

The background of the slide is a photograph of a pond. The water is dark and still, reflecting the sky and surrounding trees. In the foreground, there is a dense layer of green, filamentous algae or aquatic plants. The overall scene is somewhat dimly lit, suggesting an overcast day or a shaded area.

# Identifying Freshwater Aquatic Invasive Species in Rhode Island

# Plant Communities



emergent  
plants



floating plants

littoral zone



Submergent plants

photic zone

aphotic zone

# Plant Structure

## Leaf Arrangements



Alternate



Opposite

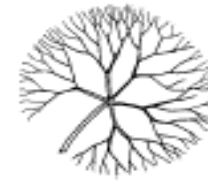


Whorled

## Finely-divided Leaf Patterns



Fork-divided



Branch-divided



Feather-divided

## Leaf Margins



Entire



Toothed or  
Serrated



Pinnately  
Lobed



Finely Divided

## Leaf Shapes



Triangular



Heart



Strap or  
Elongate



Oval



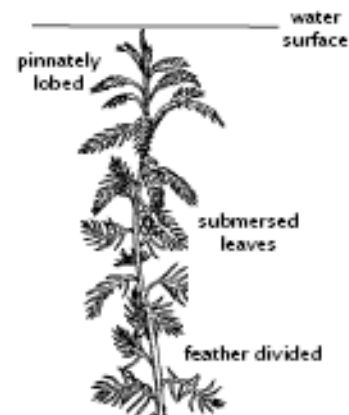
Elliptical



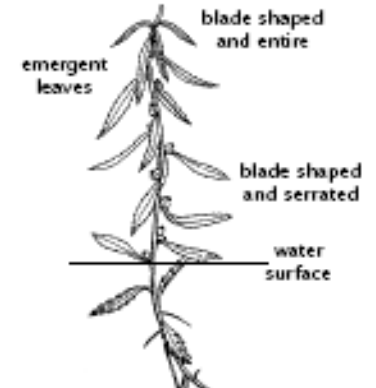
Lance or  
Blade

## Leaf Heterophylly

Some plants have two or more distinct leaf types. Mermaid weed (illustrated below) is a good example.



Submersed leaves are feather divided to pinnately lobed



Emergent leaves are blade shaped, and serrated to entire

An underwater photograph showing a dense thicket of green, feathery submersible plants. The plants have thin, brown stems and are covered in fine, needle-like leaves. The water is dark blue, and sunlight filters through from above, creating a dappled light effect on the vegetation. The overall scene is a lush, green underwater forest.

# **Submergent Plants**

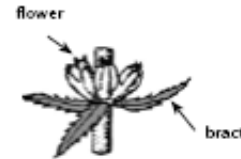
# Invasive Milfoil Species

## (*Myriophyllum* sp.)

- Submergent species
- Leaves whorled around stem
- Leaves feather-divided
- Submergent and emergent portions

Side image from Maine Volunteer Lake Monitoring Program

Bracts are specialized leaves associated with flowers. Note the "leaf-type" of the bracts and their size in relation to the flowers.



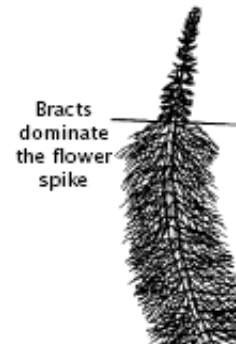
Bracts are serrated and larger than flowers (variable water-milfoil)



Bracts are entire and smaller than flowers (Eurasian water-milfoil)

The illustrations below show the emergent flowering spikes of the invasive variable water-milfoil and Eurasian water-milfoil. Not all milfoil species flower above the surface.

Variable water-milfoil



Bracts dominate the flower spike

Eurasian water-milfoil



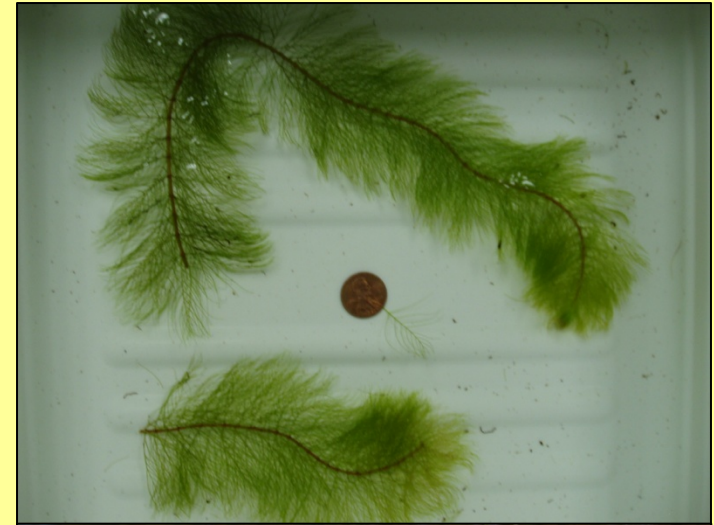
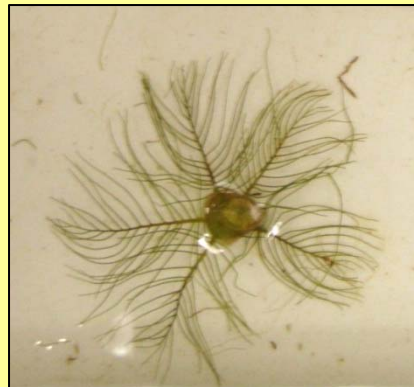
Flowers dominate the flower spike

There are 3 Invasive Milfoil Species in RI

# Variable Milfoil

(*Myriophyllum heterophyllum*)

- Densely packed whorls
- 4-6 leaves per whorl
- Stems often thick, robust and reddish
- Emergent flower spike
- Bracts are blade-shaped, serrated and much longer than the small white flowers
- Much larger and thicker than native milfoil species



# Eurasian Milfoil

(*Myriophyllum spicatum*)



- Whorls of leaves openly spaced along stem; 1-3 cm in between
- 4 leaves per whorl
- Leaf tips are blunt
- Emergent flower spike
- Bracts have smooth margins
- Flowers larger than bract



# Parrot Feather

(*Myriophyllum aquaticum*)



- Both submergent and emergent
- Emergent leaves bright green to blue-green; have waxy surface
- Submersed leaves often limp, brownish and deteriorating
- 4-6 leaves per whorl
- Small white flowers grow along stem; no flower spike or bracts



# Native Look Alike

## Low Watermilfoil (*Myriophyllum humile*)



- Leaves closely spaced but scattered along stem (as opposed to whorled)
- Leaves and stems brown to red
- Does not form emergent spikes (flowers and fruits along the stem)

# Native Look Alike

## Mermaid Weed

(*Proserpinaca palustris*)



- Submergent and emergent leaves
- Submerged leaves alternate, feather divided, 5-10 cm long
- Emergent leaves blade-shaped and serrated

# Native Look Alike

## Coontail

(*Ceratophyllum demersum*)



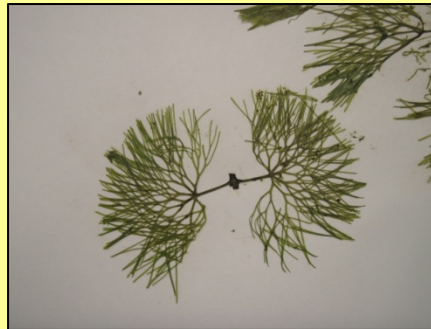
- Not rooted
- Leaves are fork-divided, finely serrated and whorled around the stem
- Whorls closely-spaced at tip, giving the plant a raccoon tail appearance
- Stiff and coarse to the touch
- Will maintain shape out of water

# Fanwort

(*Cabomba caroliniana*)



- Leaves opposite, branch-divided
- Leaves resemble fans
- Bright green color
- Small white flowers float on surface of water or are emergent
- Small elliptical floating leaves present when flowering



# Native Look Alike

## Water Marigold

(*Bidens beckii*)



- Submergent leaves are branch-divided and arranged in opposite pairs on stem
- Each leaf divides 3 times at the stem, giving the appearance of a whorl of 6 smaller leaves
- Emergent leaves are blade-shaped, serrated and surround yellow flowers
- Often coarser and stiffer than fanwort

# Curly-leaf Pondweed

(*Potamogeton crispus*)

- Submerged leaves only
- Leaves green, translucent with reddish tinge
- Leaves are alternate and attached directly to stem
- Leaves strap-shaped, taper at base and have rounded tips
- Leaves finely serrated and have wavy margins



# Native Look Alike

## Clasping-leaf Pondweed

(*Potamogeton perfoliatus*)



There are 18 species of pondweed documented in Rhode Island. Most have both floating and submergent leaves. Curly-leaf pondweed is the only serrated pondweed in Rhode Island.

- Submerged leaves are alternate, oval to blade-shaped and entire
- Leaves much wider than curly-leaf pondweed
- Leaves clasp around entire base of stem

# Spiny Naiad

(*Najas minor*)



- Long stems that branch profusely at top
- Leaves along stem may be opposite, whorled or alternate and form tufts toward the tip
- Leaves arch backward, are stiff and will maintain shape out of water
- Leaves are thin, strap-shaped, pointed and visibly serrated (7-15 spines on each side of the leaf)



# Native Look Alike

## Native Naiads

(*Najas flexilis* & *Najas gracillima*)



### *Najas flexilis*

- Leaves arch backward, are stiff and will maintain shape out of water
- Very fine serrations are visible only with magnification (20-100 spines on each side of leaf)

### *Najas gracillima*

- Leaves are slender (less than 0.2mm wide), flimsy and do not arch backward
- Leaves will not maintain shape out of water
- Fine serrations may be visible with a hand lens (13-17 spines on each side of leaf)

# Brazilian Elodea

(*Egeria densa*)

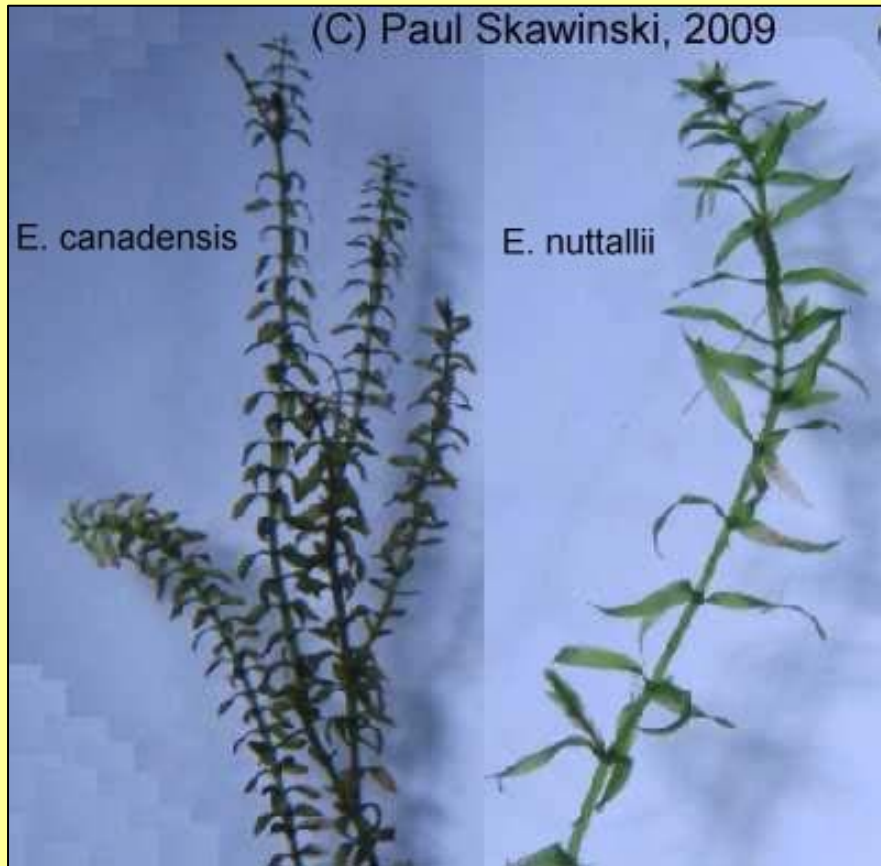
- Leaves densely whorled, blade-shaped and serrated
- 4-6 leaves per whorl
- Leaf length 1-3 cm
- Emergent white flowers
- More robust than native elodea



# Native Look Alike

## Native Elodeas

(*Elodea canadensis* & *Elodea nuttallii*)



Both species of native Elodea have whorls of 3 leaves. Leaves are finely serrated, visible only with significant magnification

### *Elodea canadensis*

- Leaves are short, stout with blunt tips
- Leaves are stiff and maintain shape out of water

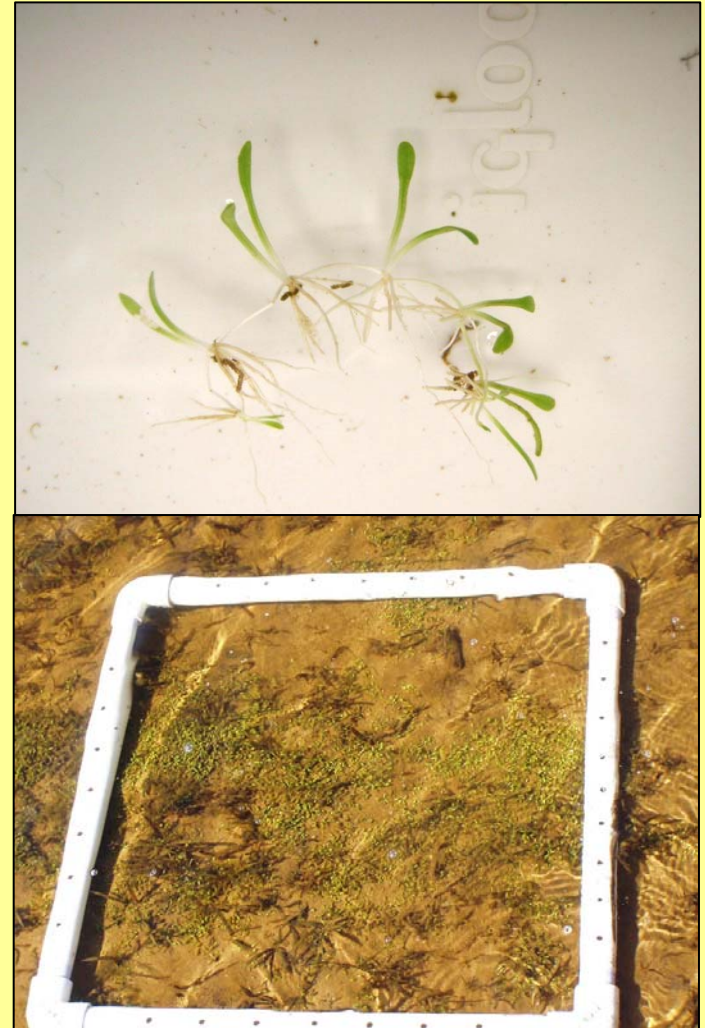
### *Elodea nuttallii*

- Leaves are longer, slender with pointed tips
- Leaves are flimsy and do not maintain shape out of water

# Mudmat

(*Glossostigma cleistanthum*)

- Low-growing, mat-forming
- Leaf pairs grow along underground rhizomes; resemble rabbit ears
- Leaves 1-4 cm long
- Visible as small green leaves along the bottom
- Common in shallow, muddy or sandy coves



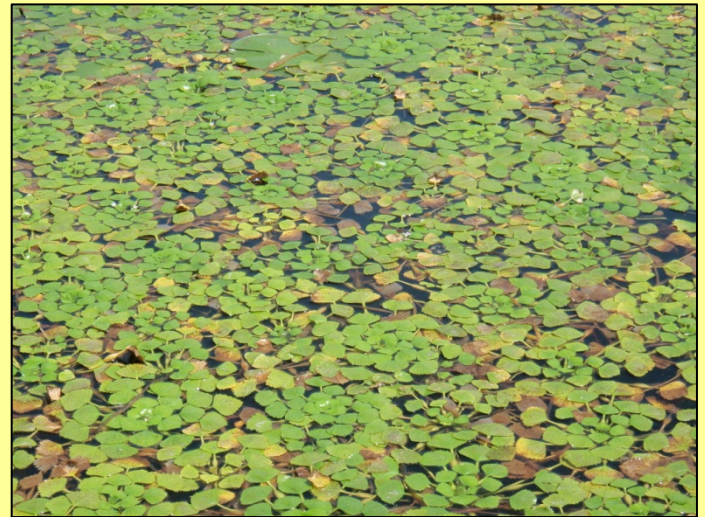
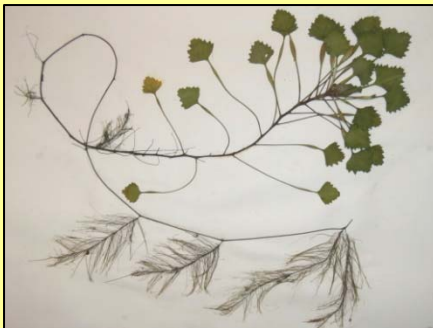
# Floating Plants



# Water Chestnut

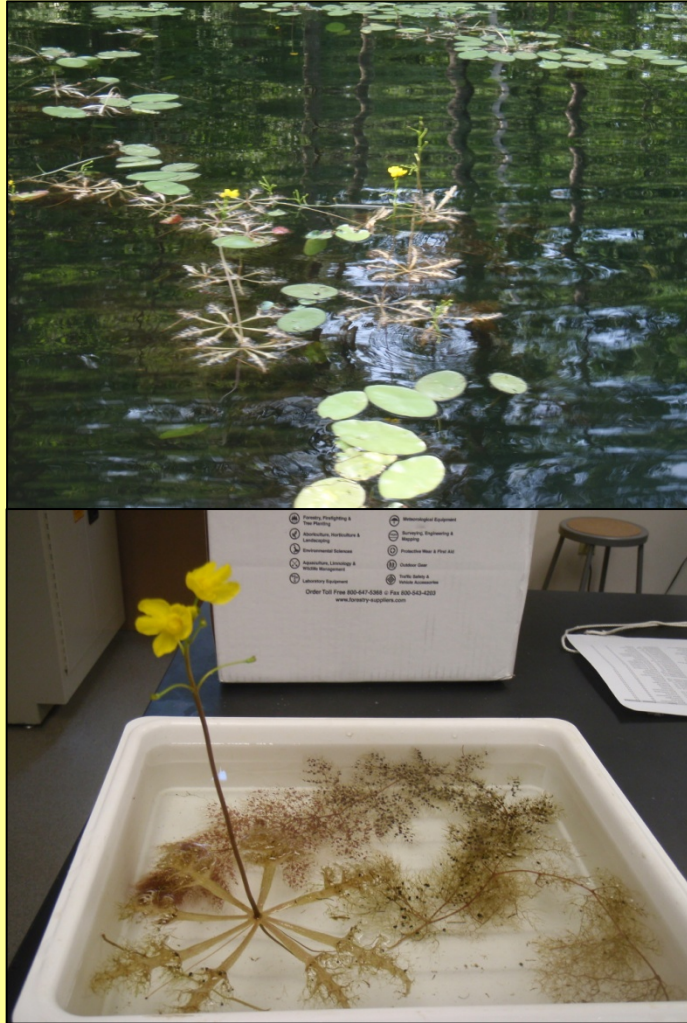
(*Trapa natans*)

- Floating and submergent leaves
- Floating leaves arranged in rosettes
- Leaves triangular and toothed
- Floating leaves attached to stem with spongy inflated leaf stems
- Submerged leaves fine and feather divided
- Fruit attached to underside of rosette
- Fruits are large and contain four barbs



# Inflated Bladderwort

(*Utricularia inflata*)



- Underwater portion not rooted; leaves are finely divided, branched, and contain “bladders”
- Flower stalk supported on floating, spoke-like wheel
- Yellow, snapdragon-like flowers

# Native Look Alike

## Floating bladderwort (*Utricularia radiata*)

Similar to inflated bladderwort,  
but generally smaller



<u>Characteristic</u>	<u>U. inflata</u>	<u>U. radiata</u>
Shape of spokes	Tapers at both ends	Thick and cylindrical
Number of spokes	6-8	4-7
Length of spokes	3-8 cm	1-4 cm
Number of flowers	5-15 (usually 9-12)	3-4



# Yellow Floating Heart

(*Nymphoides peltata*)

- Round to heart-shaped leaves with wavy margins
- Leaf notch extends from edge to stem
- Multiple leaves per stem
- Flowers emergent, bright yellow with fringed petals
- Form dense mats



# Native Look Alike

## Yellow lily

*(Nuphar variegata)*



- Oval to heart-shaped leaves with small leaf notch; leaves much larger than invasive
- One leaf per stem; stems are thick, Flowers are emergent, yellow and ball-shaped

# Native Look Alike

## Little floating heart (*Nymphoides cordata*)



Source: Don Cameron, MNAP, VLMP © 2007

- Small heart-shaped leaves
- One leaf per stem
- Small white flowers
- Clumps of elongate green roots (resembling bunches of bananas) along the stem

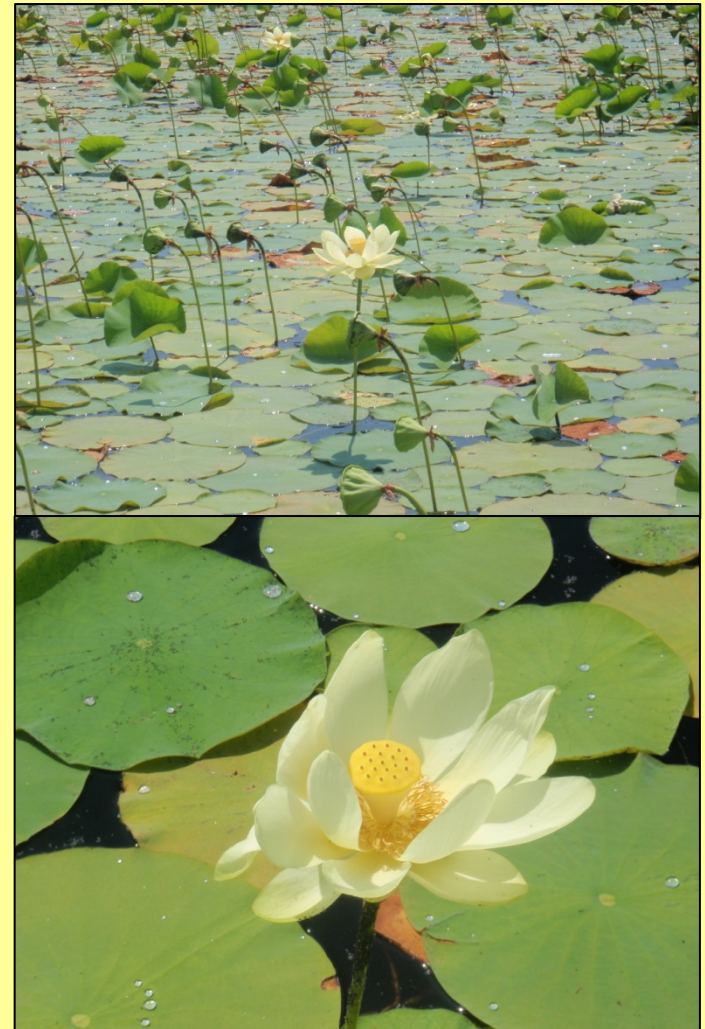
Top picture: Maine Volunteer Lake Monitoring Program

Bottom picture: USDA Natural Resource Conservation Service Plants Database

# American Lotus

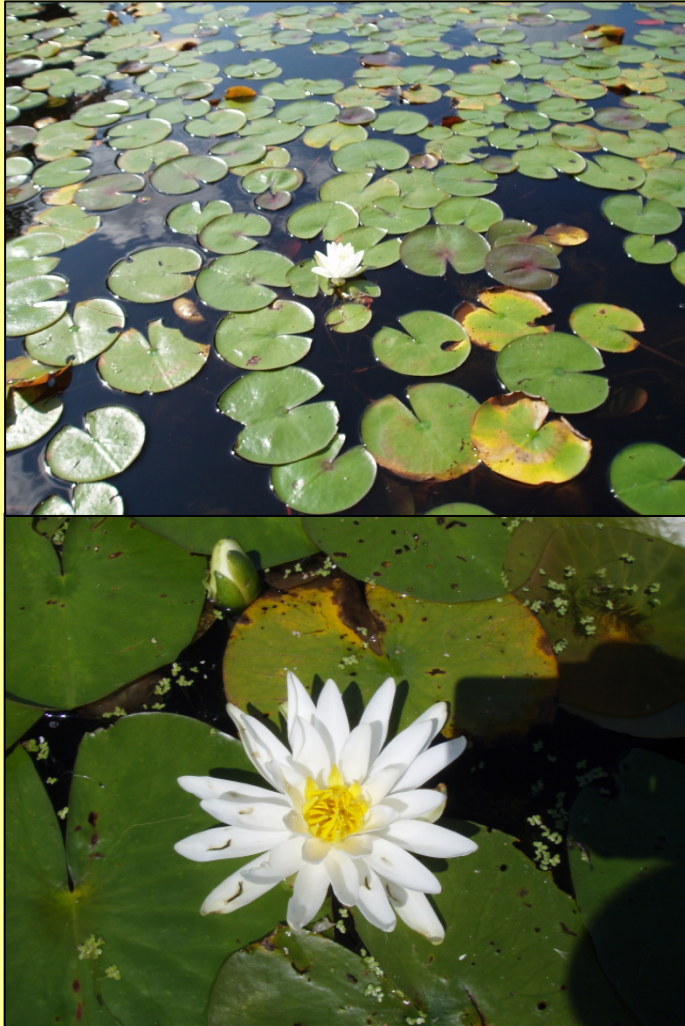
(*Nelumbo lutea*)

- Floating and emergent plant
- Round, blue-green leaves up to 2 ft in diameter
- Flat while floating and conical when emergent
- Lack the slit of native lilies
- Large white to yellow flowers
- Center of flower has cone-shaped seed pod, which remains after flower dies



# Native Look Alike

## White Water Lily (*Nymphaea odorata*)



- Round leaves with narrow leaf notch from edge to center (looks like someone took a piece of pie)
- Tops of leaves are bright green with waxy surface, undersides are reddish-purple
- Large flowers with numerous white petals and a cluster of yellow stamens

# Water Hyacinth

(*Eichhornia crassipes*)



- Floating plant
- Leaves arranged in rosette
- Leaves are rounded to kidney-shaped, bright green with waxy surface
- Leaves supported by inflated leaf stems
- Purple flower spikes

A photograph of a sandy beach with various marine life. In the center, a large, dark, ribbed clam shell is partially open, revealing a white, fleshy interior. To the left, a crab is visible, partially obscured by seaweed and other debris. Several dark, segmented worms are scattered across the sand. The background shows more sand, small pebbles, and some green seaweed. The word "Animals" is written in large, bold, black letters across the middle of the image.

# Animals

# Asian Clam

(*Corbicula fluminea*)



- Small; usually about the size of a penny up to the size of a quarter
- Thick concentric rings
- Yellow-green to brown in color
- Usually found in sand
- Look for shells of dead clams



# Zebra Mussels (*Dreissena polymorpha*)



- Yellow-brown D-shaped shell
- Very small (about the size of a fingernail)
- Alternating light and dark bands
- Found in dense clusters attached to any solid surface

**NOT YET IN RHODE ISLAND!**

As of December 2010

# Other Guides

- **Connecticut's Invasive Aquatic and Wetland Plants Identification Guide**

[http://ct.gov/caes/lib/caes/invasive\\_aquatic\\_plant\\_program/pdf\\_reports/b1027.pdf](http://ct.gov/caes/lib/caes/invasive_aquatic_plant_program/pdf_reports/b1027.pdf)

Put together by the CT Agricultural Experiment Station. Includes emergent plants. Great Pictures.

- **Maine Field Guide to Invasive Aquatic Plants**

<http://www.mainevolunteerlakemonitors.org/mciap/FieldGuide.pdf>

Put together by the Maine Center for Invasive Aquatic Plants/Maine Volunteer Lake Monitoring Program for their volunteers. Extremely comprehensive. Includes most native species as well. Available free online or hard copy can be purchased from website for \$19.95