

## AQUATIC PLANTS – *Seasonal cycles* Roberta Hill

Life, whether we are aware of it or not, is dominated by cycles. The water cycle, the nutrient cycle, the cycle of life itself, are all natural processes, fundamental to life on earth, which essentially follow circular trajectories. One of the great joys of exploring the littoral zone is the discovery of the many ways in which nature's cycles, grand and minute, elaborate and simple, are played out in these sun-filled watery places.



*Cattails in winter*

The annual cycle of the seasons is one of the most obvious--and most extraordinary--cyclical processes in the littoral zone. In Maine, where the environmental conditions vary so sharply from one season to the next, changes in these areas are especially dramatic and at no time are these conditions so extreme as in the winter. How do aquatic plant communities respond to the shortened days, the decrease in the intensity of the sun's energy, the plummeting air and water temperatures, the transformation of the habitat from one that is warm and liquid, to one that encrusted under a thick layer of ice and snow?

Though each species has its own unique approach to preparing for and surviving through the hardships of winter, there are some common strategies employed. Since most aquatic plants evolved from terrestrial plants, it is not surprising that many of their over-wintering strategies are similar to those of their wild and cultivated upland kin; strategies you may already know well from observing the plants in your garden. Aquatic plants, just like garden plants, can be sorted into groups based up what they do in response to winter and how they provide for regeneration the following spring.

**Annuals:** Annual plants, in a manner of speaking, are those that have chosen not to bother with surviving the winter at all. As their name implies, annuals live for one growing season only and must produce viable seed by season's end if they are to ensure a new generation the following year. This strategy has advantages and disadvantages. Seeds are more durable and mobile than rhizomes and rootstalks. They can disperse widely and settle into small openings in the plant cover. Many seeds are able to lie dormant in the sediments for many years awaiting favorable conditions. The product of sexual reproduction, seeds also provide genetic diversity, helping to ensure the "adaptability" of the species to environmental changes. Energy-wise, however, seed production is costly, and compared to roots and rhizomes, seeds pack away relatively little in the way of energy reserves.

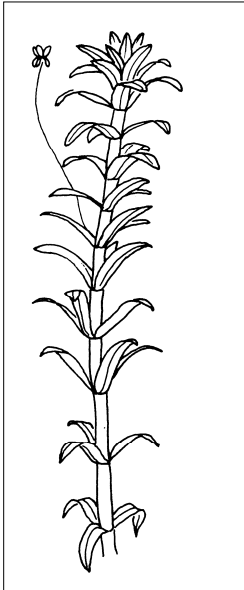
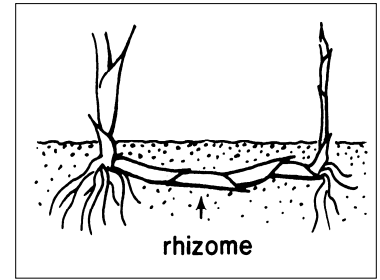
The tiny "seedling-like" waterwort (*Elatine minima*) is a good example of a native annual. The miniature flowers and seed capsules of this plant are produced in the leaf axils (where the leaf meets the stem) during the warm summer months. The ripened seeds drop and settle onto the bottom sediments through the late summer and fall, and there they remain, in a state of dormancy, through the winter. Whereas some seeds of native annuals, like wild rice (*Zizania* spp.), germinate prolifically in disturbed sediments, the key to successful germination for waterwort is a stable, undisturbed bottom and good water clarity.



*The tiny waterwort is a native Maine annual  
(photo courtesy of the Maine Natural Areas Program)*

Of the eleven invasive aquatic plants listed on Maine's watch list, only European naiad (*Najas minor*) is a true annual. The abundant seed production of this invader--tens of millions of *N. minor* seeds per acre have been counted--is a particular torment to those trying to control this plant. During the late summer or early fall, the stems of the naiads become brittle, and the profusely branched stem tips break into small fragments. Seeds remain attached in the leaf axils, and wind and water currents disperse the fragments.

**Perennials:** Most aquatic plant species found in Maine are perennials; plants capable of over-wintering, in whole or in part, and surviving three or more years. Some, indeed, are very long-lived; a water-lily bed may be hundreds of years old. Aquatic perennials often form extensive and overlapping rhizome systems, expanding every growing season. These persistent mat-like networks stabilize shoreline and bottom sediments throughout the year, making these plants critical components of the aquatic habitat and important allies in the effort to protect water quality.



*Elodea*  
**Evergreen Perennial**

Some perennials, like cattails (*Typha* spp.), send new shoots up from their rhizomes late in the growing season that remain dormant in the sediments until spring. Others, blue-flag (*Iris versicolor*) for example, die back to the root or rhizome completely, waiting for spring to send up new growth. Several perennials persist as “evergreens” through the winter, and continue to photosynthesize at a reduced rate under the ice and snow. Our native common waterweed (*Elodea canadensis*) is a good example of an evergreen perennial. And though it may look rather ragged and drained come spring, the stems (and even stem fragments) of invasive variable-leaf milfoil (*Myriophyllum heterophyllum*) may also over winter in this manner, new growth ready, come spring, to unfurl from the growth tip of each blackened stem.

Most perennials that propagate primarily by root division have back up strategies for ensuring long-term success. For example, most produce seeds. Some develop compact vegetative structures called *turions* (also referred to as winter buds) or *tubers*, turion-like structures emerging from subterranean stems. These starchy, densely packed structures have the durability and mobility advantages of seeds, without the high-energy demand or the hit-or-miss nature of sexual reproduction. The highly invasive hydrilla (*Hydrilla verticillata*) sets abundant turions and tubers during the growing season, both structures helping to earn this plant its dubious title of the “perfect weed.” Hydrilla tubers, for example, are unaffected by aquatic herbicides and may remain dormant in the sediments for up to ten years.

Some aquatic perennials have no roots or rhizomes to “die back” to at all. The duckweeds (*Lemna* spp.) are examples of *free-floating* native perennials. The tiny but prolific duckweeds are more cold tolerant than many other aquatic vascular plants, and can continue to grow at a normal rate in water temperatures as low as 7° C. In fact, solar radiation allows a dense mat of duckweed to generate its own microclimate (with temperatures up to 10° higher than ambient air temperatures). As temperatures approach freezing, the winter buds of the duckweeds sink to the pond bottom where they lay dormant until warmer conditions return. In the spring, the buds become buoyant and bob back to the surface, completing their seasonal cycle.

Some sources:

1. Through the Looking Glass A Field Guide to Aquatic Plants, Susan Borman et. al., Wisconsin Lakes Partnership, 1997
2. Aquatic and Wetland Plants of Northeastern North America, Garret E. Crow and C. Barre Helquist, University of Wisconsin Press, 2000.
3. U.S. Army Engineer Research and Development Center (ERDC).website

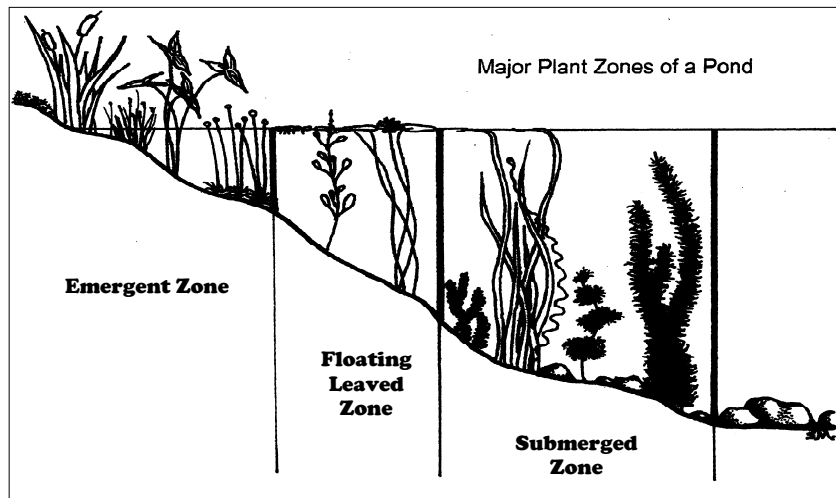


*Duckweed forming turions*  
(Photo by Prof. Cheryl C. Smart)

# AQUATIC PLANT COMMUNITIES Roberta Hill

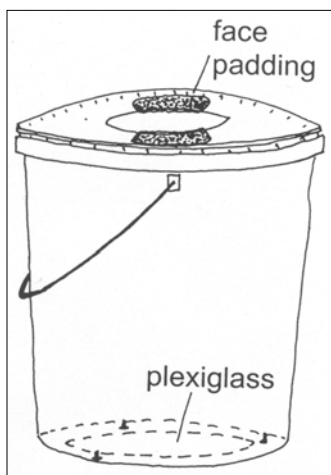
You are out in your little boat exploring the “fertile fringe” of your lake or pond, the shallow areas where sunlight penetrates to the bottom sediments and the rooted aquatic plants create a blurry mosaic of form and color. You notice that within the littoral area, the plants are loosely arranged in distinct, though overlapping “zones” or “communities.” The *emergent* plants such as cattails, pickerelweed and arrowhead hug the shore. These plants are adapted to withstand wave action and fluctuating water levels. With stiff but buoyant leaves and heavy-duty interlocking roots, they form an excellent defense against shoreline erosion and important cover for nesting waterfowl.

Beyond the emergent plants you find the floating leaved plant community. This community is notable for the patches of circular or elliptical leaves floating on the surface and later in the season for the beautiful and often fragrant flowers that emerge among the leaves. Some (like the spatterdock and fragrant water lily) are anchored to the bottom sediments by tough elastic stalks; some (like the tiny duckweeds) float freely among the rooted plants.



*Littoral zone plant communities*

When you look very closely, down below the water’s surface, you notice a third community: the graceful and wondrously varied world of the submersed plants. This group includes the translucent leaved pondweeds, the tiny waterweeds, the delicate naiads and the free-floating, plankton-eating bladderworts. These plants are all well adapted to the buoyancy of life underwater and many lack the stiff cell structure needed for life at or above the surface. The leaves here are finely divided or long and wispy, like cellophane noodles. Some submersed plants also produce a set of different, more durable, leaves to accompany their flowering parts at or above the surface.



*“Wide Angle” Scope*

The best time to view the submersed community is when the air is very still and the sunlight is not directly overhead. Early morning and late afternoon usually provide the best viewing conditions. Under these conditions, and perhaps with a pair of polarized sunglasses, you can see through the surface of the lake as if it were polished glass, each plant fully revealed in exquisite detail. However, if the wind picks up and begins to ruffle the surface you will need a piece of equipment - a simple viewing scope - to continue your exploration. The 4 ½” scope used by VLMP water quality monitors generally will not provide a wide enough field of view for plant survey work. To the left is a diagram of an inexpensive, build-it-yourself “wide-angle” viewing scope. For complete instructions for constructing a simple bucket scope, please see page 3.2.1 or download it from the VLMP website [www.mainevlmp.org/volunteer-info/invasive-plant-monitors/ipp-resources/#Survey](http://www.mainevlmp.org/volunteer-info/invasive-plant-monitors/ipp-resources/#Survey)



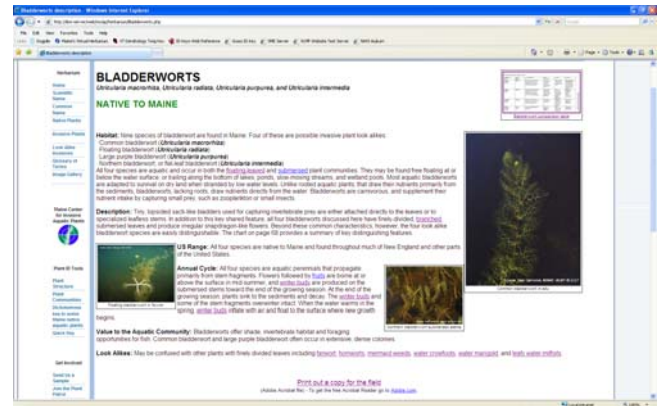
## Maine Volunteer Lake Monitoring Program

# Maine's Interactive Field Guide to Aquatic Invaders

[www.mciap.org/herbarium](http://www.mciap.org/herbarium)

The **Interactive Field Guide to Aquatic Invaders**, based on the *Maine Field Guide to Invasive Aquatic Plants*, provides users with a number of enhancements, including:

- Photos, line drawings and scanned images including plants in situ (what one would see from a boat), close-up shots, micrographs of key structures such as fruits and bracts for the 11 invasive aquatic plants on Maine's watch list and their native "look-alikes"
- Easy cross reference links providing comparisons of the invaders and their native "look-alikes"
- Factual information for each of the featured plants including: habitat, species description, origin and range, annual cycle, value in the aquatic community (for native species) and potential impacts (for invasive species)
- Comparison Charts for quick identification of similar species
- A Plant Identification Key to help determine possible identification for plant specimens
- A dichotomous Quick Key to identifying (or ruling out) the eleven invasive species
- Botanical terms are hyperlinked to an illustrated glossary



Much work is being done at the state and local level to prevent the spread of invasive plants into Maine's lakes, ponds and streams. Prevention of the spread of these organisms through raising public awareness and encouraging routine boat inspections is, as it should be, the primary focus of Maine's effort at present. Experience in other states has shown, however, that prevention is not enough. Prevention efforts, no matter how comprehensive in scope, are never 100% effective. If and when an invader *does* slip through the cracks, the best hope for eradicating it, or at least managing it in an environmentally sound manner, is *early detection*. This is where the *Interactive Field Guide* comes in.

Relatively few of Maine's 6000+ lakes and ponds and thousands of miles of rivers have been screened for the presence of invasive plants. Developing, implementing and sustaining a comprehensive early detection team in a state with so much aquatic plant habitat is a daunting task. If Maine's early detection program is to be effective, all Mainers who have an interest in the protection of our water resources, volunteers, professionals, agency personnel, students, lake association members, boaters, anglers, civic groups and others must be encouraged to participate in the effort, and be provided with the information and technical support needed to succeed.

Through its Invasive Plant Patrol Program (initiated in 2001) the Maine Volunteer Lake Monitoring Program has trained over 3500 volunteers to screen for and identify the eleven invasive aquatic plants on Maine's watch-list and to distinguish them from harmless native "look-alike" plants. The new *Maine Field Guide to Invasive Aquatic Plants* and the *Quick Key to Ruling out Maine's Eleven Most Unwanted Invasive Aquatic Plants*, provide handy, field-friendly resources for trained patrollers and the general public. The purpose of the *Interactive Field Guide* is to complement these publications with a widely accessible, easily revised and expandable resource.



# A Key to Common Native Maine Aquatic Plant Species



Adapted by



Maine Volunteer Lake Monitoring Program

## A Key to Common Native Maine Aquatic Plant Species

COMMON NAME	SCIENTIFIC NAME	PAGE
<u>Submersed Plants</u>		
Pipewort	<i>Eriocaulon aquaticum</i>	2.4.6
Wild Celery	<i>Vallesneria americana</i>	2.4.6
Water Lobelia	<i>Lobelia dortmanna</i>	2.4.6
Quillworts	<i>Isoetes spp.</i>	2.4.6
Common Waterweed	<i>Elodea canadensis</i>	2.4.7
Slender Waterweed	<i>Elodea nuttallii</i>	2.4.7
Slender Naiad	<i>Najas flexilis</i>	2.4.7
Water Starwort	<i>Callitriche spp.</i>	2.4.8
Large-leaf Pondweed	<i>Potamogeton amplifolius</i>	2.4.8
Small Pondweed	<i>Potamogeton pusillus</i>	2.4.9
Variable Pondweed	<i>Potamogeton gramineus</i>	2.4.9
Floating-leaved Pondweed	<i>Potamogeton natans</i>	2.4.9
Spiral Fruited Pondweed	<i>Potamogeton spirillus</i>	2.4.10
Clasping Pondweed	<i>Potamogeton perfoliatus</i>	2.4.10
Fern Pondweed	<i>Potamogeton robbinsii</i>	2.4.10
Ribbon Pondweed	<i>Potamogeton epiphydrous</i>	2.4.10
Watermilfoils	<i>Myriophyllum spp.</i>	2.4.11
Common Bladderwort	<i>Utricularia macrorhiza</i>	2.4.11
Large Purple Bladderwort	<i>Utricularia purpurea</i>	2.4.11
Water Crowfoot	<i>Ranunculus spp.</i>	2.4.12
Water Marigold	<i>Bidens beckii</i> , aka <i>Megalodonta beckii</i>	2.4.12
Coontail	<i>Ceratophyllum demersum</i>	2.4.13
Stoneworts	<i>Chara spp &amp; Nitella spp.</i>	2.4.13
<u>Floating-leaved Plants</u>		
Duckweeds	<i>Lemna minor &amp; Spirodella polyrhiza</i>	2.4.14
Spatterdock	<i>Nuphar variegata</i>	2.4.15
Fragrant White Waterlily	<i>Nymphaea odorata</i>	2.4.15
Watershield	<i>Brasenia schreberi</i>	2.4.15
Little Floating Heart	<i>Nymphoides cordatum</i>	2.4.16
Burreed	<i>Sparganium spp.</i>	2.4.16
<u>Emergent Plants</u>		
Arrowhead	<i>Sagittaria spp.</i>	2.4.17
Pickerel Weed	<i>Pontederia cordata</i>	2.4.17
Cattail	<i>Typha latifolia</i>	2.4.18
Horsetail	<i>Equisetum spp.</i>	2.4.18
Bayonet Rush	<i>Juncus militaris</i>	2.4.18
Robbins Spikerush	<i>Eleocharis robbinsii</i>	2.4.19
Water Bulrush	<i>Schoenoplectus subterminalis</i>	2.4.19

## How to Use this Key

In this key you are asked to make a series of choices between descriptions of different plants. Eventually, by observing the plant you are trying to identify and making these choices, you will arrive at an identification of the plant.

First, go to page 2.4.4, where you are asked to decide whether the plant has a submersed, floating-leaved, or emergent growth habit. By choosing one of these, the key then directs you to a page and number, where you will again make some choices. Each choice will be between two, three, or sometimes more options. In many cases you will need to look closely at the plant in order to be able to decide which description it fits.

There is a glossary on page 2.4.20 should you encounter an unknown term.

Thirty-seven of Maine's common native aquatic plants are covered in this key. However, there are over 120 aquatic plant species in Maine, so it is possible you are trying to identify a plant not covered by this key. Should you have questions or want a confirmation on an identification you are encouraged to send a plant sample to the Volunteer Lake Monitoring Program. Detailed information on how to prepare your specimen for shipping is provided on page 3.1.10 and in the forms section of this handbook. This information can also be found online at [www.mainevlmp.org/reporting-aquatic-species-6/](http://www.mainevlmp.org/reporting-aquatic-species-6/)

*Please do not copy without proper credit.* Additional copies of this key are available upon request from:

Maïne VLMP

24 Maple Hill Road, Auburn, Maine 04210

207-783-7733.

\*\*\*\*\*

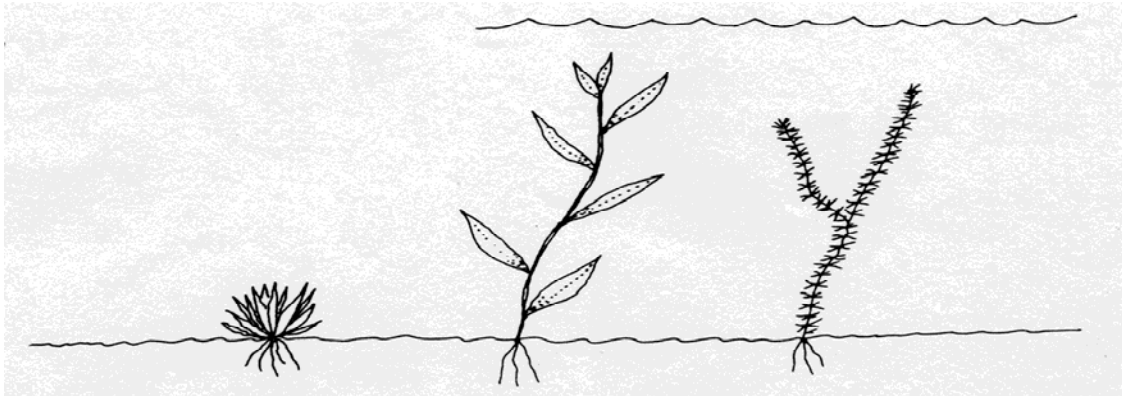
All illustrations and information, except those noted below, were adapted with permission from *A Key to Common Vermont Aquatic Plant Species* by Susan Warren, Lakes & Ponds Unit, Water Quality Division, Vermont Department of Environmental Conservation.

*Lobelia dortmanna*, *Isoetes spp.*, *Potamogeton pusillus*, *P. spirillus*, *P. perfoliatus*, *P. robbinsii*, *P. epiphydrous*, *Utricularia purpurea*, *Juncus militaris*, *Eleocharis robbinsii*, and *Schoenoplectus subterminalis* – Information provided by Roberta Hill, Illustrations by Jacolyn Bailey.

## CHOOSE BETWEEN 1A, 1B, or 1C BELOW:

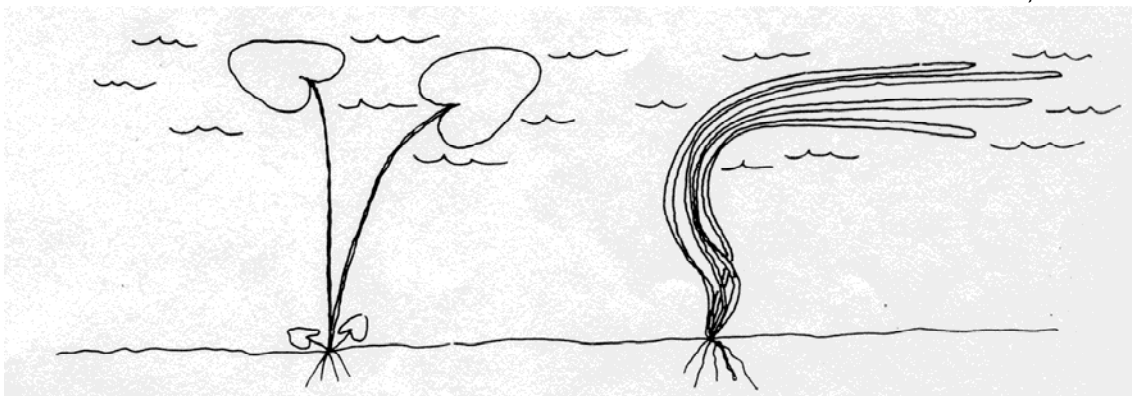
### 1A. Submersed:

Plants are growing completely or largely beneath the water's surface....page 2.4.5



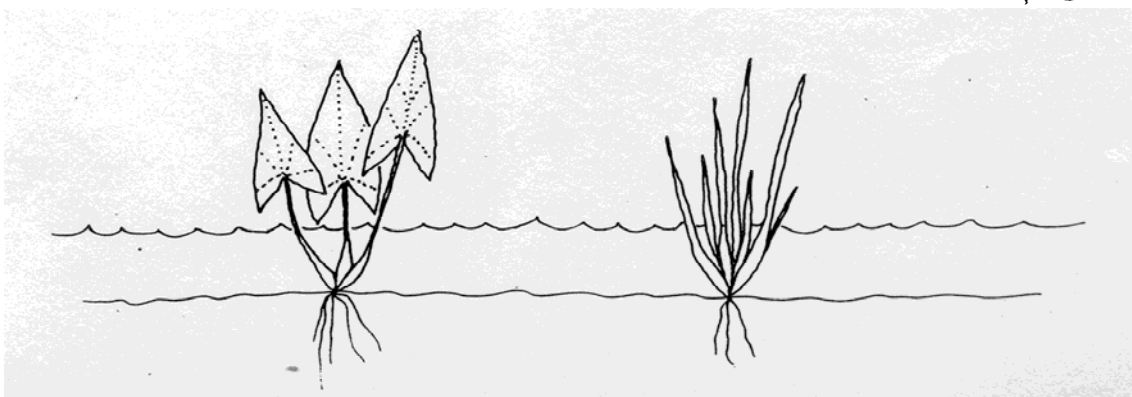
### 1B. Floating-leaved:

Plants having at least some leaves floating on the water's surface (surface of floating leaves shed water).....page 2.4.14



### 1C. Emergent:

Plants are rooted on the pond bottom and extend upright above the water's surface.....page 2.4.17

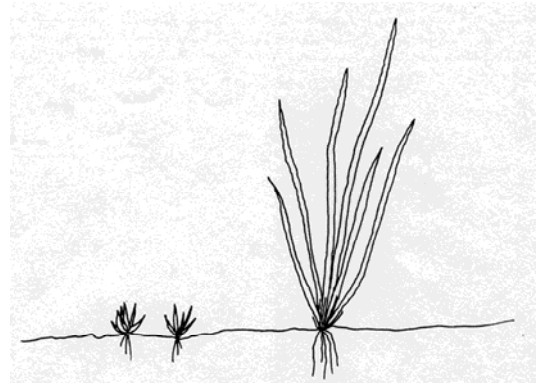




## SUBMERSED PLANTS

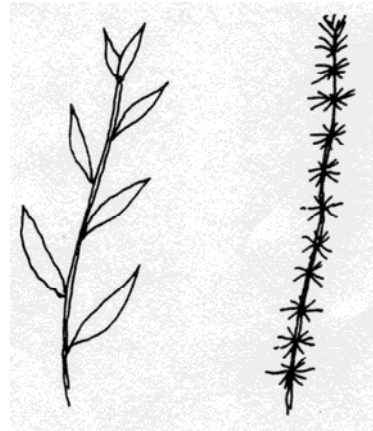
### 2A. Basal Leaves ~

All leaves emerge from a single point  
near the pond bottom.....page 2.4.6, #4

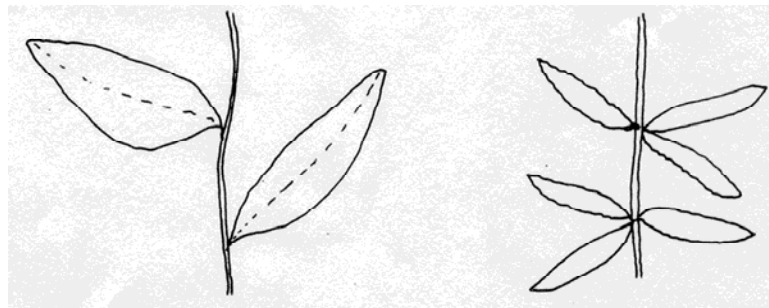


### 2B. Leaves on a Stem ~

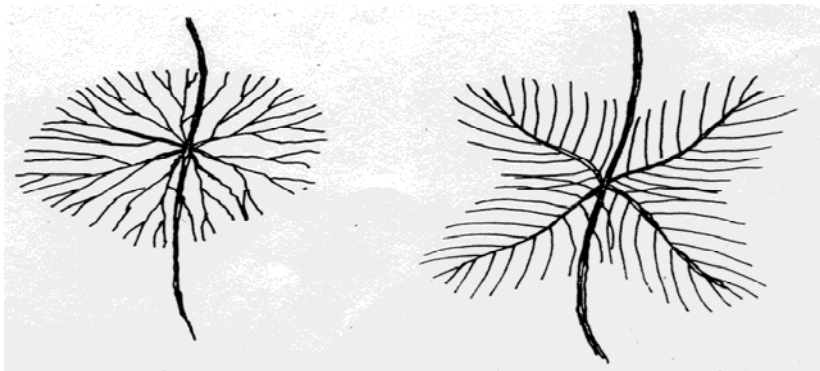
Leaves are arranged along the stem  
.....see #3 below



### 3A. Leaves undivided, flattened, may be toothed.....page 2.4.7, #5



### 3B. Leaves finely divided, or narrow round leaves (not flat).....page 2.4.11, #8

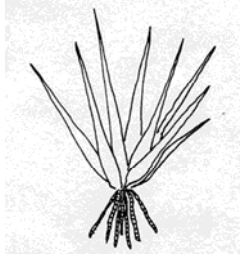


## SUBMERSED PLANTS ..... CONTINUED

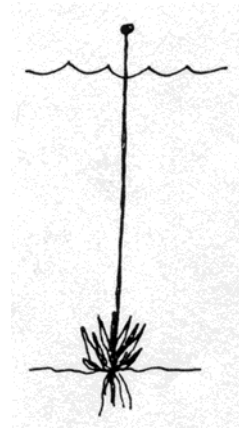
### 4. Submersed Plants With Only Basal Leaves

#### 4A. Pipewort (*Eriocaulon aquaticum*)

Roots with light  
& dark striations



In shallow water  
Pipewort will grow an  
emergent "flower"  
resembling a button



Plants are usually 1 ½ to 3 inches high

#### 4B. Water Lobelia (*Lobelia dortmanna*)

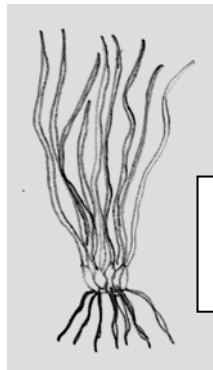
Base of plant resembles pipewort, but  
leaves are rounded at the tip



Flowers are white to lavender

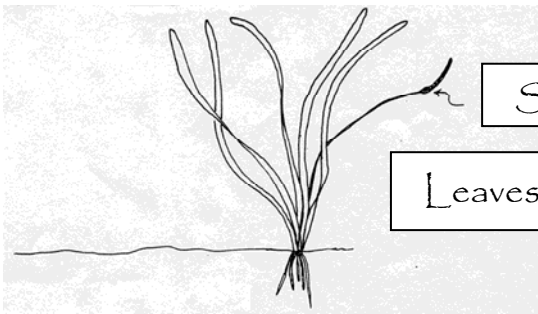
#### 4C. Quillwort (*Isotetes spp.*)

Reproductive structures are  
below water's surface and  
roots are white (not striated)



Small spikey plant, may resemble the  
basal leaves of the pipewort plant

#### 4D. Wild Celery, Eel Grass (*Vallisneria americana*)



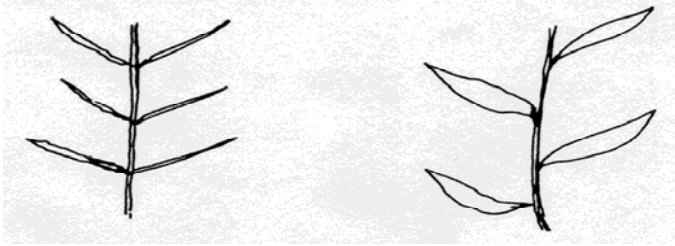
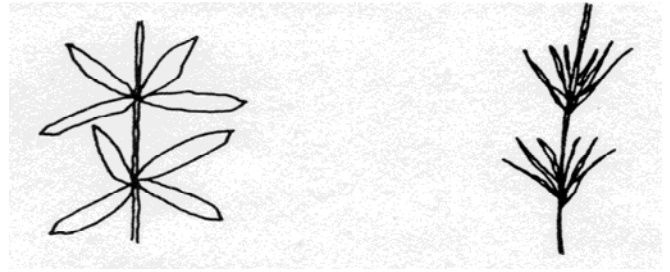
Seed Pod

Leaves are ½ to 1 inch wide and up to 2 feet long

## SUBMERSED PLANTS ..... CONTINUED

### 5. Submersed Plants With Blade-shaped, Entire Leaves

- 5A. Leaves in whorls of three or more around the stem.....see #6 below



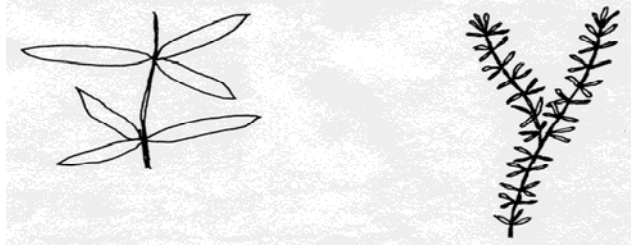
- 5B. Leaves arranged oppositely or alternately along the stem....see page 2.4.8, #7

### 6. Whorled Leaves

#### 6A. Waterweeds:

Common Waterweed (*Elodea canadensis*) & Slender Waterweed (*Elodea nuttallii*)

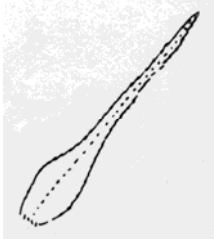
Leaves 3 in a whorl usually  $\frac{1}{2}$  to 1 inch long, plants can vary in height from less than 1 foot to upwards of 6 feet



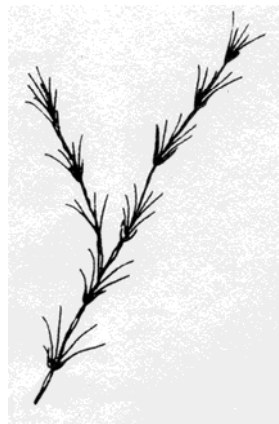
The leaves of common waterweed are generally shorter, wider and more blunt at the tip, than the leaves of slender waterweed

#### 6B. Slender Naiad (*Najas flexilis*)

Carefully pull a leaf off. Teeth are almost invisible, even with a hand lens.



Leaves may also occur in pairs or loose clusters



Leaves are about 1 inch long.

Plants are usually 1 or 2 feet high with branching stems.

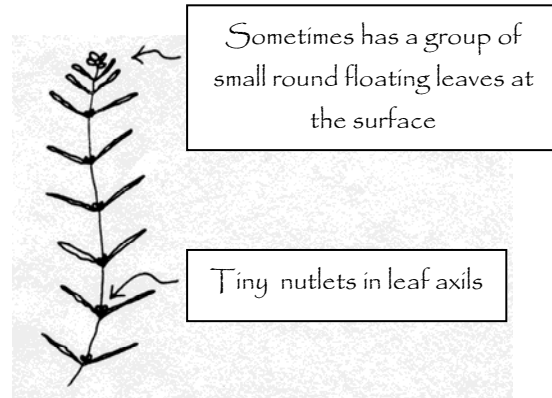
## SUBMERSED PLANTS ..... CONTINUED

### 7. Submersed Plants with Opposite or Alternate Blade-shaped Leaves

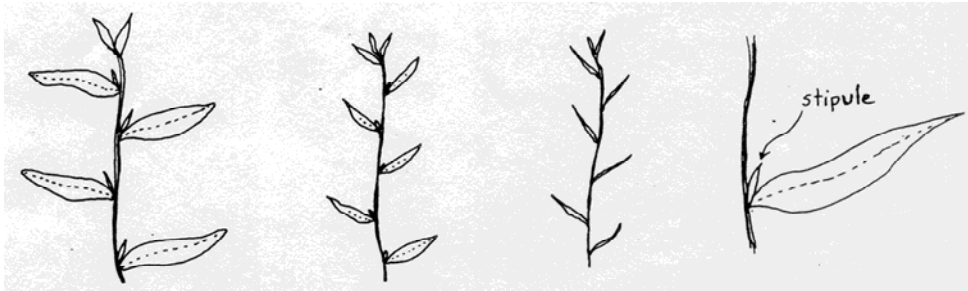
#### 7A. Water Starwort (*Callitriche spp.*)

There are 2 species of Water Starwort in Maine

Very fragile leaves about 1 inch long and 1/32 inch wide, in pairs. Generally a small plant growing in shallow water.



#### 7B. Pondweeds (*Potamogeton spp.*)



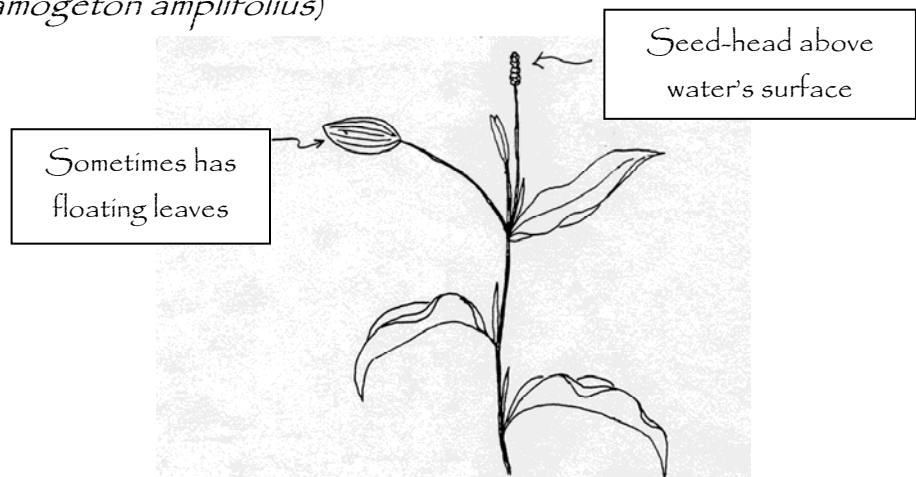
There are 22 species of pondweeds in Maine, varying between very small thin leaved species to those with large wide leaves

They are distinguished as a group by possessing a leaf mid-vein (look closely on the thin-leaves species). Also, pondweeds have small sheath-like structures (stipules) at the base of each leaf. In some species the stipule is fused to the leaf and is difficult to see.

#### Large-leaf Pondweed (*Potamogeton amplifolius*)

Large arched leaves with wavy edges, often brown, 3 or 4 inches long, and up to 2 inches wide.

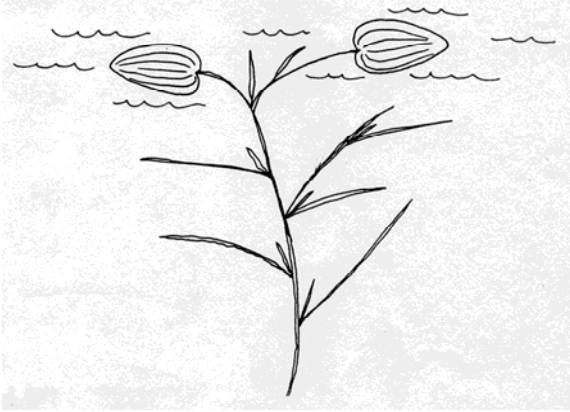
This plant can be up to 6 or 7 feet high.



## SUBMERSED PLANTS ..... CONTINUED

### 7B. Pondweeds Continued – Some Common Pondweeds

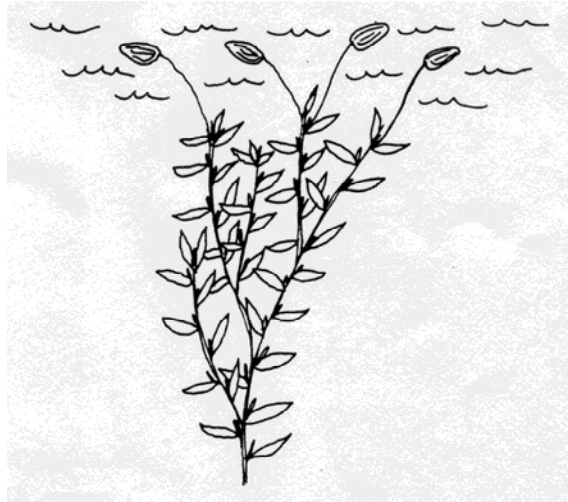
#### Floating-leaved Pondweed (*Potamogeton natans*)



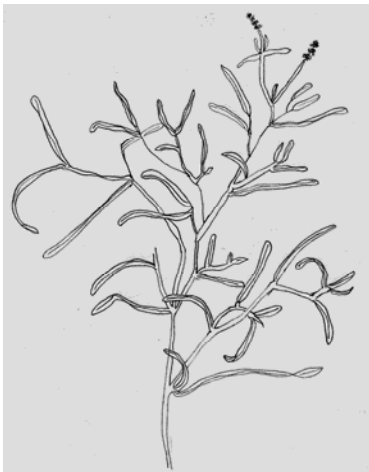
Narrow stem-like submersed leaves, up to 1/8 inch wide, usually brown, floating leaves are 2 to 3 inches long, usually growing in water 2 or 3 feet deep

#### Variable Pondweed (*Potamogeton gramineus*)

Heavily branched, many leaves, leaves are 1/2 inch to 4 inches long and may have small floating leaves



#### Small Pondweed (*Potamogeton pusillus*)



No floating leaves are produced. Submersed leaves are 1/2 to 3 inches long, linear and attached directly to the stem. Look for a pair of raised glands at the base of the leaf (Magnification may be needed.)

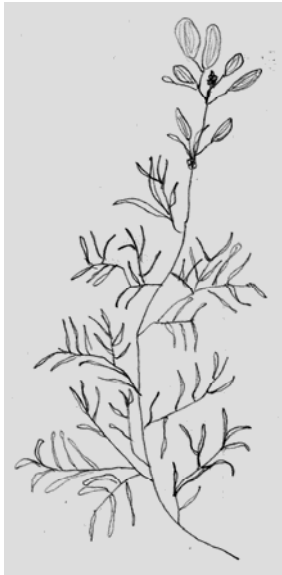


## SUBMERSED PLANTS ..... CONTINUED

### 7B. Pondweeds Continued – Some Common Pondweeds

#### Spiral Fruited Pondweed

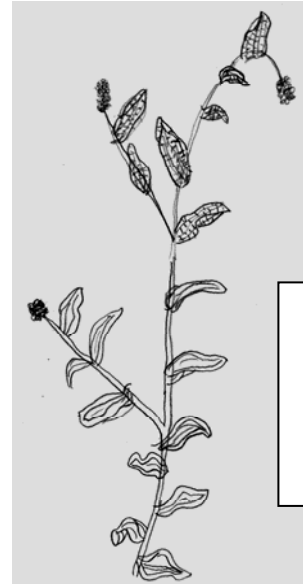
(*Potamogeton spirillus*)



Submersed stems compact and highly branched. Linear leaves may have curly appearance. Stipules fused to the leaf blade for more than half their length. Floating leaves may occur.

#### Clasping Pondweed

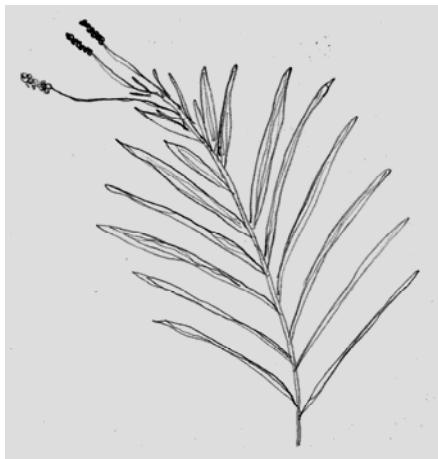
(*Potamogeton perfoliatus*)



Leaves clasp the stem. No floating leaves are produced.

#### Fern Pondweed

(*Potamogeton robbinsii*)



Leaves are two-ranked, creating a feather or fern-like appearance

#### Ribbon Pondweed

(*Potamogeton epihydrous*)



Leaves are alternate. Submersed leaves are striped and floating leaves are supported by a slender leaf stalk.

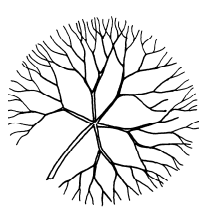
## SUBMERSED PLANTS ..... CONTINUED

### 8. Submersed Plants With Finely Divided Leaves Along A Stem.

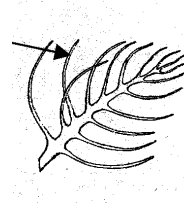
These plants must be examined closely to determine which kind of divided leaves they have.



Forked



Branched



Feather Divided



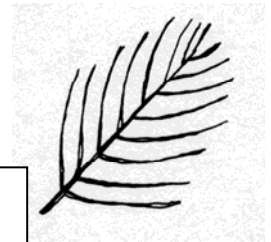
#### 8A. Watermilfoils (*Myriophyllum* spp.)

Leaves are arranged radially around the stem; not always in strict whorls

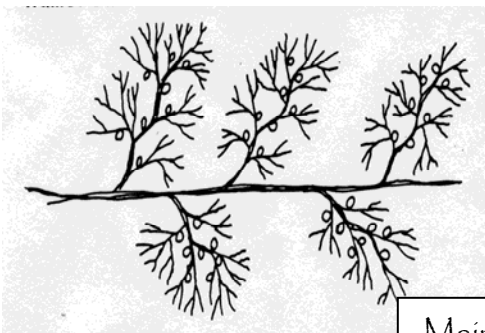


There are 6 native species of watermilfoil in Maine

All leafy milfoils have feather divided leaves (One native milfoils species lacks true leaves)



#### 8B. Common Bladderwort (*Utricularia macrorhiza*, aka, *U. vulgaris*)



The leaves of common bladderwort are branch divided and alternately arranged along the stem

Maine has 8 species of bladderworts

Both species shown here have numerous small "bladders" attached to the leaves

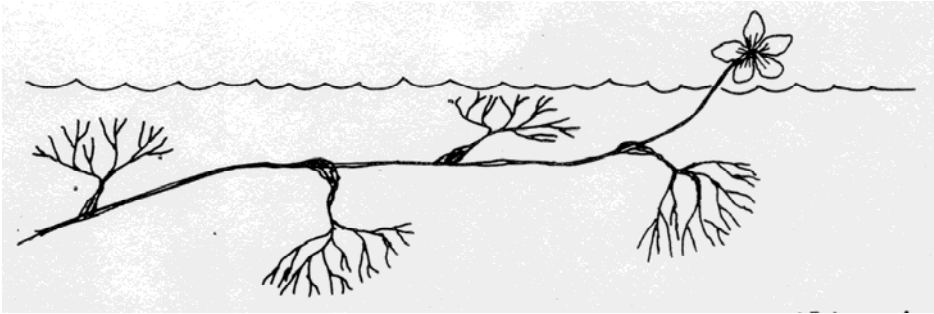
#### 8C. Large Purple Bladderwort (*Utricularia purpurea*)

The leaves of large purple bladderwort are branch divided and arranged in whorls, spaced loosely along the stem



## SUBMERSED PLANTS ..... CONTINUED

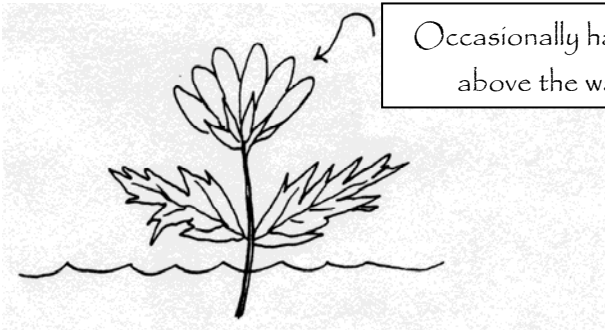
### 8D. Water Crowfoot (*Ranunculus spp.*)



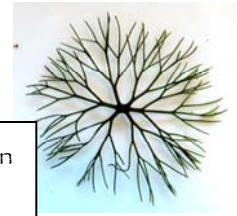
There are 2 species of water crowfoot in Maine

This plant is usually a few feet long, sometimes trailing just below the water surface. Leaves are branch divided and alternately arranged along the stem. The base of the leaf stem is thickened and clasps around the main stem.

### 8E. Water Marigold (*Bidens beckii*, aka *Megalodonta beckii*)



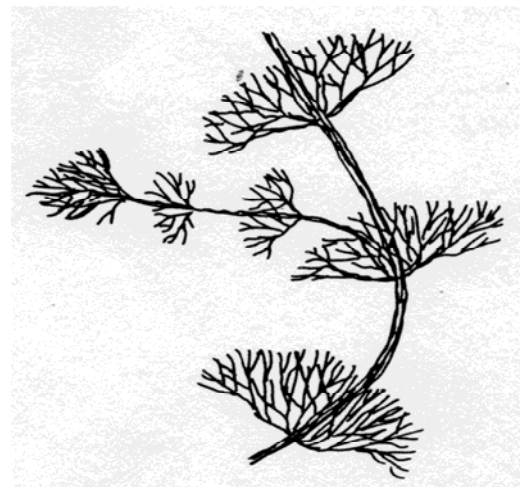
Occasionally has a yellow flower above the water's surface



Cross-section of leaves

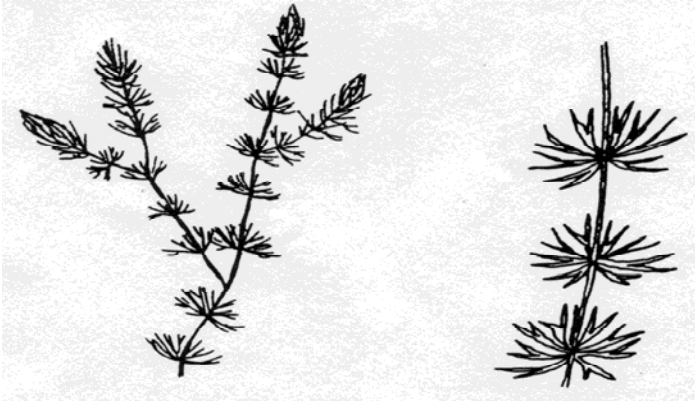
This plant usually grows only a few feet high

Two branch-divided leaves, oppositely arranged and loosely spaced along the stem. The broadly-branching leaves have no leaf stem. As a result, the pair may resemble a whorl of six smaller leaves on short leaf stems.



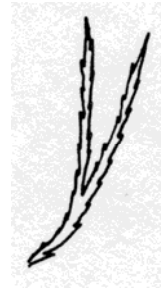
## SUBMERSED PLANTS ..... CONTINUED

### 8F. Coontail (*Ceratophyllum demersum*)



Maine is home to one other *Ceratophyllum* species

Leaf whorls are clustered at the ends of the branches, giving the plant the appearance of a raccoon's tail

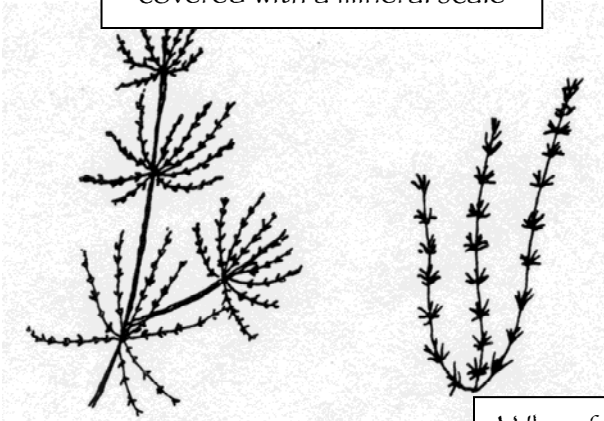


Leaves, minutely serrated

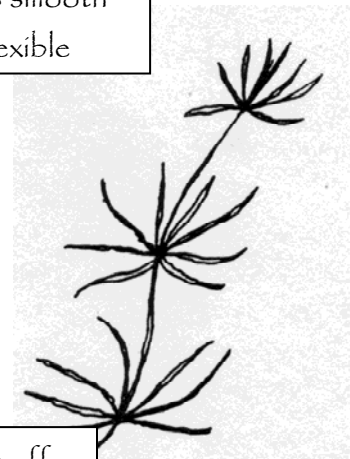
### 8G. Stoneworts (*Chara spp.* or *Nitella spp.*)

These are actually large upright forms of algae. Stoneworts usually grow in tangled masses along the bottom.

Chara is brittle and coarse, covered with a mineral scale



Nitella is smooth and flexible

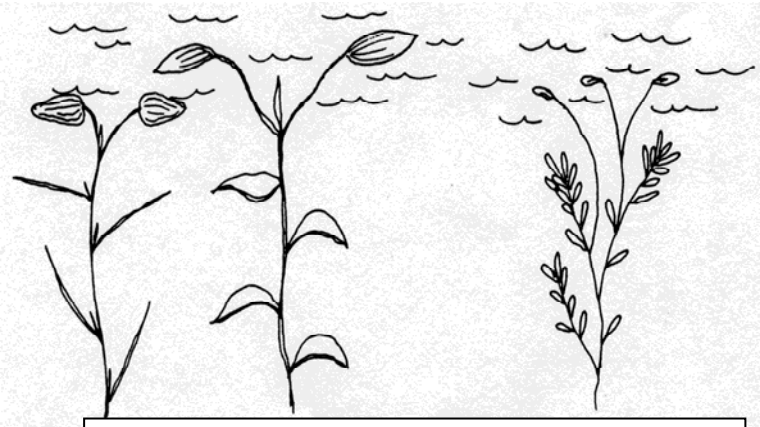


When fresh, *Chara* gives off a distinctive skunk-like odor

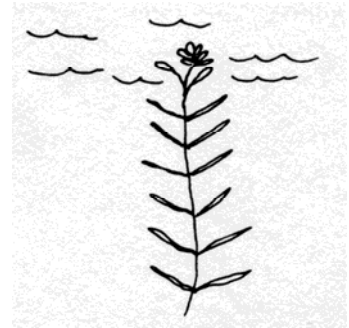
## FLOATING LEAVED PLANTS

9. Plants With Floating Leaves. Choose between 9A, 9B, or 9C below.

9A. Plants with both floating leaves, and submersed leaves on a stem.

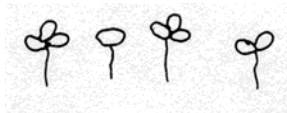


If it looks like any of these page 2.4.8, #7B

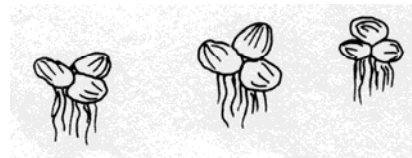


If it has thin leaves in pairs, and  
tiny round leaves at the  
surface.....page 2.4.8, #7A.  
This is Water Starwort.

9B. Very small floating plants, not rooted to the pond bottom. Each plant has a small root or roots hanging from underneath.

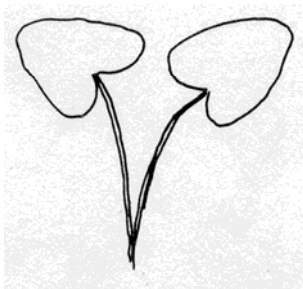


Duckweed (*Lemna minor*)  
[actual size]

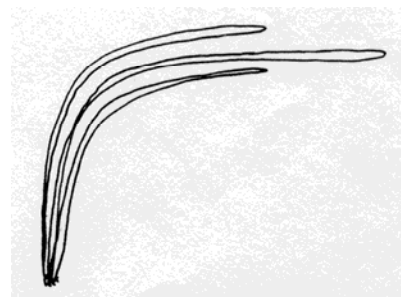


Big Duckweed (*Spirodella polyrhiza*)  
[actual size]

9C. Plants with only floating leaves on stems which are rooted in the pond bottom.



Broad floating leaves.....  
page 2.4.15, #10



Long, narrow, grass-like  
leaves..... page 2.4.16, #11

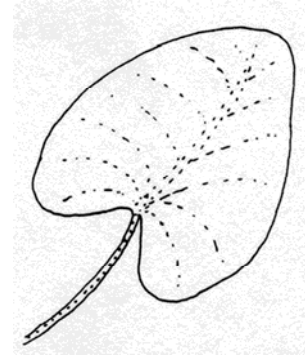
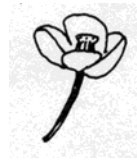


## FLOATING LEAVED PLANTS ..... CONTINUED

10. Broad Floating Leaves On A Stem Which Is Rooted In The Pond Bottom. Choose between 10A through 10D below.

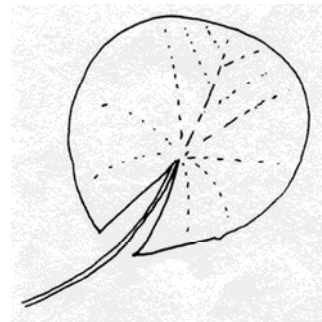
- 10A. Large elongated floating leaves with round lobes and large yellow ball-shaped flowers. **Spatterdock, Yellow Water-lily** (*Nuphar variegata*)

Leaves are 3 to 6 inches across

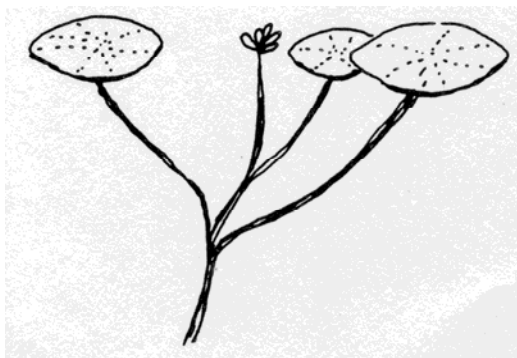


- 10B. Large rounded floating leaves with pointed lobes and white flowers. **Fragrant Waterlily** (*Nymphaea odorata*)

Leaves are 3 to 6 inches across



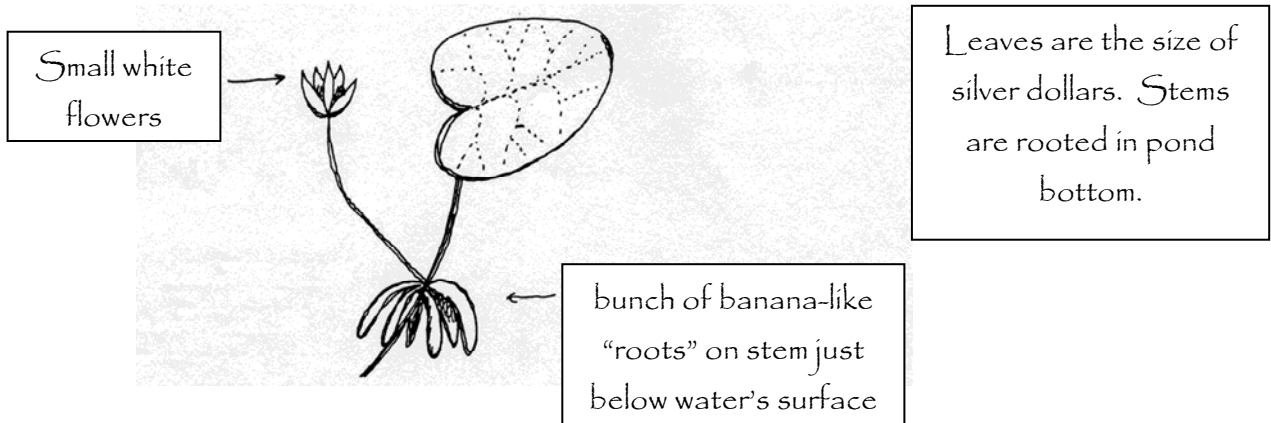
- 10C. Elliptical-shaped leaves with stem attached at the center of the leaf. **Watershield** (*Brasenia schreberi*)



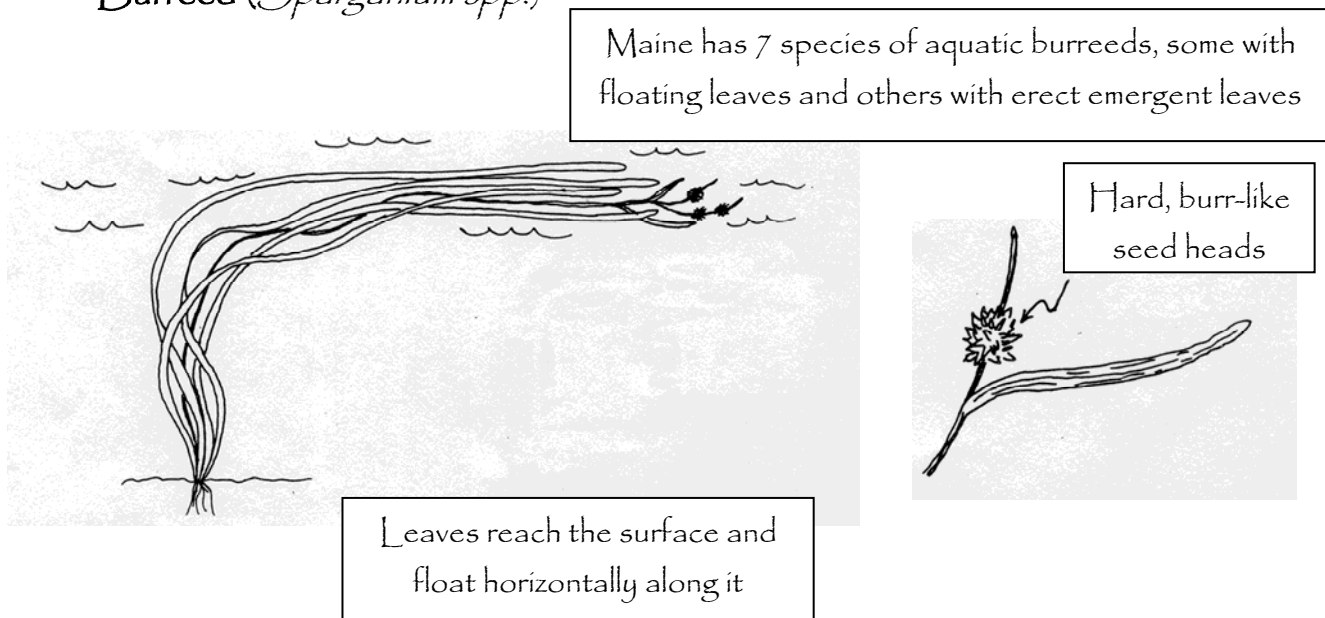
Leaves are usually 2 or 3 inches long. The stem and underside of the leaf is often covered with a clear, jelly-like material.

## FLOATING LEAVED PLANTS ..... CONTINUED

### 10D. Little Floating Heart (*Nymphoides cordata*)



### 11. Long Narrow, Grass-like Floating Leaves Burreed (*Sparganium spp.*)



## EMERGENT PLANTS

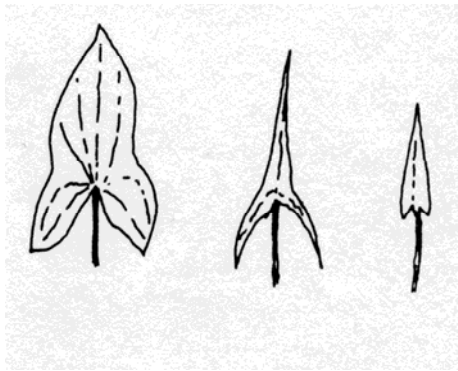
12. Plants Which Are Rooted On The Pond Bottom And With Leaves and/or Stems That Extend Upright Above The Water's Surface.

12A. Leaves long and narrow, may be round in cross-section.....page 2.4.18, #14

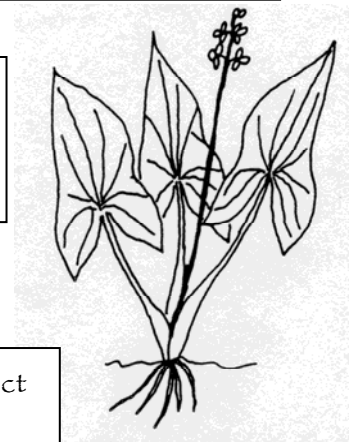
12B. Leaves broad....#13 below.

13A. Arrowhead (*Sagittaria spp.*)

Leaves with pointed lobes.  
Leaf size is variable.

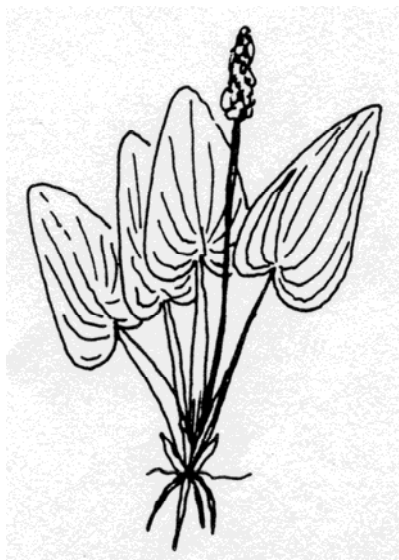


Small white  
flowers with 3  
petals



There are 5 species of arrowhead in Maine some erect emergents, others with floating leaves

13B. Pickerelweed (*Pontederia cordata*)



Leaves with rounded lobes. Small purple flowers in cluster. Plants are usually 1 or 2 feet tall.

## EMERGENT PLANTS.....CONTINUED

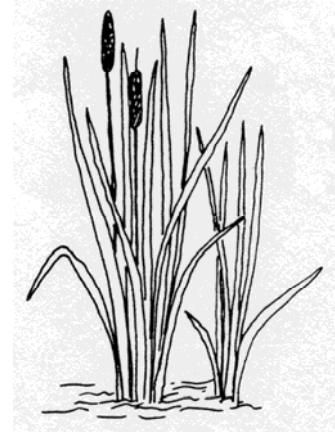
14. Emergent Plants With Long Narrow Leaves Normally Found in Relatively Shallow Water. Choose between 14A through 14C below.

### 14A. Cattail (*Typha latifolia*)

There is one other species of cattail in Maine

Leaves up to 5 feet tall.  
Dark brown "catkins", 5-6 inches long.

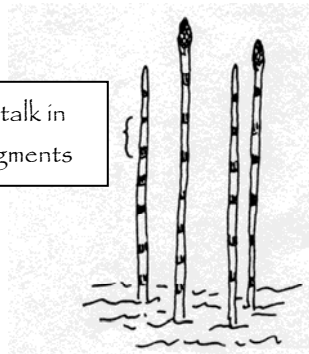
Catkin



### 14B. Horsetail (*Equisetum* spp.)

Round, hollow stalks, often 1-2 feet high, rough in texture

Stalk in segments

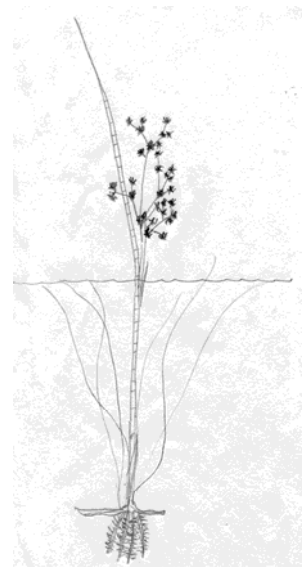


Some species branch at each segment

- 14C. The following three emergent species may produce dense patches of fine, hair-like submersed leaves.

### Bayonet Rush (*Juncus militaris*)

Tall, erect, segmented stems rise above water surface. Flowers and fruits emerge on a spray of branching stems below the tip. Thin, hair-like, submersed leaves rise from the base. Tip: squeeze the emergent stem between fingers and pull firmly, to feel the "pop" of the internal segments.



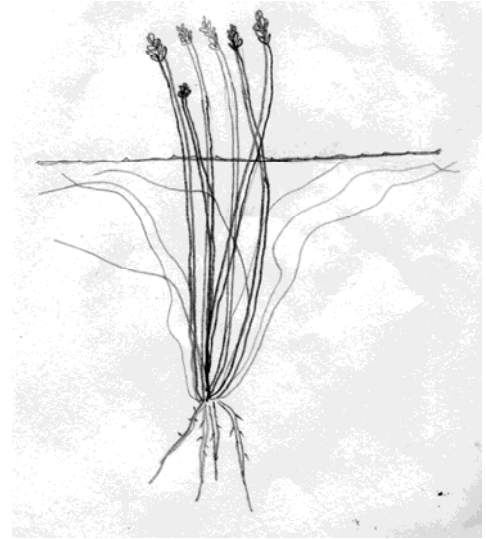
## EMERGENT PLANTS.....CONTINUED

14C. continued

Robbins Spikerush (*Eleocharis robbinsii*)

Stems are stiff, slender and triangular. They are tipped with a small spikelet that is often difficult to see.

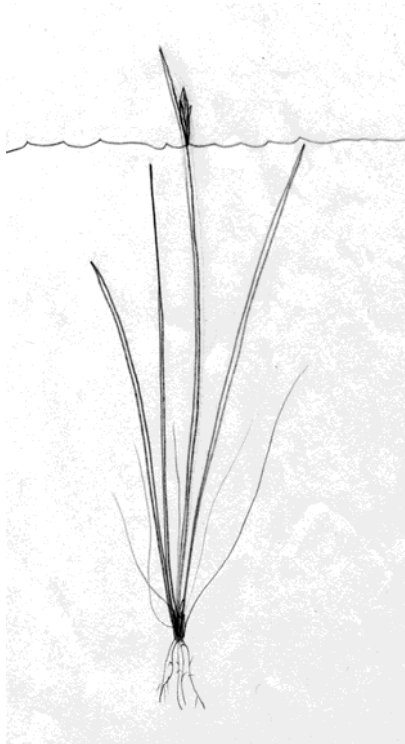
Fine, hair-like underwater stems are sterile



Water Bulrush (*Schoenoplectus subterminalis*)

Leaves sheath one another at the base. Leaf tips may float at the water surface.

Hair-like leaves arise from the base



Only the tips of fertile stems poke out of the water. Solitary spikelets emerge from fertile stems, below the tip.



# GLOSSARY

**axil** - the junction between a stem and a leaf or branch

**divided leaf** - a leaf that is cut into multiple smaller divisions

**fruit** - the seed bearing portion of a plant

**lobe** - a partial division of a leaf

**midvein** - the main or central vein of a leaf; not all plants have leaves with midveins

**nutlet** - dry fruit having a hard shell which usually contains only one seed

**sheath** - a portion of the leaf that wraps around the stem of the plant

**stipule** - a small sheath-like structure borne in the axil of the leaves in some species

**whorl** - a circle of three or more leaves radiating from the same point on a stem



## REFERENCES FOR AQUATIC PLANT IDENTIFICATION

- Borman, S., R. Korth, and J. Temte. 1997. Through the Looking Glass: A Field Guide to Aquatic Plants. Wisconsin Lakes Partnership. Stevens Point, WI. 248 pp.
- Crow, G.E. and C. B. Helquist. 2000. Aquatic and Wetland Plants of Northeastern North America. Volume Two. Angiosperms: Monocotyledons. The University of Wisconsin Press, Madison, WI. 456 pp.
- Fassett, N.C. 1957. A Manual of Aquatic Plants. With revision appendix by E. C. Ogden. The University of Wisconsin Press, Madison, WI (Originally published by McGraw-Hill, 1940.)
- Nichols, S.A. 1999. Distribution and Habitat Descriptions of Wisconsin Lake Plants. Wisconsin Geological History Survey Bulletin 96. Madison WI. 268 pp.
- Haines, A. and T. F. Vining. 1998. Flora of Maine A Manual for Identification of Native and Naturalized Vascular Plants of Maine plus addendum dated April 26, 2001. V. F. Thomas Co. Bar Harbor, ME. 846pp. plus addendum.
- Prescott, G.W. 1980. How to Know the Aquatic Plants. Second edition. WCB McGraw Hill. Boston MA. 158 pp.
- VLMP Interactive Field Guide to Aquatic Invaders website: [www.mciap.org/herbarium](http://www.mciap.org/herbarium)
- Northeast Aquatic Nuisance Species Panel website: [www.northeastans.org](http://www.northeastans.org)  
Identification resources for non-native species: [www.northeastans.org/identification-resources.html](http://www.northeastans.org/identification-resources.html)  
Geographic information about non-native species: [www.northeastans.org/geographic-resources.html](http://www.northeastans.org/geographic-resources.html)
- University of Wisconsin Herbarium website: [www.botany.wisc.edu/wisflora/](http://www.botany.wisc.edu/wisflora/)
- University of Florida Center for Aquatic and Invasive Plants website. <http://plants.ifas.ufl.edu/>
- Aquatic Plant Information System Compact Disc. Department of the Army. Engineer Research and Development Center, Corps of Engineers. Waterways Experimental Station. CEERD-EE-A. 3909 Halls Ferry Road, Vicksburg, MI 38180-6199.
- IPANE - Mehrhoff, L. J., J. A. Silander, Jr., S. A. Leicht, E. S. Mosher and N. M. Tabak. 2003.  
IPANE: Invasive Plant Atlas of New England. Department of Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT, USA.  
URL: <http://www.ipane.org>

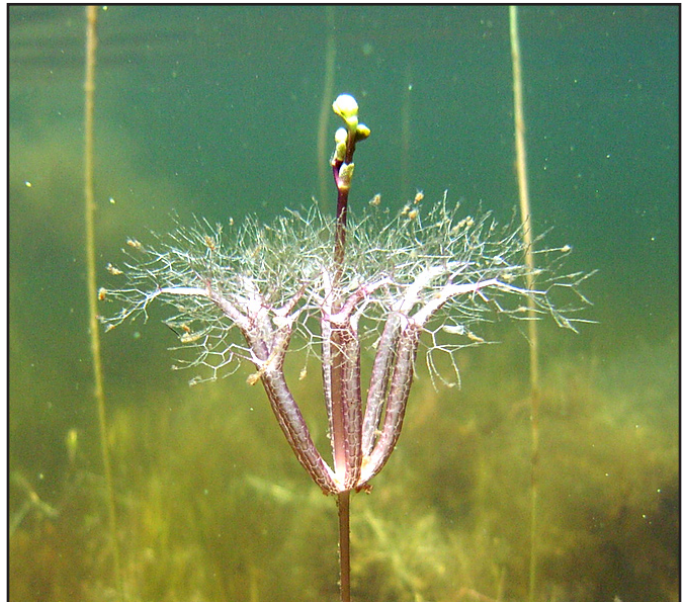
## Tips for Taking Underwater Photographs

When we wrote to Dennis Roberge to ask if he would be willing to share some of his tips for taking great underwater photographs, he replied, with characteristic humility, that he did not object to the idea in the least, but would have to pass as he did not really have much to say on subject other than he uses a good camera and takes lots of photos. Later, when we met to select the photos for an article featuring Dennis' work, Dennis began to elaborate upon his new-found passion, and tips began to emerge. We have presented Dennis' tips here in the hope of inspiring others to discover and capture similarly wonderful sights below the surface of their own favorite watery places.

1. **Use a good quality camera.** Dennis uses a Sea and Sea DX-8000/8000G housing and digital camera with a 0.6x wide-angle conversion lens (28mm – 80mm macro zoom). The camera takes very high resolution (8.2 mega pixel) images, and comes with lots of bells and whistles including settings to adjust light input, and the ability to take 30 minute videos.
2. **Take lots and lots of photos.** With digital photography, there is no reason to hold back. Each summer Dennis typically shoots several thousand photos, deleting those he is not happy with.
3. **If you are not a SCUBA diver and/or don't have a good flash system, stick to depths of less than six feet** where natural light is sufficient to get excellent photographs and the subject matter is easily accessed with snorkeling equipment. All of the shots you see here were taken while snorkeling.
4. **Be safe! Let boaters know where you are.** Dennis swims with a six-foot-long, day-glow orange, inflatable raft in tow. The 50-foot tether provides a convenient place to lash a mesh bag for collecting plant samples.
5. **Don't think you have to have special training or an artist's eye to get good photos.** When asked about this, Dennis casually revealed that in fact he really can't see much of anything when he is in the water. He can't wear his glasses under his mask and until next year when he gets his prescription dive mask "every thing is pretty much a blur." (We can hardly wait to see what Dennis will do with his craft when he can actually see what he is doing!)
6. **Feed two fish with one worm.** In the process of scouring the shallows for new subjects to photograph, Dennis, a Certified Plant Patroller, conducts screening surveys on many Maine waterbodies.



Curly-leaf pondweed on West Pond



Little floating bladderwort getting ready to flower.  
Mousam Lake



A school of sunfish in Horn Pond

# HOW TO PRESS AND MOUNT AQUATIC PLANTS

Adapted with permission from Washington State Department of Ecology

<http://www.ecy.wa.gov/ecyhome.html>

## **Materials Needed:**

**Plant Press** \* - may be purchased or built. It consists of alternate layers of corrugated cardboard, absorbent (blotting) paper or newspaper, and equal-sized pieces of plywood with straps or some other method of applying even pressure.

**Pencil and Waterproof Paper** - for making notes on site.

**Herbarium Paper** \* - acid-free, 100 percent rag paper is best. If you would rather buy paper locally, try to use heavy stock, relatively acid-free paper with a high rag content. High grade thick typing paper will work and is usually found at quality stationary stores, or university bookstores generally sell "biology paper" which is good quality 8 ½ by 11 inch white paper.

**Packets** \* - for extra plant structures (like seeds), use small envelopes or a piece of folded paper (2 x 3 inches).

**Herbarium Paste** \* - available from biological supply companies. White glue can also be used (should have a polyvinyl acetate base).

**Linen Tape** - book binders tape is best. Cellophane tapes should be avoided.

**Labels** \* - See the sample label at the end of the article for an example of a completed label. They should be sized to fit in the lower right corner of the herbarium paper.

\* These items are available from biological supply companies.

## **Collect the Plant**

1. Collect as much of the plant as possible: include roots, stems, leaves, flowers, and fruits. Plants may be collected by hand pulling, or using a weighted rake to gather plants in deeper water.
2. Write as much information about the plant as possible on the notepaper (the information will be used later for aid in plant identification and for labeling the plant). Include the date; collector's name and address; location (name of waterbody as well as the location of the waterbody); depth of water; flow rate of water; substrate (sediment) description; whether leaves and/or flowers are submersed (below the water surface), floating, or emergent (above the water surface); color and odor of flowers; and names of the plant species associated with the collected plant.
3. Wash the plant in clean water to remove algae, debris, and sediment. Keep the plants moist until they can be pressed.

## **Press the Plant:**

Note: It is easiest to identify aquatic plants before pressing. If this is not possible, press the plant while it is fresh, then send it to an aquatic plant expert as instructed below.

1. Prepare the plants for pressing:
  - For delicate submersed plants, the best method is to float the plant onto a sheet of paper (newspaper or a heavy stock paper will work, or you can float the plant directly onto the herbarium paper). This is accomplished by placing the plant in a pan of water with the paper below it. Position the plant on the paper and hold it in place with a finger. Slowly lift the paper and plant from the water. The water flowing from the paper should separate the leaves while the plant adheres to the wet paper. Cover the plant with newspaper or absorbent paper. (If the plants tend to stick to the paper, they can be covered on one side with wax paper).
  - When pressing plants with whorled or finely divided leaves, it is useful to separate one node (the stem section where the leaves are attached) and float that onto a small portion of the paper. This yields a cross section showing the leaf pattern.
  - For plants with large bulky stems, roots, or leaves, the bulky portion can be split before pressing to facilitate drying and to prevent uneven pressure in the press.
  - If extra flowers, fruits, or vegetative parts are collected, these should be pressed, dried, and later placed in the packets and glued to the herbarium paper.
2. Press the plant material by placing the plant between two sheets of newspaper or absorbent paper then sandwiching this between two sheets of corrugated cardboard. Several prepared specimens can be stacked in this manner (label or number the plants so you know which plant matches which field note). Then, put the stack between two firm pieces of wood and apply an even pressure using straps, bolts, or a heavy weight. Place in a warm, dry area. To avoid mildew, change the newspaper periodically until the plants are dry. The plants will dry faster if placed over a heat register, fan, or incandescent light bulbs.

## **Mount the Plant:**

Note: If identification of the specimen needs to be verified, send a duplicate pressed, but unmounted specimen with a complete label to an authority on aquatic plants. They will keep this specimen for their collection and notify you of the plant's name. Be sure the two specimens are of the same species.

1. Once the plant has dried and is identified, it is mounted and kept for future reference:
  - Arrange the plants on a piece of herbarium paper. If the plant is too long, it may be cut into several sections and placed lengthwise on the paper.
  - Either glue or tape the specimen to the paper (the use of glue or paste will sometimes tend to cause delicate submersed plants to curl; tape may be preferable in such cases).



- Complete a label with the plant's Latin (scientific) name, location, site description, name of collector, and the date collected. Attach the label to the lower right corner of the paper.
  - If additional reproductive parts (seeds, fruits, flowers) or vegetative parts have been collected, these are placed in the packet. This is glued to the top of the herbarium paper so the contents may be accessed.
2. Care should be taken to ensure that the specimens are not damaged by insects. Mounted plants should be stored with an insecticide or repellent (moth balls) to prevent colonization by insects.

Example of a Sample Label:

MAINE VOLUNTEER LAKE MONITORING PROGRAM	
Plant Name	<i>Sparganium fluctuans</i>
Site Description	ANDROSCOGGIN COUNTY: Lake Auburn, Auburn, Maine. Adjacent public parking area off of Lake Shore Drive, along the southern shore of the lake. Growing in water approximately 1-2 meters in depth, with <i>Elodea canadensis</i> and <i>Bidens beckii</i>
Collector's Name and Date collected	John Doe July, 2005

## HOW TO BUILD YOUR OWN PLANT PRESS

By Fred Cummings, Invasive Plant Patroller for Casco and Otisfield

### Sources for materials:

- Fat Andy's, Yarmouth, Maine (low prices on hardwood; buy short board ends and then rip them down on a table saw. Get boards as wide as you can.)
- Foster and Company (on the internet for rivets)
- Herbarium Supply Co. ([www.herbariumsupply.com](http://www.herbariumsupply.com) for straps)
- Hardware store

### Materials List:

- 8 hardwood strips 1/2" x 1" x 18"
- 12 hardwood strips 1/2" x 1" x 12"
- 32+ 3/16" x 1 1/8" alum rivets (either single end or double end rivets)

- 16 small size wood screws 3/4" long
- Carpenters wood glue
- Sand paper
- Polyurethane
- 2 straps
- Blotters and cardboard

#### Steps to Construct:

- Cut wood strips from boards at least 18" long. Rip 20 strips to the dimensions given above. Be as precise as possible.
- Sand the strips.
- Drill holes. The size depends on size of rivets. Check with vendor when you order rivets. Drill all holes on centerline of 1/2" width.
  - For four of the 18" strips: Measure from each end, 1/2" then drill 4 holes spaced 3 3/8" apart.
  - For the other four 18" strips: Measure in 1/2" from each end and drill holes.
  - For four of the 12" strips: Measure in 1/2" from each end then drill 2 holes 3 3/8".
  - For the other eight 12" strips: Measure in 1/2" from each end and drill holes.
- To keep the frames square as you rivet them together, you might want to make a jig.
- Put a dab of glue where each rivet will be, then start to put rivets in. I did the four corners first to make sure it was square.
- Finish putting all the strips together then drill holes at cross-sections of rest of frames. Do not drill all the way thru, just slightly into bottom piece, and then countersink the top to fit screw flush with top when tightened.
- When construction is complete, put a couple of coats of polyurethane or varnish to finish.

Quite a lot of work goes into to making the press, but if you like to work with wood it is a lot of fun. If you have any questions, or would like some help in making these you can call me Fred Cummings 627-3234. Hope to see you out on the water, collecting plants.

