

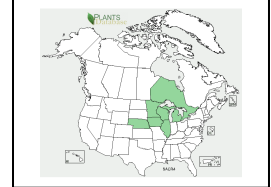
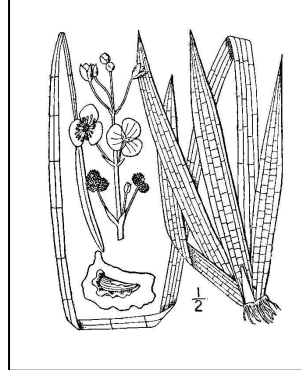
APPENDIX A

This appendix provides drawings, pictures, distribution maps, and a brief description of each species of submerged aquatic vegetation observed in Deep Creek Lake during the summer 2010 and summer 2011 SAV surveys.

***Sagittaria cristata* (Crested arrowhead)**

Monocot, Perennial, Native to the continental US and Canada. Distribution includes IA, IL, MI, MN, NE, and WI. It has not been previously documented in MD according to the USDA Plant Database (<http://plants.usda.gov/java>).

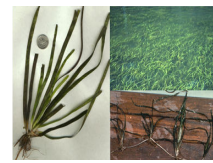
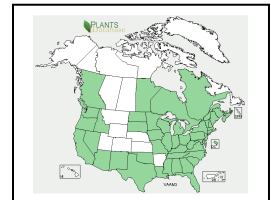
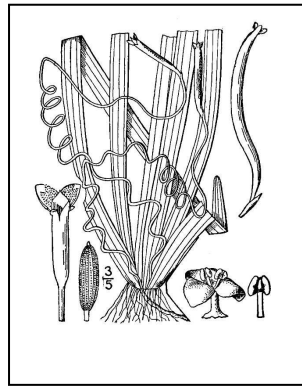
Crested arrowhead grows along the margins and bottoms of shallow lakes, ponds, and swamps. It may grow up to 75 cm tall, though in DCL it hasn't been observed more than 10 cm high. Flowering occurs July through August.



***Vallisneria americana* (Wild celery)**

Monocot, Perennial, Native to continental US and Canada. Distribution in all but seven states and most of Canada.

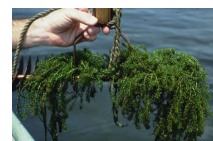
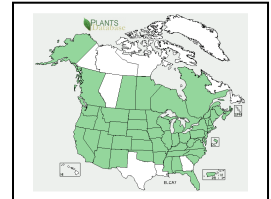
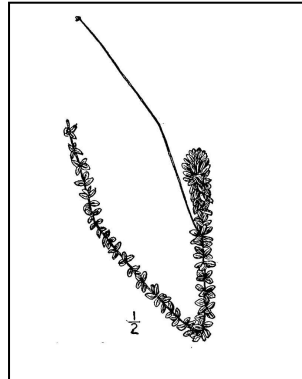
Wild celery is primarily a freshwater species, although it is occasionally found in brackish waters (up to 12-15 ppt). Wild celery seems to prefer coarse silty to sandy soil, and is fairly tolerant of murky waters and high nutrient loading. It can tolerate wave action better than some other grass species.



***Elodea canadensis* (Canadian waterweed)**

Monocot. Perennial. Native to the continental US and Canada, but considered Invasive in Puerto Rico. Distributed in all but three continental US states: TX, LA, and GA.

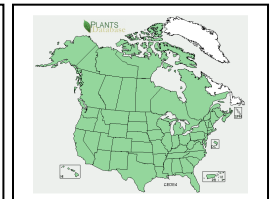
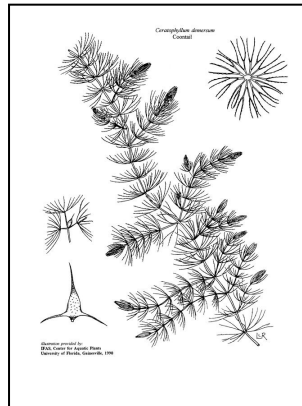
This waterweed is primarily a freshwater species. It prefers loamy soil and slow-moving water with high nitrogen and phosphorous concentrations. It will grow in a wide range of conditions, from very shallow to deep water, and in many sediment types. It can even continue to grow unrooted, as floating fragments.



***Ceratophyllum demersum* (Coontail)**

Dicot. Perennial. Native to the continental US and Alaska, Canada, Puerto Rico, and the US Virgin Islands. Invasive in Hawaii. Distribution is ubiquitous throughout the US.

Coontail's leaves grow in crowded whorls which make it resemble a raccoon's tail underwater. Each leaf is forked into segments with fine teeth on one side of the leaf margin. Leaves are brittle and keep their shape out of water. Coontail may float in dense mats beneath the surface and its base is only occasionally attached to the sediment. It may also be found near the bottom in deep water – in creek channels, for example.

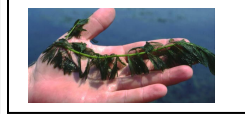
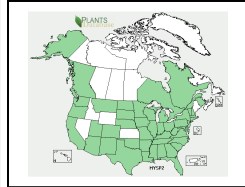
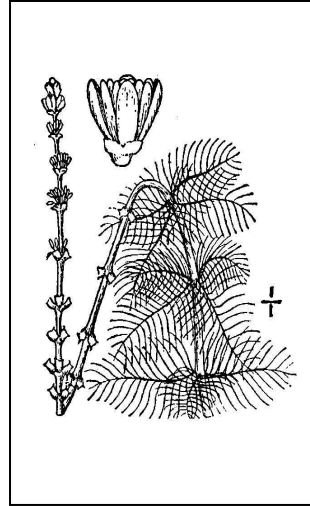


Myriophyllum spicatum (Eurasian water milfoil)

Dicot, Perennial. Invasive to the continental US, Alaska, and Canada. Native to Europe, Asia, and northern Africa. Invasive distribution throughout the US.

This plant has a long stem that branches profusely when it reaches the surface of the water. Leaves are finely divided and feather-like in appearance. There are usually 12 to 21 pairs of leaflets.

Eurasian watermilfoil can grow in ponds, lakes, reservoirs, and slow flowing rivers and streams. It will grow in shallow or deep water, fresh or brackish water, and within a wide temperature range. It tends to do well in waters that have had some sort of disturbance like intense plant management, overabundance of nutrients, or extensive motorboat use.

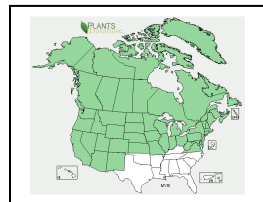
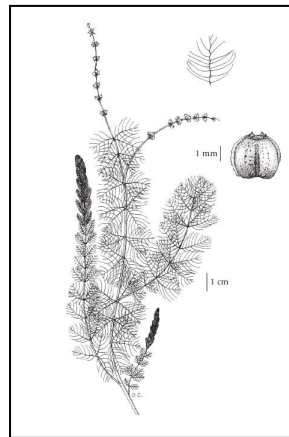


Dispersal through vegetative means is Eurasian watermilfoil's main reproductive strategy. The plant goes through autofragmentation during the growing season, where roots will develop at the nodes and the plant will break off at these nodes on its own. Fragments can also be produced by wind, waves, and human activity. These fragments will set root and grow into a new plant. New shoots begin to grow from the overwintering root crowns when water temperature reaches about 60° F in the spring. Flowering generally occurs in July. Autofragmentation usually occurs after flowering. Plants die back to the roots in the fall. These roots store carbohydrates in order to initiate the rapid growth in the spring.

Myriophyllum sibiricum (Northern water milfoil)

Dicot, Perennial. Native to the continental US, Alaska, Canada, and elsewhere. Distribution throughout Canada and the US with the exception of southeastern states from TX east to FL.

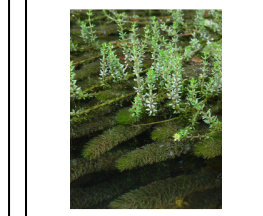
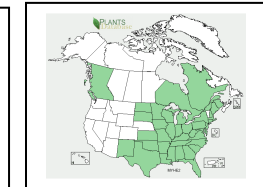
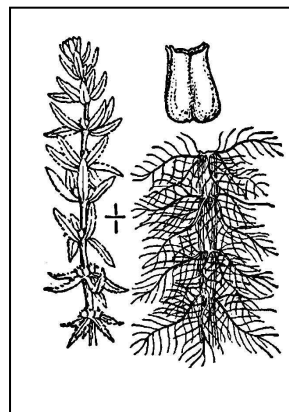
This plant is distinguished from the Eurasian water milfoil by its less finely divided leaves and larger floral bracts. It typically has 5-10 thread-like segments on each side of the midrib whereas Eurasian water milfoil has 12-24 segments. It is found in shallow to deep water of lakes, ponds, marshes, where its presence significantly increases the abundance of macroinvertebrates, although the value of milfoil is likely due more to its value as habitat than as food.



Myriophyllum heterophyllum (Two-leafed water milfoil)

Dicot, Perennial. Native to the continental US and Canada with distribution throughout the eastern US and Canada.

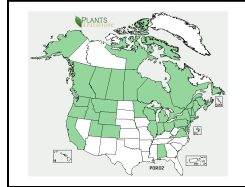
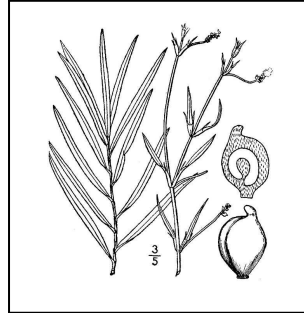
Two-leafed water milfoil has fine densely packed, featherlike leaves whorled around a main stem. It can grow up to 15 feet and may exhibit a three to six inch green spike-like flower above the waterline in late June or in July. A cross-section of the stem will reveal "pie-shaped" air chambers.



***Potamogeton robbinsii* (Robbin's pondweed)**

Monocot. Perennial. Native to the continental US, Alaska, and Canada. Distribution limited to ~ half US states and most of Canada.

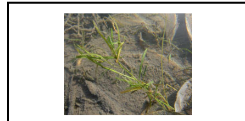
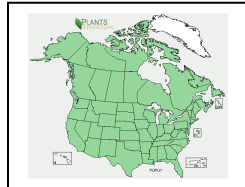
This pondweed is found in deep to shallow, often muddy waters of lakes, ponds, and rivers. It is the only *Potamogeton* that has branching inflorescences, though it rarely flowers. This plant is believed extirpated from Maryland and is threatened or endangered in several of its native states.



***Potamogeton pusillus* (Slender pondweed)**

Monocot. Perennial. Native to the continental US, Alaska, and Canada. Distributed throughout native range.

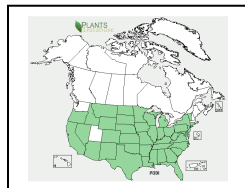
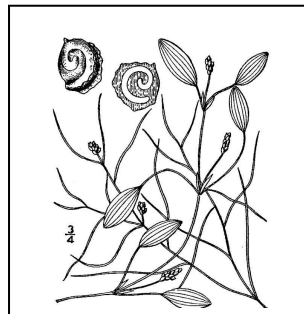
Slender pondweed grows in soft, fertile mud substrates and quiet to gently flowing water. Leaf blades of slender pondweed are entire and have pointed tips and can have a purplish tint. Like all other pondweeds, slender pondweed is considered an important food for waterfowl.



***Potamogeton diversifolius* (Waterthread pondweed)**

Monocot. Perennial. Native to the continental US and distributed throughout with the exception of far northeast.

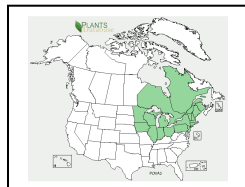
This pondweed produces a very narrow, compressed stem branching to around 35 cm. It has thin, pointed linear leaves a few cm long spirally arranged about the thin stem. Flowers emerge from the water surface.



***Potamogeton vaseyi* (Vasey's pondweed)**

Monocot. Perennial. Native to the continental US and Canada. Distribution limited to the northeastern US and eastern Canada.

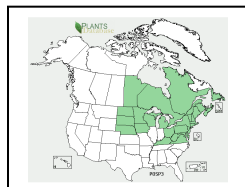
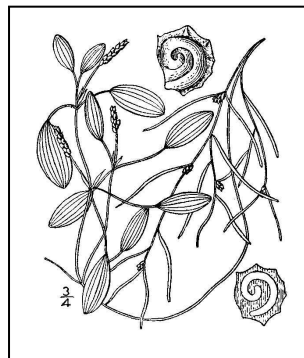
Not previously documented in Maryland, Vasey's pondweed is considered threatened, endangered, or of special concern where found in northeastern US states. It grows in quiet waters and has dimorphic leaves: very narrow, flaccid, submersed leaves and wider, thicker floating leaves.



***Potamogeton spirillus* (Spiral pondweed)**

Monocot. Perennial. Native to the continental US and Canada, but distributed only throughout the northeast US and northern mid-west, and eastern Canada.

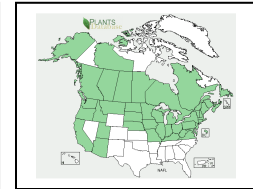
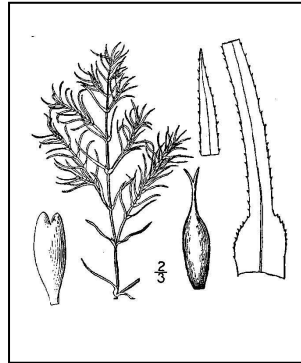
Spiral pondweed usually grows in shallow water: lakes, ponds, wet swales, and rarely quiet river borders. The submersed leaves are often curved, giving the whole bushy plant the aspect of a broad-leaved *Najas*



***Najas flexilis* (Slender or nodding naiad)**

Monocot. Annual. Native to the continental US, Alaska, and Canada. Found in most northern states and Canada.

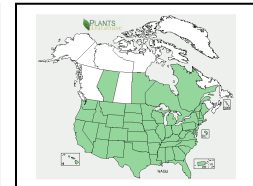
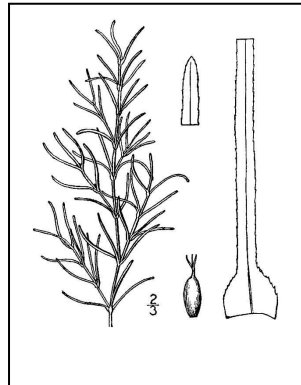
Naiads grow in small freshwater streams. They prefer sandy substrates and tolerate relatively low light. Naiads vary in size from inch-high tufts on sandy bottoms to highly branched plants two or three feet high. *Najas flexilis* is considered to be excellent food sources for waterfowl.



***Najas guadalupensis* (Southern naiad)**

Monocot. Annual. Native to the continental US, Puerto Rico, and Canada. Invasive to Hawaii. Distributed throughout US.

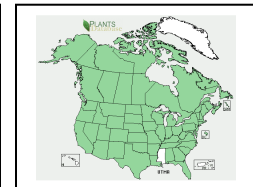
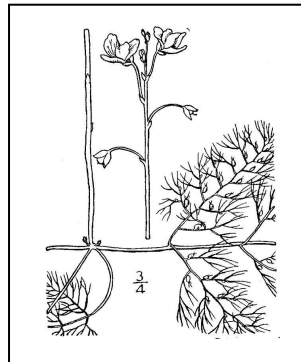
This plant grows in ponds, ditches, and streams. It produces a slender, branching stem up to 60 to 90 centimeters in maximum length. The thin, somewhat transparent, flexible leaves are up to 3 cm long and just 1-2 mm wide. They are edged with minute, unicellular teeth. Tiny flowers occur in the leaf axils; staminate flowers grow toward the end of the plant and pistillate closer to the base



***Utricularia vulgaris* (Common bladderwort)**

Dicot. Perennial. Native to the continental US, Alaska, and Canada.

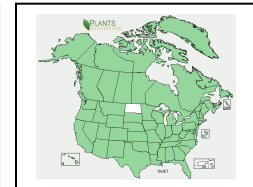
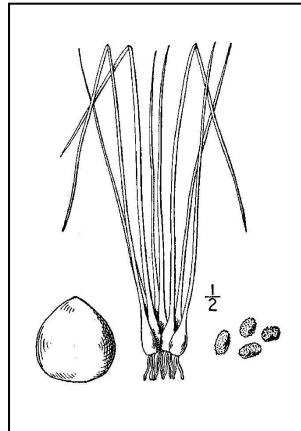
Several species of bladderwort occur in the Chesapeake Bay region, primarily in the quiet freshwater of ponds and ditches. They can also be found on moist soils associated with wetlands. Bladderworts are considered carnivorous because minute animals can be trapped and digested in the bladders that occur on the underwater leaves.



***Isoetes* spp. (Quillwort)**

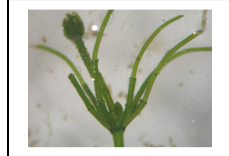
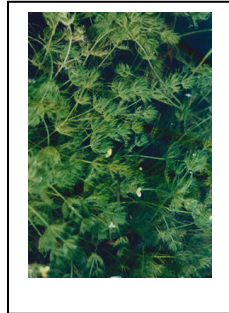
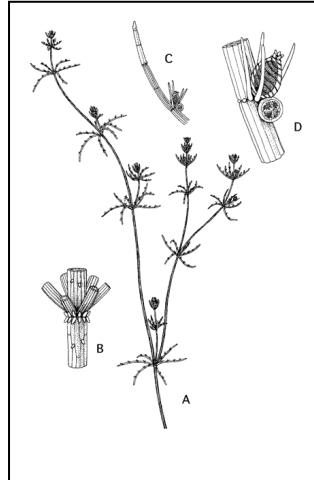
Lycopod. Perennial. Native to the continental US, Alaska, and Canada. Distributed throughout.

Quillwort leaves are hollow. Each leaf is narrow (2–20 cm long and 0.5–3 mm wide). They broaden to a swollen base up to 5 mm wide where they attach in clusters to a bulb-like, underground rhizome. This base also contains male and female sporangia, protected by a thin velum. Quillwort species are very difficult to distinguish by general appearance.



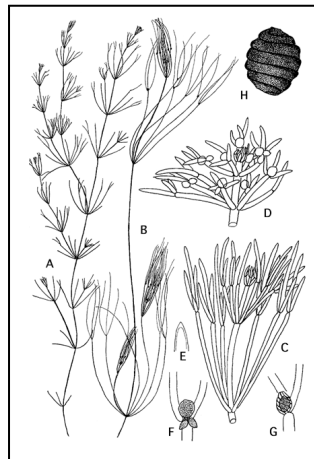
***Chara vulgaris* (macroalgae – Chara, Common stonewort)**

Chara is a green alga belonging to the Charales, a lineage that may have given rise to all land plants. It is a modern lime-secreting alga, which grows in fresh water. The stoneworts (class Charophyceae) are a very distinctive group of green algae that are sometimes treated as a separate division (the Charophyta). These algae can occur in fresh or brackish waters, and they have cell walls that contain large concentrations of calcium carbonate. Charophytes have relatively complex growth forms, with whorls of "branches" developing at their tissue nodes. Charophytes are also the only algae that develop multicellular sex organs, although these are not comparable to those of the higher plants.



***Nitella flexilis* (macroalgae – Nitella, Smooth stonewort)**

Nitella flexilis is closely related to *Chara vulgaris* in the Stonewort family, a group of complex algae that superficially resemble vascular plants more than they do other groups of algae. *Nitella* is a green, freshwater algae; a robust species growing up to a meter long with axes up to 1mm wide. Branches in whorls once or twice divided.



Most plant drawings were obtained from Britton and Brown (1913) via the USDA Plant Database.

USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions*. 3 vols. Charles Scribner's Sons, New York.

Distribution maps were obtained from the USDA Plant Database.

USDA, NRCS. 2011. The PLANTS Database (<http://plants.usda.gov>, 10 November 2011). National Plant Data Team, Greensboro, NC 27401-4901 USA.

Images were obtained from the following:

Sagittaria cristata: www.uwgb.edu/biodiversity/herbarium/wetland_plants

Vallisneria Americana: www.dnr.state.md.us/bay/sav/key

Elodea Canadensis: www.dnr.state.md.us/bay/sav/key/

Ceratophyllum demersum: www.dnr.state.md.us/bay/sav/key/

Myriophyllum spicatum: www.dnr.state.md.us/bay/sav/key/

Myriophyllum sibiricum: www.mainevolunteerlakemonitors.org

Myriophyllum heterophyllum: www.missouriplants.com

Potamogeton robbinsii: www.yankee-lake.org

Potamogeton pusillus: <http://flora.nhm-wien.ac.at/Seiten-Arten/Potamogeton-pusillus.htm>

Potamogeton diversifolius: www.dcnr.state.al.us

Potamogeton vaseyi: www.botany.wisc.edu

Potamogeton spirillum: www.uwgb.edu/biodiversity/herbarium/wetland_plants

Najas flexilis: www.vilaslandandwater.org

Najas guadalupensis: www.aquahobby.com

Utricularia vulgaris: www.dnr.state.md.us/bay/sav/key

Isoetes spp.: www.nybg.org

Chara vulgaris: http://en.wikipedia.org/wiki/File:Chara_vulgaris.jpeg; www.aquaticus.biz

Nitella flexilis: www.diszhal.info