

Aquatic Invasive Plant Surveillance for Citizen Scientists on Lakes



Hydrilla

How to hunt for
new aquatic
invasive plants in
your lake



Curly-leaf pondweed



NYS DEC & NYSFOLA
2016



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Introduction and Objective

Aquatic plants are an important part of the lake ecosystem and are a large part of a healthy lake environment. Invasive plants can disrupt ecosystems and interfere with recreational use of lakes. Early detection and rapid response (ED-RR) are critical to slowing the spread and enabling control efforts. Citizen scientists are important in that effort. Lake volunteers can bring more eyes to more places, and know important places to search on a lake.

This protocol is intended to provide an uncomplicated approach to monitor for aquatic invasive plants from the lake shoreline or by wading. This document contains the monitoring protocol and a list of recommended equipment. A monitoring form is included, which should be printed and submitted after each survey, whether or not any suspicious plants are found.

This goal is to search for the presence of some species, or to verify that they are not found. (Presence / absence). This approach will not provide a perspective on biodiversity or plant density.

Some of the most significant invasive species for New York State are described. A list of some of our favorite reference books are also included.

Where to search for invasive species

While it might be a great idea to search the entire shoreline, we don't all have that time. So strategize where you can spend time looking. Smart searching is more time efficient than trying to cover all of the shoreline.

Invasive species are often spread by people, so it's important to know where people may be visiting the lake, especially if they might be bringing boats or gear from a different lake. If you only have time to look in one spot, look at the area around boat launches.

Sometimes invasive species travel on fishing gear, so also consider searching fishing spots like docks or areas near roads.

Invasive species can enter lakes when people dump unwanted aquariums, so that's another reason to look at bridges or locations where it's an easy walk from the road to the shore. Public access areas and beaches are also places where invasive species might enter on water toys and gear.

People sometimes unknowingly plant invasive species in water gardens, so look carefully at any streams that enter from a water garden. Input areas for streams that come from other lakes can also be a priority because plants can be carried by currents and streams from one place to another.



Many invasive plants spread by fragmentation. A great way to get an idea of the plants on the lake is to look in places where fragments collect, for example on downwind beaches, or by an outlet. If any of the hotspots mentioned above are also areas where “seaweed” piles up, that’s a good spot to check carefully.

Finally, if some invasive species are located in one place in your lakes, that might be a good place to search. Remember, you know your lake best. Prioritize your effort for the best results.

Make and print out a map of your lake so that you can mark where you searched and where you found any suspicious plants. A Google or Bing map is fine for this.

When to search

There’s no bad time to search. It’s a great excuse to walk along the lake shoreline. The best times are when the invasive plants are growing and are large enough to see. Most plants are most identifiable in August, and the water’s warmer then too.

However, if your lake suffers from algae blooms late in the summer, you might want to look earlier in the season when the water is clearer and you can see more plants. And plants are easier to identify if they don’t have algae growing on them.

While August is a general rule, as always, exceptions exist. Some species have different life cycles. For example, if you know that you are concerned about curly-leafed pondweed or water chestnut, you will want to look earlier in the season. Curly-leaf pondweed grows early in the season and senesces when the water gets warmer. And you’ll want to remove water chestnut before the nutlets – the seeds - drop off the plants in mid to late August. On the other hand, some plants don’t flower until September.

How to search for plants

Get acquainted with the plants

Look at photos and descriptions of the invasive plants that are nearby so you have a general idea of what you are looking for. See this in the quick plant reference section or use the linked references.

Also, find out what invasive species are already known to be in your lake. If you are a CSLAP lake, you can find the AIS known to be in lakes in your county in Appendix E of your CSLAP report. Known AIS by county is also posted at the website <http://nysfola.org/> under aquatic plants -> AIS by county.

Gather your monitoring equipment.

See the list on the following pages. A bucket may be useful to carry the materials, especially the plastic bags containing plant samples.

Survey at the lake shore

Walk along the shoreline or wade in the water. Examine floating and rooted plants, and look at the fragments that are floating near shore. Polarized sunglasses may help you see submersed plants. Carry a rake or garden weeder to help pull plants to you. If you have a double-sided sampling rake (weed rake, weed anchor), you can throw it out into deeper water and drag it in slowly to gather plants from deeper water or less accessible areas.

Separate out the different plants collected at each location.

Collect samples

If any of the plants or plant fragments are unfamiliar or suspicious, put the plants into a plastic bag. Put a number on a piece of paper in the bag and put that number on your map of the lake at the location where you collected those samples. If you have a GPS, either put the coordinates or the waypoint of the collection location on the paper that you put into the resealable bag. Label the map with the date and time. If you have different plants, use more bags. When you are done, draw a line on the map to show the area that you covered in your search, and make sure all the numbers for the collected plants are on the map.



Identify and / or photograph

Rinse the plants in water to clean mud and algae off so that the leaves and stems are visible. Use one or more of the reference guidebooks to identify the plants that you collected. If you are not sure, take a photograph. Identification of aquatic plants can be tricky, and many invasive aquatic plants have similar “look alike” native plants. A photograph of the samples is very helpful. See the section on sample photography for tips on good aquatic plant photographs.

If the samples might be an invasive, put the plant in a plastic bag with a damp paper towel and put it in the refrigerator. Make sure it’s clear that this is not to be consumed!

Make a voucher specimen (optional)

Plants vary from location to location, and aquatic plants are especially “plastic” or variable in appearance. Making a voucher specimen may allow future scientists to look at the shape or even the DNA of your plants. If you have a plant press and patience, you can dry your plant and preserve it. The proper use of a plant press is beyond the scope of this protocol. If you are experienced at pressing plants and making plant specimens, please consider doing so for any aquatic plants that you collect.

Fill out the report form

Remember, if it’s not reported, it is as if it didn’t happen. Get credit for your work!

Survey equipment

Usual equipment

Map of the lake and pencil or pen or sharpie
Gallon size plastic resealable or locking bags
Pieces of paper to record numbers and stick in the bags with the plants
Weeding tool or cultivating fork
You might find that it's easier to carry all this in a bucket.
Consider wearing water shoes or waterproof boots if you will wade.
GPS – optional – for marking locations



Special equipment (optional)

Sampling rake – aka weed rake or weed anchor

This tool can reach plants in deeper water. While you might be able to buy one, it's easy to make. The double tines mean that it won't matter which side ends down in the water.

- Get two ordinary garden rakes.
- Remove or cut off the handles.
- Zip tie the handles and tines together back to back
- Duct tape the two handles for more comfort.
- Attach 10 meters of rope.



To use, secure the free end of the rope, swing the rake and let its weight carry it out into the water. Let it sink and pull it towards you with a steady motion. Take the plants off the tines carefully and separate them.

Hand lens

A hand lens or magnifying glass may help identify species.



How to photograph aquatic plants

Equipment

- Digital camera
- Clean water
- Shallow clear or white container. If using a clear container, have a white background, towel, or paper under the container
- Plastic ruler for scale – or a coin. Many plants look similar and size can help identify the plant.



Pose the plant

Take several photos. Take one of the whole plant, and then one of flowers, seeds, and a close-up of leaves.

Take a photo of the plant in the lake if it gives a good idea of the setting – whether emergent, floating, or submersed. Then take more photos of the plant when you get away from the lake. Take an overall photo, then ones that zoom in on leaves, flowers, and seeds.



Take a photo on a light background, such as a plain white paper towel. Avoid patterned backgrounds.

Submersed plants with fine or limp leaves look very different in and out of water, so it's good to take a photo of them in water if you can. If it's clearer out of water, take one that way too.

Photograph the plant as a whole and the details

- Select a representative portion of the plant. Include identifying portions, including leaves, flowers, roots
- Use multiple changes of water if necessary to clean off sediment and algae
- Place plant in a small amount of water in a white container or a clear container over white paper
- Float the plant in the water and spread it out for visibility
- Include a ruler or coin for scale
- Take the photo in a well-lit setting but not in direct sunlight. Typically, a flash does not work because it reflects off the water.
- Consider using the macro setting for close-ups of features
- If the leaves are whorled or hard to see in the photo, cut a cross section of the stem and lay the leaves out flat.
- Take multiple photos until you feel you have the “character” of the plant and its details
- If you numbered the location on the map, include the number in the photo
- Some photos are very large. You may have to email photos in batches.





Reporting

Scan and email or send in the map of the lake and the AIS survey form. Submit the forms even if you didn't find any suspicious plants to document where and when an area was searched.

Reports will get in faster if you can scan the forms. Then email both the scans and the photos to Stephanie June at stephanie.june@dec.ny.gov. You may need to email the photographs in batches. If you can't scan the map and form, email the photos and then send the paper documents to:

Stephanie June, Plant Survey
NYSDEC Division of Water
625 Broadway, 4th Floor
Albany, NY 12233-3502

What happens next?

Finding a potentially invasive plant is just the first step. Experts will review the photographs. Three things could happen.

- It could be identified as a known plant, but not an invasive, and not of concern. That's the most likely result, and it's a great thing. It means someone's looked, and a problem plant wasn't found. Never be concerned about sending in a "false alarm". It's really great to be able to tell someone good news.
- It could be identified as an invasive plant. In that case, someone is most likely to want to visit to take a look at the plant in the lake, collect some samples, and perhaps to determine the extent of the infestation. While finding new invasives isn't good news, it's the purpose of this protocol.
- The plant identification could be inconclusive. Many invasive plants look a lot like native plants, even if they behave very differently. In this case, depending on the circumstance, you may be asked to send in more photographs, or a plant sample, or someone may ask to visit your site.

Report Form

The AIS report form is on the next page. Early detection gives the best chance for control of an invasive. A report that no invasives were found is important data.

AIS Survey Report Form

Surveyor Information			
Names of participants:			Date:
Contact Email:	Contact Phone:		
Start time / end time:	Total people hours:		
Monitoring Location			
Lake Name:	County:	CSLAP lake number:	
Where did you look? Mark on map and check all that apply:			
<input type="checkbox"/> Boat Launch <input type="checkbox"/> Public access <input type="checkbox"/> Shoreline <input type="checkbox"/> Road crossing <input type="checkbox"/> River inflow <input type="checkbox"/> River outflow			
Other:			
Were you looking for a specific species (for example, hydrilla hunt)? If so, what?			
What did you find?			
Check this box if no invasives were found during the survey. Else fill in items below If an invasive is known to be present in your lake, and you are sure of the identification, a photo is not needed			
Species found (or unknown)	Location	Specimen #	Comments (eg: habitat, depth, rooted or floating, density)
Email photos and, if possible, scan forms and send both to: stephanie.june@dec.ny.gov Or, send the paper forms to: Stephanie June, NYSDEC Division of Water, 625 Broadway, 4th Floor, Albany, NY 12233-3502			

Key Invasive Plants in NYS

NYS DEC has identified three invasive plants as key search targets for volunteers. The three are Eurasian watermilfoil, hydrilla, and water chestnut. Eurasian watermilfoil is considered one of the most widespread invasive plants in New York, and we probably do not know the full extent of its presence. Knowing its extent in NYS lakes is an indicator of the potential for dispersal of other invasives. Hydrilla is one of the newer and more significant invasives to New York State, although it has severely affected other parts of the US. Finding early infestations may help to limit its negative impact in NY. Water chestnut is a key plant because it is easy to identify and, when found early, can be successfully controlled by volunteers. If not controlled, water chestnut can greatly change the ecosystem.

Eurasian watermilfoil



Dense canopy on surface at Cayuga Lake - Robert L. Johnson

Eurasian watermilfoil (*Myriophyllum spicatum*) is extremely adaptable and will thrive in a wide range of environmental conditions. A submersed plant, EWM grows in water up to 10 meters deep (33 feet). When it reaches the surface, it can form a dense canopy and send up flower spikes. EWM will survive under ice and so it can be visible early in the season.

Eurasian watermilfoil has finely dissected feather-like leaves. The leaves are arranged in whorls of 4 (rarely 5) around the stem at each node. Each Eurasian watermilfoil leaf generally has 12 or

more leaflet pairs. While this feature can distinguish Eurasian watermilfoil from other milfoil species, the number of pairs of leaf divisions can vary.



The growing stem tips of Eurasian watermilfoil (and other milfoil species) are tassel-like and often red; especially early in the growing season.

Tiny pinkish flowers occur on

reddish spikes that stand several inches above the water



A photo of EWM that include a whorl of leaves as in the photo above can be very helpful for identification.

Hydrilla

Hydrilla (*Hydrilla verticillata*), also commonly called water thyme, is a submersed plant which roots on the lake bottom. The long stems branch when they reach the surface and form dense mats.

Hydrilla has pointed, bright green leaves about 5/8 inches long. The leaves grow in whorls of 3 - 10 along the stem, 5 being most common.



The margins of the leaves are serrated (toothed). The underside of the leaf has a reddish central spine and one or more small spines that give it a rough feeling when rubbed between your fingers.



When it flowers, thin stalks from the stem end in a single, small, floating white flower at the water's surface. A key identifying feature is the presence of small (up to half inch long), dull-white to yellowish, potato-like tubers which grow 2 to 12 inches below the surface of the sediment at the ends of underground stems. These tubers form at the end of the growing season and serve to store food to allow Hydrilla to overwinter.



Water chestnut



Water Chestnut (*Trapa natans*) is a rooted, aquatic plant with both floating and submersed leaves. The floating leaves form a rosette which is its most recognizable feature. The floating leaves are green, glossy and triangular with toothed edges. The submersed leaves are feathery, and are found whorled around the stem. Plant stems are cord-like and can attain lengths of up to 16 feet.

Water chestnut is an annual plant, and so relies on a seed bank to grow each year. The seeds, called nuts or nutlets, are produced starting in July. These nuts have sharp, spiny protrusions which help transport and

distribute the seeds. Nutlets can attach to waterfowl and deer. The sharp nutlets can also injure people and pets.

The goal is to find the plants and harvest them before the nutlets drop in August. Once the seeds are produced, they can be viable in the substrates for up to 20 years.



This plant is often found mixed among other floating leaf plants. For that reason, it might not be easy to find in a shore based survey. This plant is less likely to fragment than other aquatic plants, although the nutlets may wash up on the shore, since they also disperse by floating before they settle to the sediment.



Our floating leaf plants generally have smooth edges, so the key is to look for a rosette or a floating plant with jagged edges.

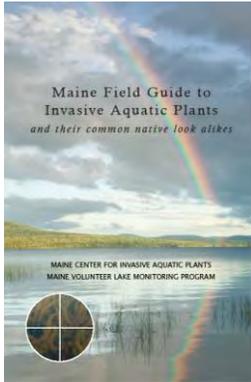


Recommended references

NYS DEC identifies common aquatic invasive species at this website:

<http://www.dec.ny.gov/animals/50272.html>

Maine Field Guide to Invasive Aquatic Plants



Maine's Vounteer Lake Monitoring Program has a good set of resources on their monitoring page, including some plant identification pages.

<http://www.mainevlmp.org/volunteer-info/invasive-plant-monitors/ipp-resources/>

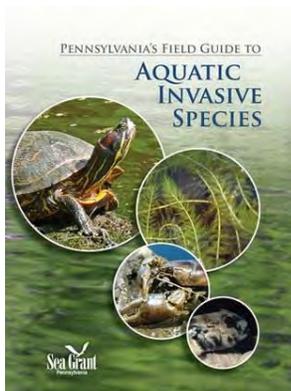
Maine Field Guide to Invasive Aquatic Plants has invasive plants and their native "look alikes", and is available for free download:

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

Connecticut's Aquatic and Wetland Invasive Plant Identification Guide

This online reference has a **description** of the invasive plants and shows the counties in Connecticut in which they were discovered. It's useful and scary to see what's so close to us. Find it here:

<http://1.usa.gov/1grrqdg>



Pennsylvania's Field Guide to Aquatic Invasive Species

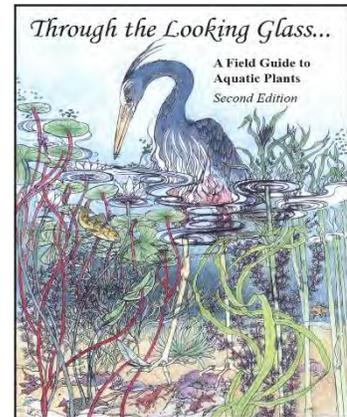
This field guide is available for an online download for free, and contains information about aquatic and wetland plants, fish, algae, invertebrates, and reptiles, how to distinguish the invasive from native species, and maps of where they are found in Pennsylvania.

This is the link for the download:

http://anstaskforce.gov/Documents/AIS_Field_Guide_Finalweb.pdf

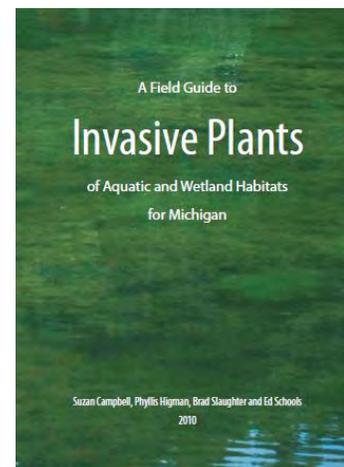
Through the Looking Glass

The second edition is revised and has an expanded discussion of aquatic invasive species. Most of these are described under a section called Similar Species to point out key differences between native species and similar looking non-native plants with the potential for invasive growth. This book can be purchased from NYS FOLA at PO Box 98, LaFayette, NY 13084 (800)-796-3651, or at this link: <http://www.uwsp.edu/cnr-ap/UWEXLAKES/Pages/resources/bookstore/TTLG.aspx>



A Field Guide to Invasive Plants of Aquatic and Wetland Habitats for Michigan

This field guide includes photos and descriptions of 47 invasive plant species. A downloadable pdf of this guide is available at <http://mnfi.anr.msu.edu/invasive-species/AquaticsFieldGuide.pdf>



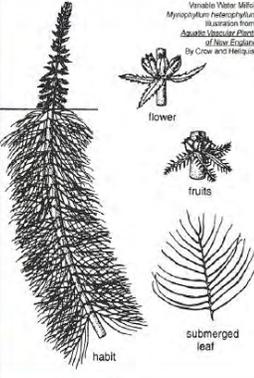
APIS

The Army Corps of Engineers has a website that provides the Aquatic Plant Identification System (APIS). Find help with plant identification at this site: <http://el.ercd.usace.army.mil/apis/IDSystem/idsystemintro.aspx>

Quick Plant Reference

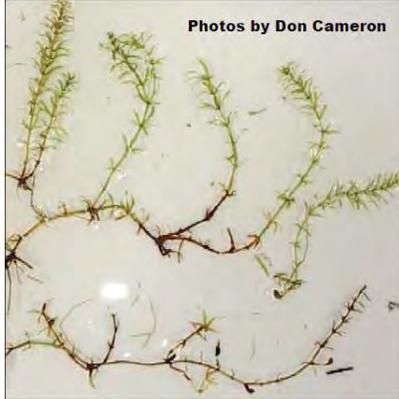
Other aquatic invasive plants are also of concern. It's good to know their general appearances and to be on the lookout for them. While the three top species have been identified, we want to know if you find anything else that looks suspicious. If in doubt, send in photos!

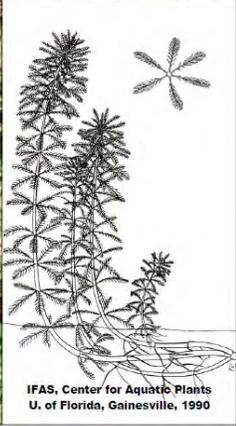
This set of "most unwanted" plants comes from the Maine Volunteer Lake Monitoring Program <http://www.mainevlmp.org/volunteer-info/invasive-plant-monitors/ipp-resources/>

Variable Water-milfoil <i>Myriophyllum heterophyllum</i>	Invasive
 <p style="text-align: center;">Variable Water Milfoil <i>Myriophyllum heterophyllum</i> By Roberta Hill © 2004 MCIAP</p>	 <p style="text-align: center;">Photo by Ann Murray University of Florida / IFAS Used with permission</p>  <p style="text-align: center;">Variable Water Milfoil <i>Myriophyllum heterophyllum</i> Illustration From <i>Aquatic Invasive Plants of New England</i> By Crow and Helquist</p>
<p>Look Alikes: <i>Utricularia</i> sp. (Bladderwort) Native <i>Ceratophyllum demersum</i> (Coontail) Native Other <i>Myriophyllum</i> species</p>	

Eurasian Water-milfoil <i>Myriophyllum spicatum</i>	Invasive
 <p style="text-align: center;">Eurasian Water Milfoil <i>Myriophyllum spicatum</i> Collected and photographed by Don Cameron © 2004 MCIAP</p>	 <p style="text-align: center;">Photo Courtesy New Hampshire DES</p>  <p style="text-align: center;">IFAS Center for Aquatic Plants University of Florida, Gainesville, 1990</p>
<p>Look Alikes: <i>Utricularia</i> sp. (Bladderwort) Native <i>Ceratophyllum demersum</i> (Coontail) Native Other <i>Myriophyllum</i> species</p>	

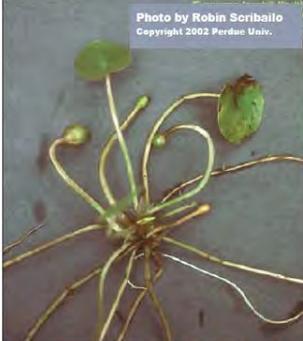
Curly-leaved Pondweed <i>Potamogeton crispus</i>	Invasive
Photos by Maine DEP Invasive Species Program	
	 <p style="text-align: center;">Turion</p>  <p style="text-align: center;">Copyright 2001 University of Florida Center for Aquatic and Invasive Plants</p>
<p>Look Alikes: <i>Potamogeton richardsonii</i> (Clasping-leaf Pondweed) and other <i>Potamogeton</i> species Native</p>	

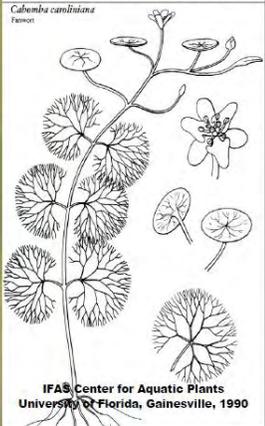
Hydrilla <i>Hydrilla verticillata</i>	Invasive
 <p style="text-align: center;">Tuber</p>	
 <p style="text-align: center;">Photos by Don Cameron</p>	 <p style="text-align: center;">IFAS Center for Aquatic Plants U. of Florida, Gainesville, 1990</p>
<p>Look Alikes: <i>Egeria densa</i> (Brazilian Elodea) Invasive <i>Elodea canadensis</i> (American Waterweed) Native</p>	

<p>Parrot Feather <i>Myriophyllum aquaticum</i></p>	<p>Invasive</p>
<p>Photo by Vic Ramey University of Florida / IFAS Used with permission</p> 	<p>Photo by Don Cameron</p>   <p>IFAS, Center for Aquatic Plants U. of Florida, Gainesville, 1990</p>
<p>Look Alikes: <i>Other members of the Myriophyllum genus</i></p>	

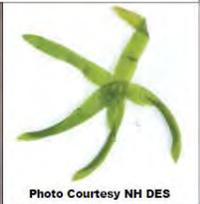
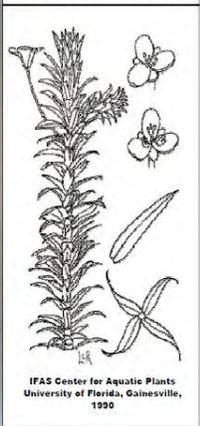
<p>Water Chestnut <i>Trapa natans</i></p>	<p>Invasive</p>
<p>Photo by Vic Ramey University of Florida / IFAS Used with permission</p> 	<p>Photo by Vic Ramey University of Florida / IFAS Used with permission</p>   <p><i>Trapa natans</i> © 2005 MCIAP</p> <p>Water Chestnut <i>Trapa natans</i> © MCIAP 2004</p>
<p>Look Alikes: None</p>	

<p>Yellow Floating Heart <i>Nymphoides peltata</i></p>	<p>Invasive</p>
<p>Photo by Vic Ramey University of Florida / IFAS Used with permission</p> 	<p>Photo by M. Malchoff Lake Champlain Sea Grant / VTDEC</p>   <p>Copyright 2002 U. of Florida Center for Aquatic and Invasive Plants</p>
<p>Look Alikes: <i>Nuphar variegata</i> (Spatterdock) Native <i>Hydrocharis morsus-ranae</i> (European Frogbit) Invasive <i>Nuphar microphylla</i> (Yellow Waterlily) Native</p>	

<p>European Frogbit <i>Hydrocharis morsus-ranae</i></p>	<p>Invasive</p>
<p>Photo by Robin Scribailo Copyright 2002 Perdue Univ.</p> 	<p>Photo by Robin Scribailo Copyright 2002 Perdue Univ.</p>   <p>Photo by M. Malchoff L.C. Sea Grant / VTDEC</p> <p>Copyright 2002 U. of Florida Center for Aquatic and Invasive Plants</p>
<p>Look Alikes: <i>Nymphoides Cordata</i> (Little Floating Heart) Native <i>Nymphoides peltata</i> (Yellow Floating Heart) Invasive <i>Nuphar microphylla</i> (Yellow Waterlily) Native</p>	

<p>Fanwort <i>Cabomba caroliniana</i></p>	<p>Invasive</p>
 <p>Photo by Maine DEP Invasive Species Program</p>	 <p>Photo Courtesy: New Hampshire DES</p>
	 <p><i>Cabomba caroliniana</i> Fernald</p> <p>IFAS Center for Aquatic Plants University of Florida, Gainesville, 1990</p>
<p>Look Alikes: <i>Bidens beckii</i> (Water Marigold) Native <i>Ranunculus flabellaris</i> (Yellow Water Crowfoot) Native <i>Utricularia</i> sp. (Bladderwort) Native</p>	

<p>European Naiad <i>Najas minor</i></p>	<p>Invasive</p>
<p>Photos by Don Cameron</p>	
 <p>cm</p>	
	 <p>Image From: <i>Aquatic Vascular Plants of New England</i> By Crow and Hellquist</p> <p>habit leaves</p>
<p>Look Alikes: <i>Najas flexilis</i> (Slender Naiad) Native Other <i>Najas</i> species Native</p>	

<p>Brazilian Elodea <i>Egeria densa</i></p>	<p>Invasive</p>
 <p>Photo by Maine DEP Invasive Species Program</p>	 <p>Photo Courtesy NH DES</p>
	 <p>IFAS Center for Aquatic Plants University of Florida, Gainesville, 1990</p>
<p>Look Alikes: <i>Hydrilla verticillata</i> (Hydrilla) Invasive <i>Elodea canadensis</i> (American Waterweed) Native</p>	

<p>American Waterweed <i>Elodea canadensis</i></p>	<p>Native</p>
 <p><i>Elodea canadensis</i> MCIAP - 2004</p>	<p>American Water Weed <i>Elodea canadensis</i> By Don Cameron © 2004 MCIAP</p>
 <p>From <i>Through the Looking Glass... A Field Guide to Aquatic Plants</i> © 1997</p>	

[Other potential target plants: starry stonewort, water hyacinth, water lettuce, swollen bladderwort?]

Acknowledgements.

Photos, approaches, and ideas came from many sources. Thanks in particular to Scott Kishbaugh of NYSDEC, Robynn Shannon of NEAPMS, and Chris Doyle of SOLitude, formerly ABI. The websites and approaches of Maine and Wisconsin were also a source of ideas and inspiration.