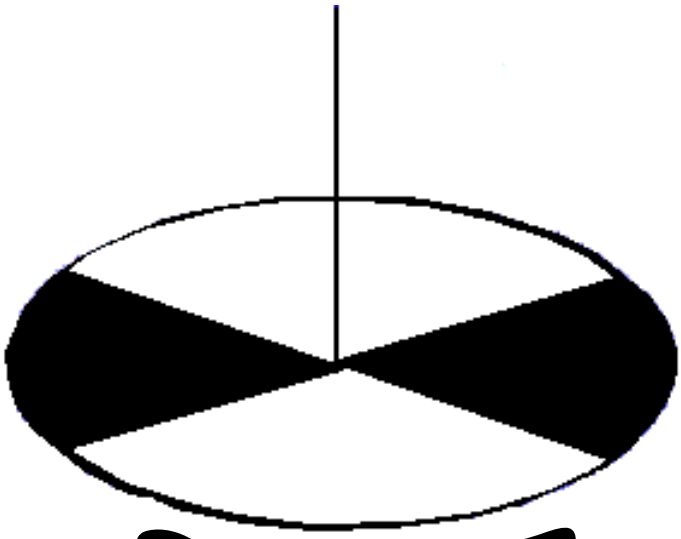


CSLAP

Aquatic Plant Sampling Protocol

New York Citizens Statewide
Lake Assessment Program

New York State Federation of Lake Associations

Department of Environmental Conservation

AQUATIC VEGETATION SAMPLING

1. BACKGROUND

Aquatic vegetation plays a critical role in lake ecosystems. Although the larger class of aquatic vegetation includes the microscopic plants includes free-floating algae (*phytoplankton*), algae attached to surfaces (*periphyton*), and larger branched alga (*charaphytes*), this discussion will be limited to larger rooted plants referred to as *macrophytes*. Macrophytes serve a crucial function in providing food, shelter, bottom stability, and nutrient transport to and from the sediment. However, macrophytes can also proliferate in the wrong places at the wrong times, frequently earning the title "weed". Of particular concern to many lakefront residents and recreational users are the exotic, or non-native macrophytes, which can frequently dominate a native aquatic plant community and crowd out more beneficial species. Macrophytes can be found throughout the *littoral zone*, the near-shore areas in which sufficient light reaches the lake bottom to promote phytosynthesis. However, plant growth in any particular part of the lake is a function of available light, nutrition and space, bottom substrate, wave action, and other factors.

Whether the lake managers role is to better understand the lake ecosystem or better manage the aquatic plant community, knowledge of the macrophyte species distribution is paramount to the management process. There are many procedures available for assessing and monitoring aquatic vegetation. Some of these techniques have been described in "Aquatic Vegetation Monitoring and Assessment Protocol Manual", developed by the NYS Fresh Water Institute. Many plant quantification techniques require SCUBA divers, precise on-site plant identifications, rigid sampling controls, and biomass measurements, most of which are beyond the scope (financial and technical) of CSLAP and other volunteer monitoring efforts. This protocol describes the procedures for a "semi-quantitative" plant monitoring program, in which volunteers collect plant specimen from known locations, providing field information and qualitative abundance estimates for a semi-quantative assessment of the macrophyte communities within critical areas of the lake. While these

techniques will help to provide better information for lake managers interested in optimizing their understanding and management of the lake, they are inadequate substitutes for professional plant surveys. Lake associations planning to devote significant time and expenditures toward a plant management program are advised to pursue more extensive plant surveying activities.

2. FOCUS OF SAMPLING EFFORTS

Although too much of any aquatic plant can be considered a problem, most invasive aquatic plants (those that create ecological, recreational, or aesthetic problems) are exotic plants- that is, those plants that are not native to a particular lake or geographic area. In New York State, there are four primary submergent exotic plants- Eurasian watermilfoil (*Myriophyllum spicatum*), water chestnut (*Trapa natans*), curly-leafed pondweed (*Potamogeton crispus*) and fanwort (*Cabomba caroliniana*). **However, in recent years, several other plants have either migrated into New York State or have been identified as invasive exotic plants. These include Brazilian elodea (*Egeria densa*), hydrilla (*Hydrilla verticillatum*), brittle naiad *(Najas minor*), variable watermilfoil (*Myriophyllum heterophyllum*), parrot feather (*Myriophyllum aquaticum*), and Euoropean frog-bit (*Hydrocharais morsus-ranae).*** Tracking, management, or eradication of these plants necessitates an early detection of the introduction of these plants to a lake. To that end, the NYSDEC developed a pamphlet titled Common Nuisance Aquatic Plants in New York State, which provides information, including known distribution maps, and line drawings and photographs of these four plants. CSLAP sampling volunteers involved in the collection of aquatic plants should also be on the lookout for these exotic plants, and for most CSLAP lakes, these plants will provide the focus for the aquatic plant monitoring efforts conducted through this program.

3. SAMPLING DAYS AND TIMES

Aquatic plant (macrophyte) communities do not experience significant daily fluctuations; as such, the aquatic plant sampling techniques described below can be conducted after water sampling sessions, at a time convenient to the volunteer. Given the time required to conduct these surveys, however, the volunteer is advised to keep the (previously-) collected water samples cool and shaded during the plant sampling sessions.

Due to the seasonal nature of macrophyte growing seasons, plant sampling need not be conducted any more frequently than every few months, say in early June (corresponding to the start of the CSLAP sampling season and the peak growing season for curly-leafed pondweed), mid-August, and in early October (the end of the CSLAP sampling season and the end of the growing season for several exotic plants). Each sampled site, described below, should be visited at about the same frequency, to compare seasonal changes between sites. More frequent sampling could be conducted to assess on-going plant management techniques, but generally would provide little additional information for baseline assessments.

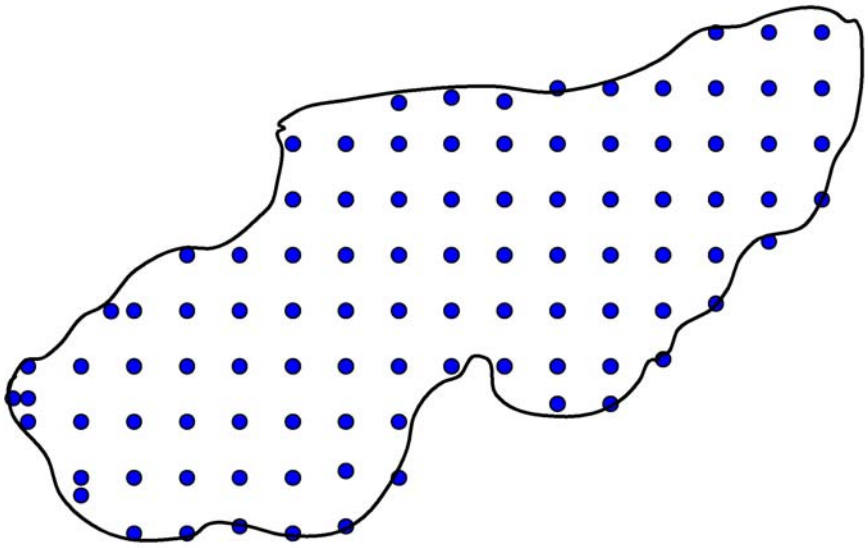
4. SAMPLING LOCATION

The DEC sampling protocol for aquatic plant sampling required as part of the enhanced aquatic pesticides review program is described on the DEC website at http://www.dec.ny.gov/docs/water_pdf/aquatic06.pdf. In both the "original" CSLAP plant surveys and this new sampling protocol, weighted sampling rakes are used. The primary differences in the programs correspond to the method by which sampling sites are selected (and located) and the standardized methods for evaluating the abundance of these plants.

Sample locations in the new CSLAP plant sampling protocol direct sampling volunteers to use an overlay grid system. The preferred grid is a 100m x 100m overlay in which the sampling

points correspond to the middle of these grids. Additional sampling points can be added or grid points can be moved slightly to assure sampling at the shoreline or areas of particular concern- points should be moved < 25 meters to prevent “merging” with nearby points, unless dictated by specific local sampling needs. An example of such an overlay is seen in Figure 7:

Figure 7: CSLAP sampling grid overlay

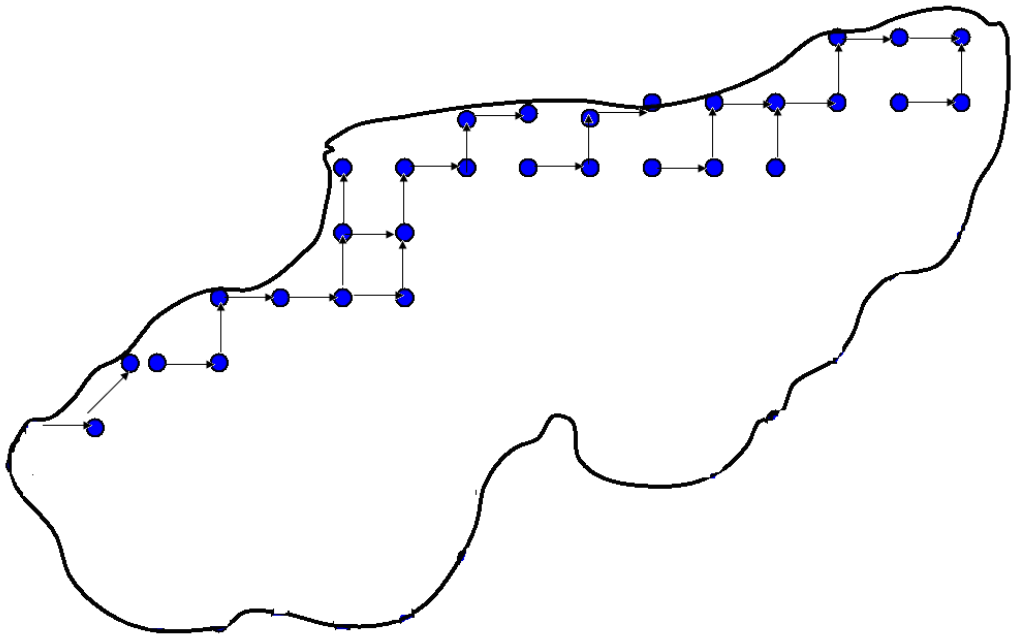


Sampling points can be numbered for future or easy reference, usually in a systematic pattern from west to east or north to south (or some combination). For those sampling volunteers with access to a hand-held GPS (global positioning system device), each sampling point can be identified by coordinates, either in advance or in the field. The navigational tools associated with these hand-held GPS units allow the sampling volunteer to record these sampling points within the device and to navigate to points in the future to assure consistency in sampling results. GPS coordinates should be in NAD83 or WGS84 format, recorded in decimal degrees (example: 44.1234 degrees).

Alternatively, sampling volunteers can identify sampling points by moving along the shoreline in approximately 100 meter intervals. Depending on the contour depths of the lake, sample grid points can be sampled “on the fly” by navigating from location to location, using the rake to determine if plants are found at these locations. Distances between sites can be approximated- 100 meters is about the length of a football field. An example of that process is shown in Figure 8 for a partial lake survey; all or part of a lake can be evaluated using these methods.

If a GPS unit is not available, site descriptions will suffice, particularly if accompanied by a map showing site numbers and site location descriptions. These descriptions might include the name of the lake resident with the closest lake cottage, shoreline landmark (name of wetland, road intersection, etc.), or other permanent “anchor” point. Lake depth and/or distance from shoreline could also be used.

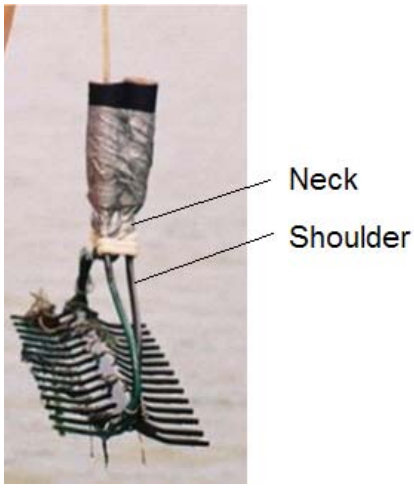
Figure 8: Sampling points



VEGETATION SAMPLING EQUIPMENT CHECKLIST

Equipment to be brought into the boat
(in addition to the standard lake sampling equipment listed on p. 9)

_____ "CSLAP Aquatic Vegetation Survey Form(s)"
_____ weighted sampling rake (with 20-40 ft line attached to handle), preferably two-sided
_____ Secchi disk and measured line (for sounding depth)
_____ Map of lake with overlay grid of sampling points (if sampling sites are pre-determined)
_____ sealable plastic bags ("baggies") for plant specimens
_____ paper towel(s)
_____ tape or labels to mark plastic bags
_____ permanent ink pen to write on the bag labels
_____ plant identification keys (if available)



Instructions for making two-sided rake

Step 1: Cut the heads off two metal garden rakes, approximately 3-6 inches from the metal heads

Step 2: Line up the back of the heads, as show in diagram to the left

Step 3: Using plastic zip ties every 2-3 tines, attach the rakes. Tighten the ties as much as possible, and cut them off at the collar

Step 4: Connect the “necks” of the rake heads (see diagram) with 1-2 zip ties

Step 5: Connect the “shoulders” of the rake heads (see diagram) with 1 tie near the neck and 1 tie near the heads on each side of the rake(s)

Step 6: Connect the tethered line to the rake. This can be done in one of two ways: (a) drill a hole through the top of the wood handles and draw the line through the hole, tieing the line off on one side; or (b) wrap the line around the shoulders in a figure 8, and then around the outside of the shoulders, tieing the line off on one side.

Step 7: Wrap the other end of the line around a winder

Step 8: Duct tape the wood handles together to keep them from separating

Figure 9: CSLAP Aquatic Plant Survey Form

Example CSLAP Aquatic Plant Survey Form

Lake Name	Pennant Lake					Start Time:			12:30				Description Starting Point:			Jones Dock									Station
Sampling Date:			6/31/08			End Time:			13:30				Lat:	42.7825				Long:		-74.2554					Description
						Exotics/Target Plants:							Native and Other Plants:												
Station#	Sample#	Lat	Long	Depth (m)	Overall Plant Abundance	Eurasian watermilfoil (=E1)	water chestnut (=E2)	curly leafed pondweed (=E3)	fanwort (=E4)	Other Target: (=E5)	Other Target: (=E6)	Other Target: (=E7)	Coontail (=N1)	White water lily (=N2)	Plant 3 (= N3)	Plant 4 (=N4)	Plant 5 (=N5)								
1	1	43.782781	-74.255430	1	M	T		T					M												Hamels
2	1	43.788939	-74.257232	1.5	D		M							D											Howard
3	1	43.786458	-74.257202	0.5	D	D							M		S										Utley
4	1	43.791360	-74.153010	3	S										S										Rollins
5	1	43.792960	-74.249730	1	T	T										T									Feliz
6	1	43.794020	-74.254760	1.5	M		S										M								Burrell
7	1	43.791656	-74.261278	2	M			T								M									Victorino
8	1	43.791981	-74.265915	0.5	Z																				Werth
9	1	43.788530	-74.268680	2	T	T											T								Stairs
10	1	43.786980	-74.262510	3	Z																				N wetland
11	1	43.783810	-74.258520	0.5	S	S							S	S											Lidge
12	1																								
13	1																								
14	1																								
15	1																								
16	1																								
17	1																								
18	1																								
19	1																								
20	1																								
Abundance Values: Z = Zero; T = Trace (fingerful); S = Sparse (handful), M = Moderate (rakeful); D = Dense (too much to bring in boat)																									
Additional Comments:		North end of lake sampled- south end will be sampled next month																							
		Native plants #3 through #5 and all exotic plants submitted for identification																							
		Station description = resident of closest house to site																							

ON-LAKE PROCEDURES

Step 1: Load plant sampling equipment into boat.

Step 2: Complete first part of CSLAP Aquatic Plant Sampling form (Figure 9)

a. Record lake name, sampling date, and start time in military hours.

b. Record description and/or GPS coordinates for launch site.

Step 3: Go to first sample point and record GPS coordinates or site description on CSLAP Aquatic Plant Sampling form (see Figure 9).

a. If available, record GPS coordinates in NAD83 or WGS84 units, recorded as degree minutes.

b. Record site description at first sampling point.

c. Lower the Secchi disk or use an electronic depth finder to find the water depth at this sampling site. Record this on the sampling form to the nearest 0.1 meter.

Step 4: Collect aquatic plant sample

a. Throw the rake out to the end of the tethered line from the near side of the boat. Try to throw the rake with the tines down (less important if you use a two sided rake). Make sure the open end of the rake line is tied to the boat or is otherwise secured to the boat or sampler.

b. Slowly retrieve the rake line.

c. Bring the rake into the boat and observe the vegetation on the rake tines.

d. Estimate the overall plant abundance using the following scale, and record on the sampling form:

Z = zero plants = no plants on rake
T = trace plants = fingerful on rake
S = sparse plants = handful on rake
M = medium plants = rakeful of plants
D = dense plants = difficult to bring into boat

e. Remove plants from the rake tines and separate into individual piles corresponding to different types of plants. If you are not sure the plants are the same, put them into separate piles.

f. If any plants look like the one of the exotics shown in Appendix A, estimate the abundance of that pile using the scale above, and record it on the appropriate line on the sampling form.

g. Take a single representative specimen of that plant, shake off any excess water, remove any debris (mud, other plants, algae, etc.) and place it in a plastic bag. Include any surface leaves, roots, or flowers associated with the plant. Alternatively, a digital photo can be taken of each plant and sent to the NYSDEC for identification at sakishba@gw.dec.state.ny.us. If photos are collected instead of plants, these should be labeled in the manner described in **Step 4i.** Any digital photos should be taken against a white backdrop (piece of paper, tray ,etc.) to improve the contrast.

h. Place a piece of a moist paper towel in the bag with the plant, making sure any extra water is removed from the bottom of the bag.

i. Place a label on the outside of the bag that includes the name of the lake, the date, and the number of the plant (E1 for Eurasian watermilfoil, E2 for water chestnut, etc. , with the "E" corresponding to "Exotic").

j. Repeat **Step 4f** through **Step 4i** for any other suspected exotic plants

k. Estimate the abundance of any plants not suspected of being exotic and record it on the form. The first occurrence of this "native" plant should be recorded as N1, N2, and so on. If the plant species is known, this can be recorded on the form, although the plant ID (N1, N2, etc.) should still be used.

l. Complete **Step 4k** for all native plants. These plants can also be submitted for identification, using the procedures outlined in **Step 4g** through **Step 4i,** although for the purposes of an invasive plant survey, native plant identification is not critical.

m. Any plants not collected by the rake but observed at this sampling site should also be included in this summary. If the plant abundance can be estimated, it should be assigned the appropriate plant ID (E1, N1, etc.). These plants can also be collected and submitted for identification.

Step 5: Go to the next sample point and repeat Steps 3 and 4

a. If GPS navigation is used, navigate to the next sampling point. If shoreline-only sampling is the primary objective, move to a point approximately 100 meters from the previous sampling point, at about the same distance from the shore.

b. Throw the rake out the side of the boat, as described in **Steps 4a** to **4c**. If plants are observed, record the coordinates and/or site description, and repeat **Steps 3 and 4** (the rake toss portion has already been completed). Any "repeat" plants observed in the rake tosses should be recorded using the same plant ID (E1, E2, N1, N2, etc.) as in the earlier rake tosses. No additional specimen need to be bagged for subsequent samples sharing the same ID, although a better specimen (with surface flowers, seeds, roots, nutlets, etc.) can replace the original specimen if needed.

c. If no plants are found, record the overall plant abundance as zero (= Z), and record the site coordinates and/or site description, and record the water depth, and move to the next sampling point.

d. If a more comprehensive survey is sought, travel in a line perpendicular to the shore for a distance of about 100 meters (or to the pre-designated coordinates of the next deeper site) and repeat **Steps 5b** and **5c.**

e. If the bottom depth drops off substantially further away from the shoreline, move in a direction parallel to the shoreline, going approximately 100 meters to the next sampling point and repeat **Steps 5b** and **5c.** If more plants are likely to be found at a sampling point further out in the lake (deeper water), move to the next deeper site and repeat **Steps 5b** and **5c.**

Step 6: Continue along shoreline and collect additional samples, following the procedures outlined above.

a. If any plants are observed at any sampling site, but are not collected by the rake (such as small floating surface plants like duckweed, larger plants such as lilies, or filamentous algae), these should be recorded and their relative abundance should be estimated, using the abundance scale provided earlier as a guide.

b. Any other plants observed within the lake but not at a "formal" sampling site, such as outside the samplers dock, washed up along the shore, or collected by other lake residents, can be assigned an ID for reference, and can be submitted for identification.

Step 7: Add any additional comments to the bottom of the plant sampling form.

a. This may include a "legend" indicating how the sampling sites were named or described, a summary of which plants (E1, N2-3, etc.) were submitted for identification, and where any additional plants (as collected in Step 6) were observed.

b. Record the end time for the sampling session on the form.

SHIPPING PROCEDURES

Step 1: Place the plant samples in the CSLAP sampling crate if available.

a. If the plant sampling is conducted as part of a regular CSLAP water sampling session, or if a water sample has not yet been sent, place the labeled bags in the same shipping crate with the water sample.

b. Place the CSLAP plant sampling form on top of the Styrofoam box (but inside the cardboard cover) along with the other sampling paperwork.

Step 2: If the sampling crate is not available, ship the samples directly to the DEC.

a. Open the baggie(s) to remove any excess air and place in an envelope.

b. Place the sampling form in the envelope outside of the plant baggie(s).

c. Ship samples to the NYSDEC at the following address:

NYSDEC Division of Water
c/o Scott Kishbaugh
625 Broadway, 4th Floor
Albany, NY 12233-3502

Step 3: Send digital photos to NYSDEC for identification

a. If digital photos are collected instead of voucher (archived) specimen, these should be emailed to the following address: sakishba@gw.dec.state.ny.us.

b. The name of the lake and date should also be included in the email title and body of the message

CONVERSIONS

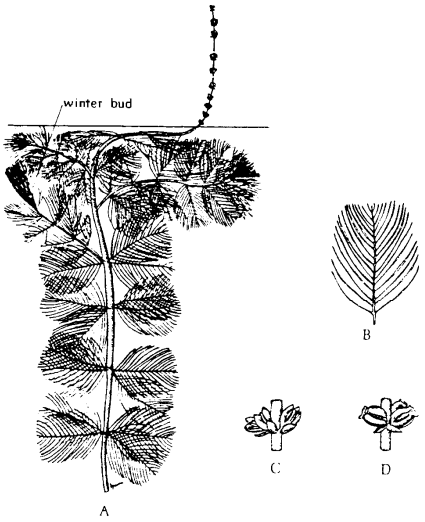
1. Distance- Meters to Feet

Meters	Feet
0.3	1.0
0.5	1.6
1.0	3.3
1.5	4.9
2.0	6.6
2.5	8.2
3.0	9.8
3.5	11.5
4.0	13.1
4.5	14.8
5.0	16.4
5.5	18.0
6.0	19.7
6.5	21.3
7.0	23.0
7.5	24.6
8.0	26.2
8.5	27.9
9.0	29.5
9.5	31.2
10.0	32.8
15.0	49.2
20.0	65.6
25.0	82.0
30.0	98.4
50.0	164.0

2. Temperature- °C to °F

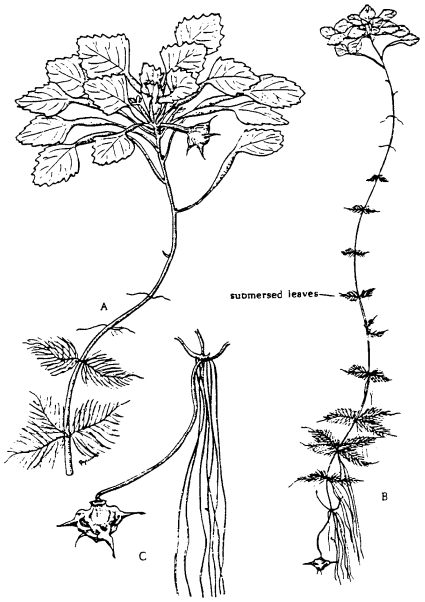
°C	°F
0.0	32.0
5.0	41.0
10.0	50.0
11.0	51.8
12.0	53.6
13.0	55.4
14.0	57.2
15.0	59.0
16.0	60.8
17.0	62.6
18.0	64.4
19.0	66.2
20.0	68.0
21.0	69.8
22.0	71.6
23.0	73.4
24.0	75.2
25.0	77.0
26.0	78.8
27.0	80.6
28.0	82.4
29.0	84.2
30.0	86.0
35.0	95.0
40.0	104.0
100.0	212.0

Appendix A- Common Nuisance Aquatic Plants in New York State



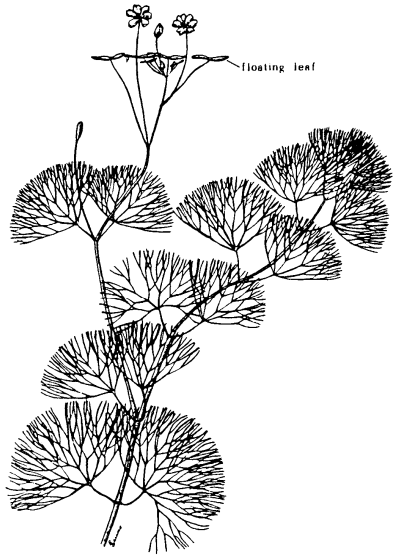
Myriophyllum spicatum: A. habit of submersed form with emergent inflorescence, × ½. B. leaf, × 1. C. flowers, × 2. D. fruits, × 2.

Eurasian watermilfoil (*Myriophyllum spicatum*)



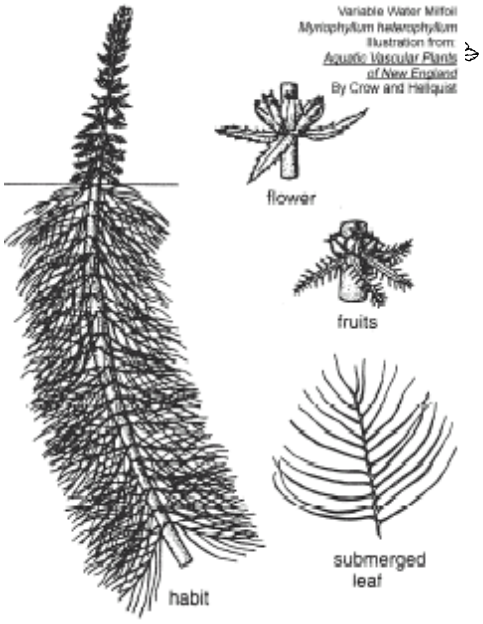
Water chestnut (*Trapa natans*)

Curly-leafed pondweed (*Potamogeton crispus)*

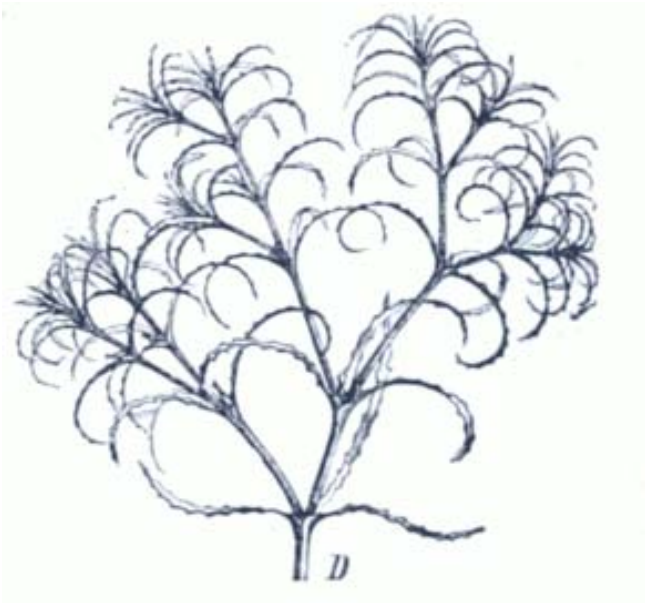


Fanwort (*Cabomba caroliniana)*

Appendix A- Common Nuisance Aquatic Plants in New York State



Variable watermilfoil
(*Myriophyllum heterophyllum*)



Brittle naiad (*Najas minor*)

Hydrilla (*Hydrilla verticillatum)*

Brazilian elodea (*Egeria densa)*