all water from every conceivable space and item before you leave the area you are visiting.
- Remove the drain plug from boats and put boat on an incline so that the water drains out
- Drain all water in live-wells, bilge, ballast tanks, transom wells, kayaks, canoes, rafts, motors, jet drives, boat hulls, scuba tanks and regulators, boots, waders, bait buckets, seaplane floats and swimming floats.

#### **Dry:**

- Dry Equipment, if possible, allow for 5 days of drying time before entering new waters.

#### **Additionally, under the law**

- Boaters must inspect their vessel for vegetation and aquatic nuisance species and properly remove and dispose of all vegetation and nuisance species before transporting the vessel. You can be fined \$95 per violation ([CGA 15-180](#)) and [Public Act 12-167](#).

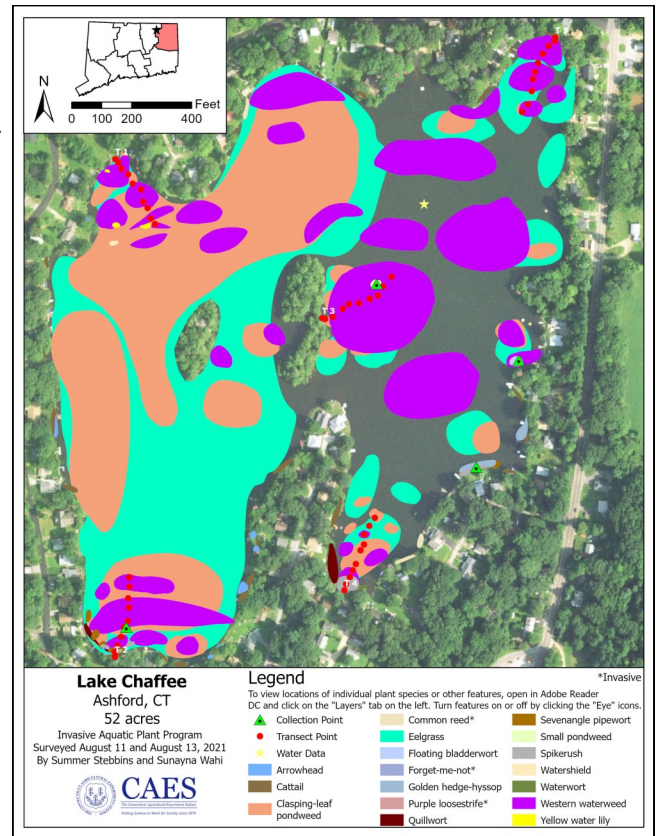
# Managing Nuisance Aquatic Vegetation in Connecticut

(all photos by CAES IAPP)

## Invasive Aquatic Plant Control

Aquatic vegetation proliferates in water with proper sunlight, chemistry, sediment and freedom from antagonistic organisms. Managing invasive aquatic plants usually requires a multifaceted approach. It is important to accurately identify the species present. This can be accomplished through an aquatic plant survey (top right). Sometimes nuisance plants, such as lily pads, are native. Although they may need to be managed, their removal could result in replacement with more problematic invasive species. In addition, certain native plants may be highly beneficial or rare and warrant protection. Combinations of management techniques that adapt to yearly changes are usually most effective. This discussion of invasive aquatic plant control is intended to be introductory in nature. The Aquatic Ecosystem Restoration Foundation (2020) has an online guidebook that details the subjects discussed below

(<http://aquatics.org/bmpchapters/BMP4ed.pdf>).



## Nutrient Reduction

Because nuisance aquatic vegetation is stimulated by nutrients, especially phosphorus and nitrogen, reducing the amount of these elements reaching a water body is an important part of any management program. Public education on preventing septic tank failures (bottom right) and use of fertilizers is important. Using soil tests to determine nutrient needs helps assure fertilizer is used at the proper rates and at the right time. Recent legislation in Connecticut has banned phosphorus from fertilizers used on established lawns unless substantiated by a soil test. CAES tests soil for citizens ([portal.ct.gov/caes](http://portal.ct.gov/caes)). Unfertilized vegetated buffer zones along shorelines are effective in limiting the movement of fertilizer to ponds and lakes. The misapplication of fertilizer to pavement is of concern because storm drains often discharge into lakes and ponds.



## Water Level Drawdown

Lowering the water level of a lake or pond can expose unwanted vegetation to lethal drying and freezing conditions. Where water level drawdown is feasible, this is a cost effective aquatic plant management technique. Non-target plants and other aquatic organisms, however, can be negatively impacted. Usually drawdowns are performed in the winter when recreational use is minimal. Warm winters, snow cover and groundwater seepage can prevent necessary freezing and drying. Minor naiad (*Najas minor*) seems tolerant to drawdown probably because it regrows from seeds each year. Care needs to be taken to properly assess the refill time. If the body of water is not filled by spring problem vegetation can expand into areas where plant growth is normally limited by light penetration. A side benefit of winter drawdown is docks and other shoreline structures are protected. CAES IAPP has been monitoring the effects of the annual drawdowns on Candlewood Lake (above) since 2007 and found good control of Eurasian watermilfoil (*Myriophyllum spicatum*) in the drawdown year (CAES IAPP, 2018). Drawdowns may require permits from local, state or federal agencies.



## Herbicides

Managing invasive aquatic plants with herbicides is sometimes necessary. An aquatic herbicide must meet strict requirements of the United States Environmental Protection Agency and then be registered in the state where it is used. In Connecticut, aquatic herbicides may not be applied without obtaining a permit from the Connecticut Department of Energy and Environmental Protection (CT DEEP). Choosing the best herbicide requires proper plant identification, a sense for the non-target species you want to protect, the time of year you want to treat, potential water use limitations (i.e. drinking, swimming, irrigation etc.), and acceptance by stakeholders. There are two general types of herbicides, contact and systemic. Contact herbicides are usually quick acting but have little effect on roots and reproductive propagules such as seeds, turions and tubers. Regrowth, therefore, can be expected. Systemic herbicides are slower acting but have the capability of controlling the root system. Longer term control is possible but elimination of an invasive species is unlikely. The suppressive effect of herbicides often prevents further spread. Herbicides are available in liquid or granular forms (above). CT DEEP (2014) offers an online guide (<https://portal.ct.gov/-/media/DEEP/pesticides/Certification/Supervisor/aweeds.pdf>) to the latest approved aquatic herbicides and their use.





## Sediment Removal

Shallow areas of lakes and ponds with fertile sediment will promote plant growth. Removal of the sediment is a long term solution. Sediment removal is performed through various types of dredging and permits from local, State and Federal agencies are usually necessary. Dredging is performed either wet or dry. Wet dredging does not require lowering the water level and has the advantage of minimal disruption to recreational use. Dry dredging (right) involves lowering the water level, drying the sediment and using excavation equipment to facilitate removal. This method is efficient and sometimes the material can be sold to recoup some of the costs. The downside of dry dredging is its negative effects on the aquatic ecosystem and the inability to use the waterbody for long periods (often many years).



## Biological Controls

Introducing an organism that feeds specifically on an invasive aquatic plant can provide targeted long-term control. Unfortunately, virtually no reliable target specific biocontrols are available for invasive aquatic plants in the northeastern USA. A biocontrol being tested for Eurasian watermilfoil is the milfoil weevil (*Euhrychiopsis lecontei*) (bottom). Although the larvae and adults feed on Eurasian watermilfoil and they are native to most lakes with the plant, neither the natural or introduced populations are currently considered a reliable control. The most common biocontrol in Connecticut is an herbivorous fish called grass carp (*Ctenopharyngodon idella*) (right). This fish was originally cultivated in China for food, but its propensity to eat vegetation brought it to Europe and the USA for aquatic weed control. Concerns over grass carp developing breeding populations have caused it to become regulated in many states including Connecticut. Prior to liberation, a state permit must be obtained, the fish must be documented to be sterile (triploid) and inlets and outlets usually must be screened to prevent the fish

from escaping. Grass carp are usually considered more suitable for smaller waterbodies and are introduced at various rates depending on the amount of vegetated acres, the plants being controlled and other factors. Recently, however, these fish have been used in larger lakes including Candlewood Lake, Connecticut's largest lake. The fish take a year or two to obtain sufficient size to reduce vegetation and after about five years restocking is often necessary. Unfortunately grass carp may prefer native plant species and unforeseen damage to the aquatic ecosystem can occur. In addition, as plants are consumed and passed through the fish's digestive system nutrients are released into the water that may cause algal blooms. Because grass carp are sensitive to copper based algacides, treating the algae can be challenging.



from escaping. Grass carp are usually considered more suitable for smaller waterbodies and are introduced at various rates depending on the amount of vegetated acres, the plants being controlled and other factors. Recently, however, these fish have been used in larger lakes including Candlewood Lake, Connecticut's largest lake. The fish take a year or two to obtain sufficient size to reduce vegetation and after about five years restocking is often necessary. Unfortunately grass carp may prefer native plant species and unforeseen damage to the aquatic ecosystem can occur. In addition, as plants are consumed and passed through the fish's digestive system nutrients are released into the water that may cause algal blooms. Because grass carp are sensitive to copper based algacides, treating the algae can be challenging.



## Harvesting

Probably the simplest means for controlling an area of invasive aquatic plants is removing them by hand pulling or mechanical cutting (above, left). Hand pulling is particularly effective in small areas and can reap tremendous benefits when used to remove new infestations. Sometimes SCUBA divers are employed. Unfortunately, many areas are too large for hand pulling to be practical and mechanical cutters (above, right), rakes or suction harvesters are needed. If the root systems are not removed rapid re-growth can occur, and the procedure may be considered an expensive mistake. Several lakes in Connecticut have dedicated weed harvesting boats that operate each year (above, right). To prevent new introductions, weed harvesters need to be thoroughly cleaned before moving from one waterbody to another.

## Benthic Barriers

Benthic barriers are blanket-like materials that are spread over unwanted aquatic vegetation to prevent light from reaching the plants. They are particularly well suited to small areas but occasionally are used for larger areas. Although most benthic barriers are installed in the spring and removed in the fall, they can be installed for as little as several weeks and then moved. Work done by CAES IAPP has shown that benthic barriers can be effective when installed for as little as a month. More research is needed to document the level of control when this procedure is utilized. If benthic barriers are left in place for more than one growing season sediment settles on the surface and plants can take root.



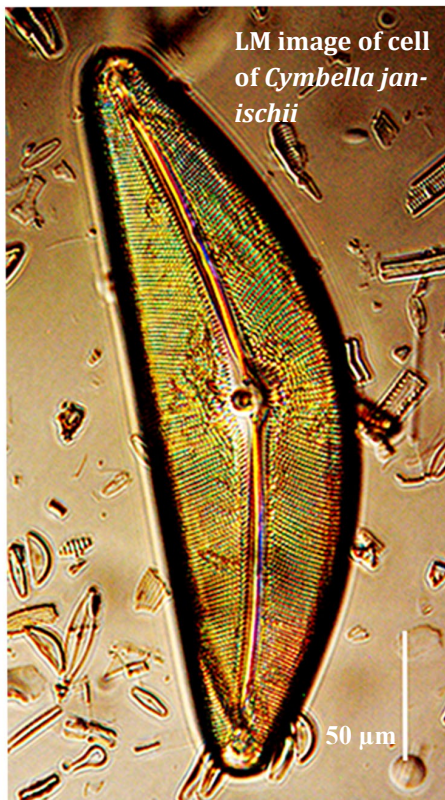
## Sources of further information on invasive aquatic plant management

Aquatic Ecosystem Restoration Foundation. 2020. Biology and Control of Aquatic Plants – A Best Management Practices Handbook Fourth Edition. L. Gettys, W. Haller, D. Petty, eds. Retrieved May 11, 2022 from <http://aquatics.org/bmp.html>

CT DEEP. 2014. Nuisance Aquatic Vegetation Management - A Guidebook. Retrieved May 11, 2022 from <https://portal.ct.gov/-/media/DEEP/pesticides/Certification/Supervisor/aweedspdf.pdf>

# Nuisance & Purportedly Invasive Algae in Connecticut Waterways

Algae are important members of aquatic ecosystems. They can range from uni-cellular micro-algae, diatoms, (cannot see with the naked eye) to 300 foot tall kelp forests of macro-algae. They are photo-autotrophs, meaning they fix CO<sub>2</sub> through photosynthesis in order to make energy. As a result of photosynthesis, they release oxygen. Many diatoms, including the 3 species that will be discussed here, are indicator species of water quality and overall environmental conditions because of how sensitive they can be to things like temperature, pH, and available nutrients. For this reason, algae and diatoms have been reported to be at great risk to climate change and recently, algae have been reported in areas not previously thought to be. Invasive diatom species are causing damage to ecosystems and infrastructure in Connecticut waterways and abroad.



## *Cymbella janischii*

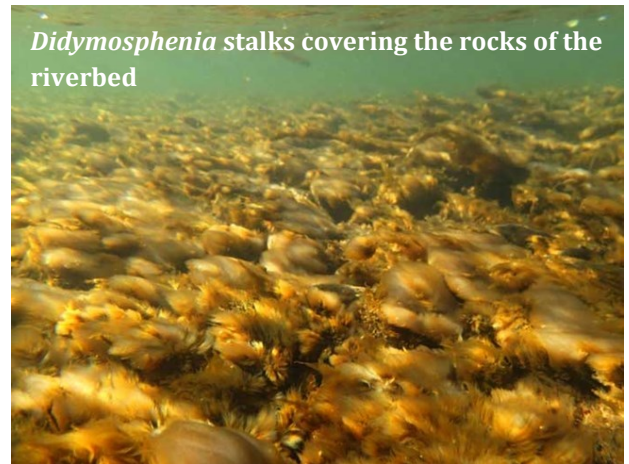
*Cymbella janischii* was first reported in the Farmington River in 2011. It is a known invasive species in Connecticut and can be a nuisance because of its ability to form thick mats of growth on the bottom of rivers and streams. It is unsightly, can cause a disruption to recreational activities such as swimming, and disrupts the benthic ecosystems by covering large amounts of the area it grows in. *Cymbella janischii* is native to the pacific northwest of the United States but is not indigenous to Connecticut. It has been reported in areas as far away as Japan. Compared to the *Didymosphenia* taxa, *Cymbella janischii* prefers warmer waters with higher nutrients. It is hypothesized that *Cymbella janischii* spreads on fishing gear, specifically felt waders that provide a dark, moist area for the algae to survive in until the next use in

a different waterbody. Moving this algae can be avoided by rinsing fishing gear with water that's over 140 degrees Fahrenheit for at least 30 seconds or spraying with a solution of bleach and water (3 oz / gallon) for at least 10 minutes. Mucilaginous stalks of *Cymbella janischii* are pictured to the right covering a rock.



## ***Didymosphenia geminata*—Rock Snot, Didymo**

First reported east of the Mississippi in 2005, *Didymosphenia geminata* easily covers 100% of benthic ecosystems in rivers and streams with thick mats of algal growth. Also known as rock snot, this algae is present in the Farmington River where fishermen noticed it growing on rocks. Didymo is known to thrive in waterways that have low nutrient levels, specifically low phosphorus. It can thrive in man made waterways designed for things like hydro power plants, water treatment plants, canal systems, and agricultural waterways for irrigation. In addition to this, didymo is extremely unsightly and is a nuisance where it blooms. Because of its destructive nature to benthic ecosystems and its impact on important infrastructure, control measures have been investigated. As with *Cymbella janischii*, care should be taken to clean fishing gear after using it in order to stop it spreading into other waterbodies.



## ***Didymosphenia hullii*— Rock Snot, Didymo**

*Didymosphenia hullii* was reported as a new species in 2016 and looks very similar to *D. geminata*. It requires identification under a microscope to tell the two apart. *Didymosphenia hullii* and other species are genetically similar, and *D. hullii* is perhaps evolutionarily young.



Content for this section including all images was provided by Dr. Diba Khan-Bureau. Citations can be found in the Literature Cited section of this document.

## Invasive Aquatic Clams and Mussels

Invasive freshwater Asian clams (*Corbicula fluminea*) and zebra mussels (*Dreissena polymorpha*) are now present in many Connecticut waterbodies. Quagga mussels (*Dreissena bugensis*) have been found in neighboring states and will probably spread to Connecticut. Like invasive aquatic plants, these bivalves can colonize rapidly and degrade natural ecosystems, fisheries, recreational opportunities, and real estate values. In addition, these organisms can threaten mechanisms used for hydroelectric power generation. Zebra mussels colonize hard surfaces including boats and docks, and soft surfaces such as aquatic plants (see figure below). Species identification for these three bivalves can be found on the following pages.

There are a variety of native mussel and clam species that are abundant in Connecticut lakes and ponds. Generally, the native species are larger than the ones described in this guide. Refer to the CTDEEP guide to native mussels for further information ([https://portal.ct.gov/-/media/DEEP/wildlife/pdf\\_files/nongame/fwmuslpdf.pdf](https://portal.ct.gov/-/media/DEEP/wildlife/pdf_files/nongame/fwmuslpdf.pdf)).



# *Corbicula fluminea*

## Common names:

Golden clam  
Asian clam  
Asiatic clam  
Good luck clam

## Origin:

Asian  
Africa  
Australia

## Key features:

At the sediment surface or slightly buried

**Size:** 0.5 to 0.75 inches

**Shell:** triangular shape (unlike most oval-shaped clams), beak is centrally located and high

**Color:** Yellowish brown to black

**Reproduction:** Hermaphroditic, self-fertilization

## Easily confused species:

Fingernail clams: *Sphaeriidae*



USGS , US Geological Survey, Bugwood.org

5431587

F. Moretzsohn

*Corbicula fluminea*



Fabio Moretzsohn, Texas A&M University-Corpus Christi, Bugwood.org

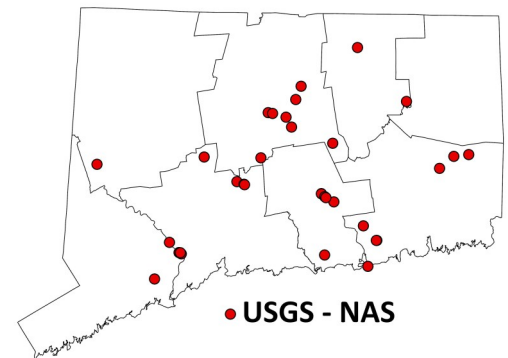
1.0 cm

5530924



USGS , US Geological Survey, Bugwood.org

5431588



# *Dreissena bugensis*

## **Common name:**

Quagga mussel

## **Origin:**

Dnieper River drainage of Ukraine

## **Key features:**

Colonizes on hard surfaces

**Size:** up to 1.5 inches

**Shell:** unstable on edge (unlike *Dreissena polymorpha*), round shape, asymmetrical

**Color:** dark concentric rings, color is paler near the hinge, black, cream, or white bands

## **Easily confused species:**

Zebra mussel: *Dreissena polymorpha*



Amy Benson, U.S. Geological Survey, Bugwood.org



Mike Quigley, NOAA, Bugwood.org

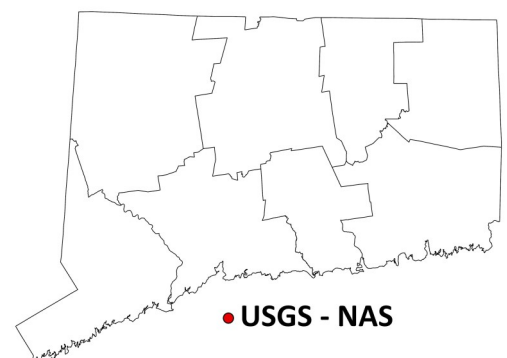


Mike Quigley, NOAA, Bugwood.org



Rebekah D. Wallace, University of Georgia, Bugwood.org

5489098



# *Dreissena polymorpha*

**Common name:**

Zebra mussel

**Origin:**

Black, Caspian, and Azov Seas (Europe)

**Key features:**

Colonizes on hard surfaces

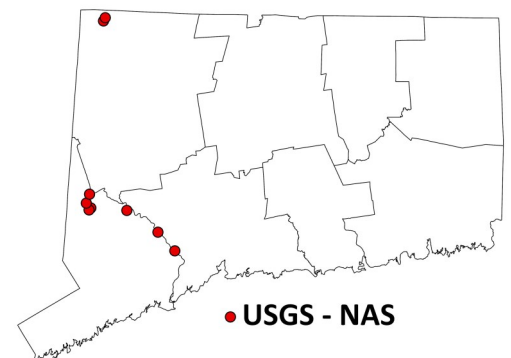
**Size:** less than one inch

**Shell:** conspicuous black stripes, stable on flattened underside (unlike *Dreissena bugensis*)

**Color:** color patterns vary, dark or light colored shells, most commonly with stripes

**Easily confused species:**

Quagga mussel: *Dreissena bugensis*



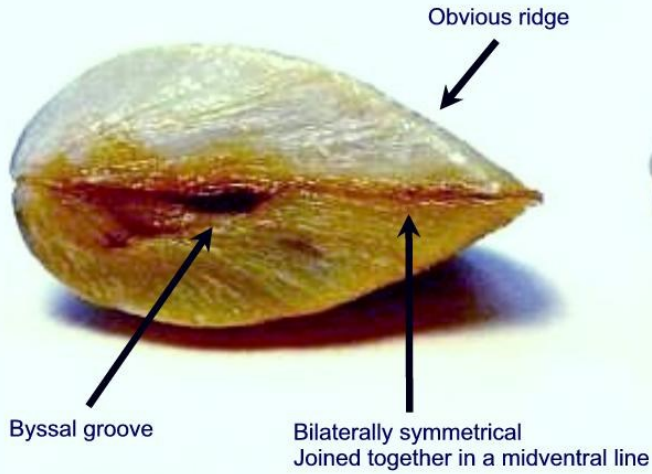


# Commonly Confused Aquatic Mussels

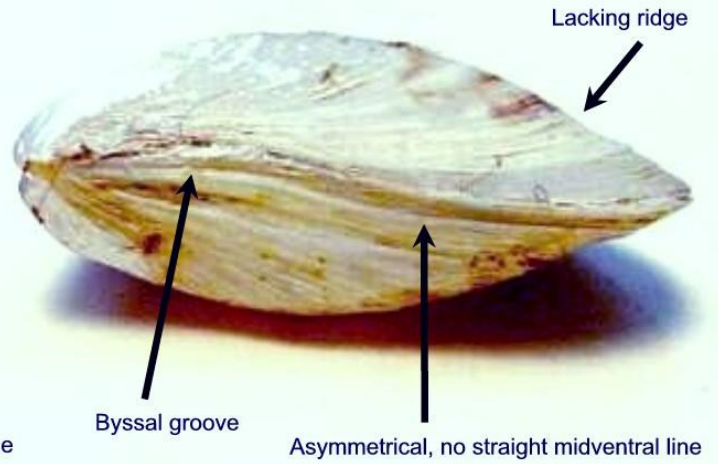
## Differences between Quagga and Zebra Mussels

(all photos by Myriah Richerson—USGS-NAS)

*Dreissena polymorpha*



*Dreissena rostriformis bugensis*



U.S. Geological Survey

*Dreissena polymorpha*

*Dreissena rostriformis bugensis*



*Sits flat on ventral side*  
*Triangular in shape*  
*Color patterns vary*



*Will not sit flat on ventral side*  
*Rounder in shape*  
*Darker concentric rings on shell*  
*Pale in color near the hinge*

U.S. Geological Survey

## Literature Cited

- Aquatic Ecosystem Restoration Foundation. 2020. Biology and Control of Aquatic Plants – A Best Management Practices Handbook Fourth Edition. L. Gettys, W. Haller, D. Petty, eds. Retrieved May 11, 2022 from <http://aquatics.org/bmp.html>
- Aquatic Plant Management Website. 2013. Aquatic plant fact sheet. Retrieved March 1, 2018. <http://www.weedscience.ncsu.edu/aquaticweeds/>.
- Britton, N.L. and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. Vol. 1: 37.
- CAES IAPP. 2018. The Connecticut Agricultural Experiment Station Invasive Aquatic Plant Program (CAES IAPP). Retrieved March 1, 2018. <http://www.ct.gov/caes/iapp>.
- Center for Aquatic and Invasive Plants, University of Florida. 2005. Aquatic, Wetland and Invasive Plants in Pen-and-Ink. IFAS Publications, Gainesville, Florida.
- Center for Aquatic and Invasive Plants, University of Florida. 2018. Plant information and images. Retrieved March 1, 2018. <http://plants.ifas.ufl.edu/>
- Connecticut Aquatic Nuisance Species Working Group. 2006. Connecticut aquatic nuisance species management plan. Retrieved March 3, 2018. <http://www.ctiwr.uconn.edu/ProjANS/SubmittedMaterial2005/Material200601/ANS%20Plan%20Final%20Draft121905.pdf>.
- Connecticut Department of Energy and Environmental Protection. 2018. Aquatic Invasive Species. Retrieved March 5, 2018 [http://www.ct.gov/deep/cwp/view.asp?a=2696&q=322690&deepNav\\_GID=1630&pp=12&n=1](http://www.ct.gov/deep/cwp/view.asp?a=2696&q=322690&deepNav_GID=1630&pp=12&n=1).
- Connecticut Department of Energy and Environmental Protection. 2013. A Field Guide to the Freshwater Mussels of Connecticut. Retrieved March 5, 2018. [http://www.ct.gov/deep/lib/deep/wildlife/pdf\\_files/nongame/fwmusl.pdf](http://www.ct.gov/deep/lib/deep/wildlife/pdf_files/nongame/fwmusl.pdf).
- Cornell University. 2018. New York Invasive Species Information. Retrieved March 3, 2018. <http://nyis.info>.
- Couch, R. and E. Nelson. 1985. *Myriophyllum spicatum* in North America. Pp. 8-18 in: Anderson, L.W.J., ed., Proceedings of the First International Symposium on Water Milfoil (*Myriophyllum spicatum*) and related Haloragaceae Species. Aquatic Plant Management Society, Vicksburg, Mississippi.
- Crow, G.E. and C.B. Hellquist. 2000. Aquatic and wetland plants of northeastern North America. Vol 1. Pteridophytes, gymnosperms, and angiosperms: dicotyledons. The University of Wisconsin Press, Madison, Wisconsin.
- Crow, G.E. and C.B. Hellquist. 2000. Aquatic and wetland plants of northeastern North America. Vol 2. Angiosperms: Monocotyledons. The University of Wisconsin Press, Madison, Wisconsin.
- Fassett, N. 1957. A manual of aquatic plants. Rev. Eugene Ogden. The University of Wisconsin Press. Madison, Wisconsin.
- Fishman, K.J., R.L. Leonard and F.A. Shah. 1998. Economic evaluation of Connecticut lakes with alternative water quality levels. Connecticut Department of Environmental Protection. 79 Elm St. Hartford CT.

Global Invasive Species Database. 2018. Species information. Retrieved March 3, 2018. <http://www.icungisd.org/>.

Invasive and aquatic species. 2018. Weeds. Invasive.org. Retrieved March 1, 2018. <http://www.invasive.org/>.

Invasive plant atlas of New England (IPANE). 2018. IPANE species. Retrieved March 1, 2018. <http://www.eddmaps.org/Species/>

Invasive plant atlas of New England. 2018. Data and Maps. Retrieved March 1, 2018. <https://www.eddmaps.org/ipane/>.

Khan-Bureau, D. A., Blanco, S., Morales, E. A., Ector, L., Beauchene, M. S., & Lewis, L. A. 2022. Using geometric morphometrics to disentangle *Didymosphenia hullii* and *D. geminata* (Bacillariophyceae) from Connecticut, USA, and two congeneric relatives. *European Journal of Phycology*, 1-11.

Khan-Bureau, D. A., Morales, E. A., Ector, L., Beauchene, M. S., & Lewis, L. A. 2016. Characterization of a new species in the genus *Didymosphenia* and of *Cymbella janischii* (Bacillariophyta) from Connecticut, USA. *European Journal of Phycology*, 51(2), 203-216.

Khan-Bureau, D. A., Beauchene, M. S., Ector, L., Morales, E. A., & Lewis, L. A. 2014. Observations of two nuisance stalk-forming diatoms (Bacillariophyta) from a river in Connecticut, Northeastern USA: *Didymosphenia* sp. and *Cymbella janischii* (A. Schmidt) De Toni. *BioInvasions Record*, 3(3).

Les, D.H., and L.J. Mehrhoff. 1999. Introduction of nonindigenous aquatic vascular plants in southern New England: A historical perspective. *Biological Invasions* 1:281-300. North Carolina State University

Northeast Aquatic Nuisance Species Panel. 2018. Species information. Retrieved March 3, 2018. <http://northeastans.org>.

Tenaglia, D. Missouri Plants. 2007. Retrieved March 3, 2018. <http://www.missouriplants.com/>.

Texas Invasive Species Institute. 2014. Species database. Retrieved March 3, 2018. <http://www.tsusinvasives.org>.

United Water Conservation District. 2010. Species information. Retrieved March, 3 2018. <http://www.unitedwater.org>.

USDA National Invasive Species Information Center. 2018. Aquatic Species. Retrieved March 3, 2018. <https://www.invasivespeciesinfo.gov/aquatics/main.shtml>.

USDA Natural Resources Conservation Service (NRCS). 2018. Plants database. March 3, 2018. <http://plants.usda.gov/>.

USGS Nonindigenous Aquatic Species. 2018. Species information. Retrieved March 3, 2018. <http://nas.er.usgs.gov>.

Washington State Noxious Weed Control Board. 2010. Weed list. Retrieved March 1, 2018. <http://www.nwcb.wa.gov/>.





The Connecticut Agricultural Experiment Station was founded in 1875. It is chartered by the General Assembly to make scientific inquiries and conduct experiments regarding plants and their pests, insects, soil and water, and to perform analyses for state agencies. Station laboratories or research farms are located in New Haven, Windsor, Hamden, and Griswold.



# CAES

---

The Connecticut Agricultural Experiment Station

---

*Putting Science to Work for Society since 1875*

[www.ct.gov/caes](http://www.ct.gov/caes)

Equal employment opportunity means employment of people without consideration of age, ancestry, color, criminal record (in state employment and licensing), gender identity or expression, genetic information, intellectual disability, learning disability, marital status, mental disability (past or present), national origin, physical disability (including blindness), race, religious creed, retaliation for previously opposed discrimination or coercion, sex (pregnancy or sexual harassment), sexual orientation, veteran status, and workplace hazards to reproductive systems unless the provisions of sec. 46a-80(b) or 46a-81(b) of the Connecticut General Statutes are controlling or there are bona fide occupational qualifications excluding persons in one of the above protected classes. To file a complaint of discrimination, contact Dr. Jason White, Director, The Connecticut Agricultural Experiment Station, 123 Huntington Street, New Haven, CT 06511, (203) 974-8440 (voice), or [Jason.White@ct.gov](mailto:Jason.White@ct.gov) (e-mail). CAES is an affirmative action/equal opportunity provider and employer. Persons with disabilities who require alternate means of communication of program information should contact the Chief of Services, Michael Last at (203) 974-8442 (voice), (203) 974-8502 (FAX), or [Michael.Last@ct.gov](mailto:Michael.Last@ct.gov) (e-mail).