Maryland Department of Natural Resources

Tidewater Ecosystem Assessment

New Germany Lake
SAV Survey
2012

Report of Survey Activity and Results

December 2012

Prepared For

Maryland Department of Natural Resources

Maryland Park Service

Prepared by

J. Brooke Landry, Maryland Department of Natural Resources

INTRODUCTION

In response to concern regarding increased amounts of submerged aquatic vegetation (SAV) in New Germany Lake, the Maryland Department of Natural Resources initiated an SAV survey in summer 2011, and repeated this survey in summer 2012. The goal of the SAV survey was to define the distribution and relative abundance of SAV species present by sampling several points throughout the lake each summer.

Background

Located in New Germany State Park in western Maryland, New Germany Lake is a 13 acre lake surrounded by forests. Prior to 1837, it was a 9-15 foot channelized stream called Poplar Lick Run. In 1837 the Swauger Mill Dam was constructed, creating a 9 acre lake. Lake size increased to 13 acres in 1933 when the current dam was constructed two feet higher with a concrete spillway at the same site as Swauger Mill Dam.

Today the lake is the State Park's center of summertime activity. Non-motorized small boats are available to rent; fisherman enjoy the largemouth bass, catfish, bluegill, and trout; and swimming is available from the "east beach" within a guarded swimming area. Snorkelers are likely to get a glimpse of the many salamanders that hide within and among the SAV and submerged tree limbs, and possibly even a Hellbender, a species of giant salamander endemic to North America. Hellbenders are becoming exceedingly rare and although they normally inhabit areas with large rocks and swiftly moving water, one was seen several years ago in New Germany Lake.

Because the lake is stream-fed, it receives nutrient and sediment run-off from the surrounding watershed. Fueled by the incoming nutrients and increased water temperatures, SAV begins growing throughout the lake beginning in late spring. Submerged aquatic vegetation can be found in a variety of aquatic habitats and forms the foundation of healthy lake ecosystems. Similar to their terrestrial counterparts, SAV are underwater grasses which provide a myriad of important ecological functions. Through the process of photosynthesis, SAV produces oxygen which is vital to the survival of all lake organisms. It provides food, habitat and nursery grounds for many species of fish and invertebrates, absorbs nutrients which decreases the likelihood of algal blooms, improves water clarity by reducing turbulence which allows suspended solids to settle to the bottom and get incorporated into plant root systems, reduces shoreline erosion by reducing the effects of waves and currents, and is a major food source for waterfowl. Healthy native aquatic plant communities also help prevent the establishment of invasive plants like Eurasian water milfoil (*Myriophyllum spicatum*).

METHODS

Field

Submerged aquatic vegetation surveys took place on June 28, August 21, and September 20, 2012. Using SCUBA or snorkel gear, natural resource biologists sampled 39-50 $0.25m^2$ quadrats placed systematically but haphazardly throughout the lake. Exact quadrat locations (latitude and longitude) were recorded using a Garmin handheld GPS

device. Depth was recorded at each quadrat sampled. Within each quadrat, a total SAV percent cover was estimated, which included all macrophytes, both vascular plants and macroalgae, as well as the percent cover of each genus present.

Data Analysis

Data were first entered into an Excel spreadsheet. For each sampling event, mean percent cover values were calculated for total SAV, total macroalgae, and for each vascular plant genus observed. To show trends in the distribution and density of each macrophyte group, distribution and density maps were created in ArcGIS ArcMap using the georeferenced percent cover data. Shapefiles for each sampling event were created, and from these, grid surfaces were interpolated using the default settings of the Inverse Distance Weighted (IDW) function in the Spatial Analyst Extension. Depth, total SAV, total macroalgae, and each genus of vascular plants observed were interpolated and mapped for each sampling period. An outline of the lake was used as an analysis mask, so that only interpolated surfaces within the lake boundaries were shown. Surface covers were classified and color-coded.

RESULTS

We observed three genera of vascular plants and two genera of macroalgae in New Germany Lake during the 2012 SAV surveys. These plants include *Najas flexilis, Najas guadalupensis, Najas minor, Potamogeton pusillus, Potamogeton diversifolius, Heteranthera dubia* (a single shoot in a single quadrat, so not counted in analyses) and the macroalgae *Chara vulgaris* and *Nitella flexilis*. During summer 2011, four genera of vascular plants were observed, including four species of *Potamogeton*, four species of *Najas*, one species of *Utricularia*, and one species of *Isoetes*. Common names are given in Table 1. Descriptions of each species or genus are given in Appendix A.

Table 1. List of macrophytes observed in New Germany Lake during summer 2011 and 2012 SAV surveys. One asterisk indicates presence in 2011, two indicate presence in 2011 and 2012.

Species	Abbreviation	Common name
*Potamogeton pusillus***	Pp	Slender pondweed
*Potamogeton vaseyi**	Pv	Vasey's pondweed
*Potamogeton spirillus**	Ps	Spiral pondweed
*Potamogeton diversifolius***	Pd	Waterthread pondweed
*Najas flexilis***	Nf	Nodding naiad
*Najas gracillima**	Ng	Slender naiad
*Najas guadalupensis***	Ngp	Southern naiad
*Najas minor***	Nm	Brittle naiad (spiny)
*Utricularia vulgaris**	Uv	Common bladderwort
*Isoetes spp.**	Iso	Quillwort
*Chara vulgaris***	Cv	Chara
*Nitella flexilis***	Nit	Nitella

Average total SAV cover was 60% on June 28, 2012 (Table 2). Macroalgae, specifically *Chara vulgaris*, was the dominant plant during this first summer survey in June (average cover of 51%). Also observed in June were small amounts of *Najas flexilis, N. minor* (a non-native species), *Potamogeton pusillus, and Nitella flexilis* (Fig. 1).

Table 2. Mean cover values for Total SAV, Macroalgae, *Najas spp., Potamogeton spp*., and Other, which includes *Utricularia vulgaris* and *Isoetes spp*., during June, August, and September SAV surveys in New Germany Lake.

	Average Total Percent Cover				
Date	**SAV**	**Macroalgae**	***Najas***	***Potamogeton***	**Other**
6.28.12	**60**	**51**	**7**	**2**	**0**
8.21.12	**71**	**6**	**64**	**0**	**0**
9.20.12	**89**	**0**	**87**	**0.4**	**0**

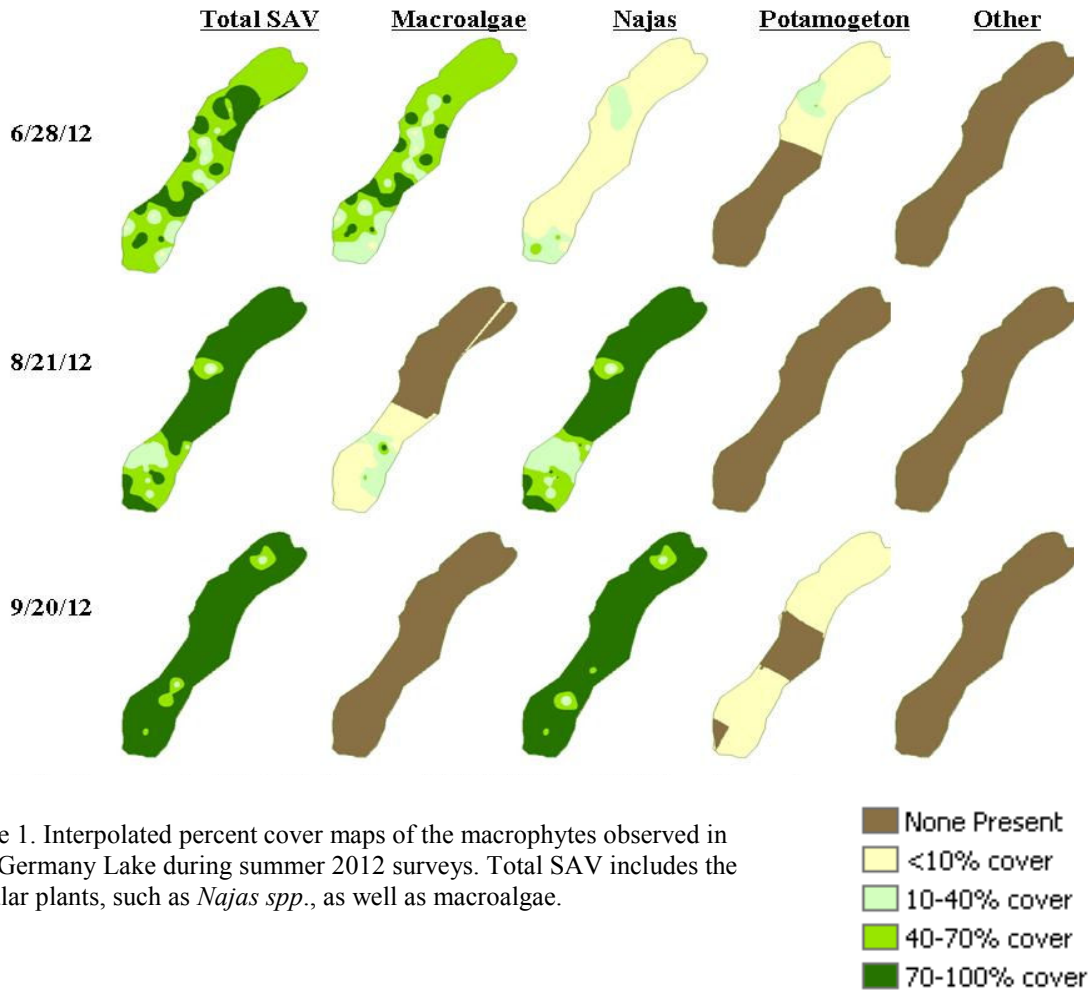


Figure 1. Interpolated percent cover maps of the macrophytes observed in New Germany Lake during summer 2012 surveys. Total SAV includes the vascular plants, such as *Najas spp*., as well as macroalgae.

By August, average total SAV cover increased to 71% but dominance shifted from macroalgae to vascular plants, specifically *Najas minor*. In fact, macroalgae all but disappeared by August. *Chara* was not observed at all in August, and *Nitella* was only observed in small amounts. *Najas flexilis* and *N. guadalupensis* were also observed, but again, only in small amounts. The bulk of the total SAV in August was composed of *N. minor*, which was densest in the middle and northern region of the lake where the water is shallower than in the southern end near the dam (Fig. 2).

During the early fall survey, which took place in September, average total SAV cover increased to 89%. The only genus observed in New Germany Lake at that time was *Najas*, and the vast majority of that was *N. minor*. By September, even the deeper water had high densities of *N. minor*.

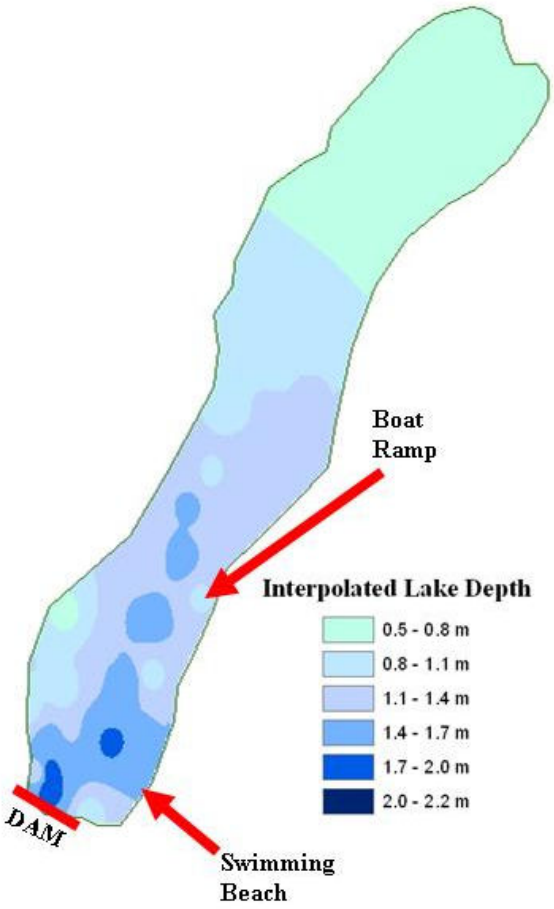


Figure 2. Interpolated water depth (meters) in New Germany Lake during summer 2012 surveys.

DISCUSSION/CONCLUSION

The goal of the SAV survey was to define the distribution and abundance of the SAV community throughout New Germany Lake. As such, the results of the survey provide a comprehensive view of the Lake's SAV community as a whole and how this community changes in space and time. The survey methodology is a globally accepted method to identify changes in an SAV community; it does not focus on any one species over another.

In 2011, our results indicated that New Germany Lake supported a healthy and somewhat diverse population of SAV relative to its size, including four genera of vascular plants and two species of macroalgae. Of the four vascular plants, the Naiads (*Najas spp*.) and the Pondweeds (*Potamogeton spp*.) were the most abundant. Pondweeds are perennial flowering plants with creeping rhizomes and leafy branches. Their leaf blades may either be floating or submersed and it can be difficult to differentiate one species from another. Naiads are annual plants that grow in small freshwater streams or ponds. Naiads vary in size from inch-high tufts to highly branched plants two or three feet high. They are considered an excellent food source for waterfowl. *Chara vulgaris* is a macroalgae that superficially resembles the vascular plants in the lake because of its stem-like and leaf-like structures. *Chara* plants are rough to the touch because of deposited calcium salts on the cell wall. *Nitella flexilis* is another robust freshwater macroalgae that grows up to a meter long with axes up to 1mm wide.

With the exception the *Isoetes* and *Utricularia*, the same genera of plants were present in the lake in 2012. Results from our 2012 SAV surveys, however, indicate that a major community shift took place over the course of the summer. Macroalgae made up the majority of the plant biomass in the June survey, but it was only observed in trace amounts in August and then was completely absent in September. Vascular plant diversity decreased as well. Where *Potamogeton spp*. were commonly observed in 2011, there were only two observation of *P. pusillus* in June 2012, and only trace amounts of *P. diversifolius* were detected in September. *Utricularia* and *Isoetes* were absent in 2012. *Najas flexilis* and *N. guadalupensis* were observed, but in small amounts. *Najas minor*, however, an exotic plant from eastern Europe and Asia, was observed in high densities in practically every quadrat sampled in August and September and was by far the dominant species present.

While Naiads are an excellent food source for waterfowl, decreased biodiversity is not the favored state-change and this substantial shift in community structure to a non-native species is of concern. *Najas minor*, also known as minor, brittle, spiny, or bushy naiad, is an introduced species that was first reported in North America in 1932 when it was collected from Ashtabula County, OH, and then reported from the tidal Hudson River in New York in 1934. Sediment seed records indicate a simultaneous appearance in the northern portion of Chesapeake Bay.

Najas minor prefers calm waters such as ponds, lakes, and reservoirs, and is capable of growing in depths up to 4 meters. It has been observed to tolerate brackish water, and it is

more tolerant of turbidity and eutrophic conditions than some native species of *Najas.* Consequently, it has replaced native species in many instances. Although its growth is usually compact and relatively bushy, as it is observed in New Germany Lake, the highly branched stems can grow up to 4 ft. in length. The visibly serrated leaves of the plant are opposite, unbranched, strap-shaped, and are around 4.5 centimeters in length and only 1 mm wide. *Najas minor* is one of the more distinctive species of *Najas*, however, young sterile individuals resemble *N. gracillima*.

Although *Najas minor* can easily and rapidly reproduce by fragmentation, the primary means of reproduction is by seeds, which grow along its stem. Its reproductive season starts from August, peaks in September, and ends in October. It has small flowers located in clusters along the leaf axils.

Najas minor can form dense, monospecific stands in shallow water that inhibit the growth of native species of aquatic macrophytes. This appears to be what has happened in New Germany Lake. Introduction into New Germany could have been by small boat, by bird, or even on swimming gear. *Najas minor* was observed only twice in 2011, in two quadrats at moderate densities during the September SAV survey, at which time *N. flexilis* and *N. guadalupensis* were the dominant vascular plants in the lake. Cause for the dramatic expansion of the plant in 2012 is unclear, although it could be linked to the near complete drawdown of the lake water level during the 2011-2012 winter season. The water in the lake was drawn down specifically to control aquatic macrophytes. It is possible that the drawdown killed the majority of other vascular plants but left the small amounts of *N. minor* unscathed and able to reproduce rapidly and outcompete the macroalgae by August 2012. Water level drawdown has been known to increase the density of some species of Naiad, but prior evidence for the effect on this species was not found.

RECOMMENDATIONS

According to information available through the Global Invasive Species Database (GISD, http://www.issg.org/database/species/management_info.asp?si=1560&fr=1&sts=&lang=EN), *Najas minor* is regulated or outright illegal in several states where it has become a nuisance species. It has not previously been reported as present or established in Maryland according to this database, although seeds have been found in sediment cores taken in the upper Bay. Because the species is so easily fragmented and transported, and reproduces so rapidly when introduced to a new water body, we do not recommend mechanical removal unless it is confined to a lake with no discharge. Aquatic plant harvesters have been recommended to remove large quantities of *N. minor* in lakes, as have rotovators, but these do carry the risk of negatively affecting any fauna using the plants as habitat.

Based on reports given by the U.S. Army Corps of Engineers via the GISD, some herbicides work better than others for this plant. Endothall, dipotassium, and endothall

mono have been used in hopes of providing "nuisance relief," but non-target plant species were also negatively affected. The following herbicides and brands were reported to yield excellent control for *N. minor* by the US army Corp of Engineers: diquat: Reward, Weedtrine-D; fluridone: Sonar AS, Sonar SRP, Sonar PR, Sonar Q, and Avast!; and endothall Aquathol K, Aquathol Super K, Hydrothol 191. *Najas minor* was found to be completely unaffected by the herbicide butachlor. Any herbicide application also risks negatively affecting the plants associated fauna.

With regards to New Germany Lake specifically, MD DNR recommends SAV surveys during summer 2013 to confirm that the plant is established and will continue to be a nuisance. Removal efforts are often more harmful to the ecosystem as a whole than the plant itself, so due diligence is required before action is taken. Should removal efforts be deemed necessary, a thorough evaluation of available control measure and their benefits and cost to New Germay Lake will take place and an action plan created.

Throughout the summer 2013 season, it will be vitally important that all swimmers and boaters, particularly those that launch their own small boat, are alerted to the invasive nature of the plant. Action should be taken to ensure that *Najas minor* not be transported from New Germany Lake to other lakes or water bodies in the area via swim gear or boats. Ideally, action should also be taken to ensure that no seeds or fragments are released over the dam.

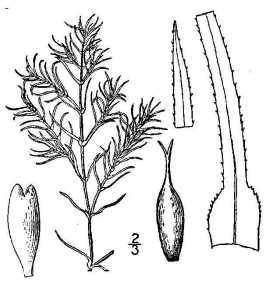
APPENDIX A

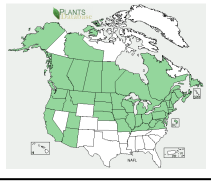
This appendix provides drawings, pictures, distribution maps, and a brief description of each species of submerged aquatic vegetation observed in New Germany Lake during the summer 2011 and summer 2012 SAV surveys.

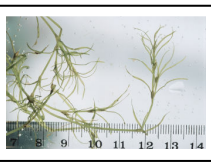
Najas flexilis (Slender naiad)

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.



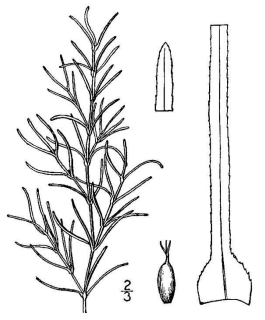


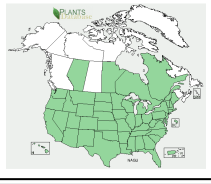


Najas guadalupensis (Southern naiad)

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



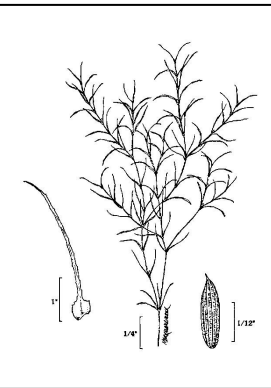


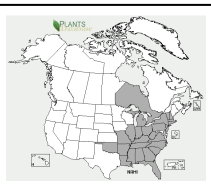
Najas minor (Brittle naiad)

Monocot. Annual. Introduced to the US where it is considered invasive, but established throughout eastern US and part of Canada. Native to North Africa, Japan, Turkey, India as well as central and eastern Europe.

This plant prefers calm waters, such as ponds, reservoirs, and lakes, and is capable of growing in depths up to 4 m. It grows in dense clusters and has highly branched stems. This plant is capable of propagation from stem fragments or from small seeds which grow along its stem. The small flowers are located in clusters along the leaf axils. The leaves of the plant are opposite, unbranched, strap-shaped, and are around 4.5 centimeters in length. The leaves have serrations which are visible to the naked eye.

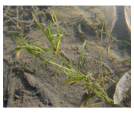
Dense growth of Brittle naiad inhibits the growth of native aquatic plants. It may spread to new areas by seeds or by stem fragments carried by boats.





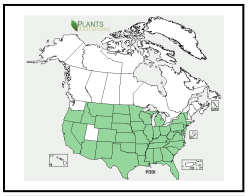
***Potamogeton pusillus* (Slender pondweed)**
Monocot. Perennial. Native to the continental US, Alaska, and Canada. Distributed throughout native range.

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.



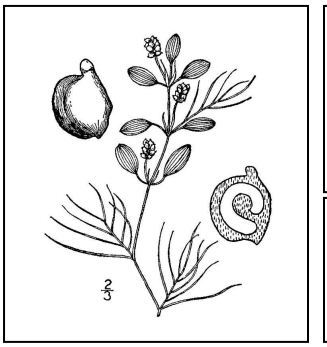
***Potamogeton diversifolius* (Waterthread pondweed)**
Monocot. Perennial. Native to the continental US and distributed throughout with the exception of far northeast.

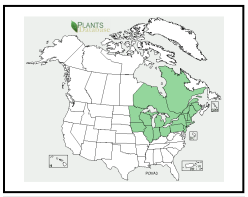
This pondweed produces a very narrow, compressed stem branching to around 35 cm. It has thin, pointed linear leaves a few cm long spirally arranged about the thin stem. Flowers emerge from the water surface.



Pota*mogeton vaseyi* (Vasey's pondweed)
Monocot. Perennial. Native to the continental US and Canada. Distribution limited to the northeastern US and eastern Canada.

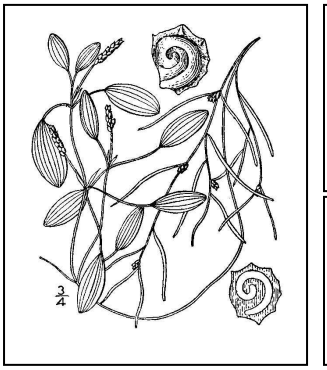
Not previously documented in Maryland, Vasey's pondweed is considered threatened, endangered, or of special concern where found in northeastern US states. It grows in quiet waters and has dimorphic leaves: very narrow, flaccid, submersed leaves and wider, thicker floating leaves.

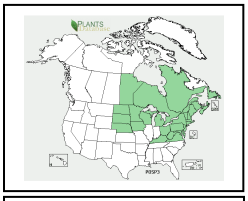




***Potamogeton spirillus* (Spiral pondweed)**
Monocot. Perennial. Native to the continental US and Canada, but distributed only throughout the northeast US and northern mid-west, and eastern Canada.

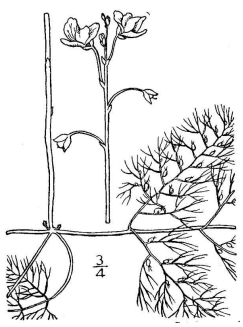
Spiral pondweed usually grows in shallow water: lakes, ponds, wet swales, and rarely quiet river borders. The submersed leaves are often curved, giving the whole bushy plant the aspect of a broad-leaved *Najas*

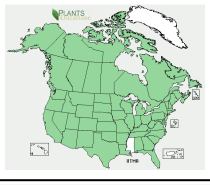




***Utricularia vulgaris* (Common bladderwort)**
Dicot. Perennial. Native to the continental US, Alaska, and Canada.

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.