**Swollen Bladderwort**

Common Names: Swollen Bladderwort, Floating Bladderwort, Large Floating Bladderwort, Inflated Bladderwort.

Scientific name: Order/Family/Genus/Species

Scrophulariales/Lentibulariaceae/Utricularia/U. inflata/U. inflata
Overview:
Swollen Bladderwort is a known invasive species in the state of Washington. Introduced to Western Washington in the early 1980's, the plant is now found in at least 5 counties. Its method of introduction is unknown. Utricularia inflata, native to Europe, closely resembles other native bladderworts, and presents the possibility that we may have a larger invasive population than we currently realize. A beautiful and fascinating species, it is known to be endangered in its home ranges. That, however, does not prevent it from posing a significant threat to some of our own native populations of flora and fauna in addition to possibly serious financial costs should its local range increase. While U. inflata is, as far as we know, limited to a handful of locations in Western Washington at this time, there is a disturbing lack of any effort to eradicate the population while it remains small.

Key features:

A. Lacy underwater foliage with seed-like bladders
B. Yellow snapdragon-like flowers
C. Spoke-like structure supporting the flower stalk

Basic features for Utricularia inflata are:

Distribution (Kremer et al. 1962)
FIG. 1; Key describing distinguishing features of Utricularia inflata; Courtesy of The American Journal of Botany.
Life History and basic ecology:

Swollen Bladderwort is a free-floating perennial herb; rootless, carnivorous, and aquatic, it uses "seeds" or bladders to capture prey. The stem and flowers are supported by a wheel or spoke-like structure with lacy, finely divided and haired underwater foliage. The stem can vary from six inches to two meters long and while usually emergent, can be either partly supported by exposed sediment, submersed or floating. In his 1962 paper, Reinert also states that the emergent flowers are only produced when the plant actually becomes embedded in the substrate when the water levels drop and the water becomes stagnant, the leaves remain in the mud while the stems can be produced during submerged conditions due to low water. The plant sends out thin, thread-like shoots that widen in the middle and then taper again at the terminal end. "The roots of U. inflata are produced when the plant becomes stranded on the bottom of the water column where they remain dormant in the sediment until the plant is completely out of water. At that point, the leaves are covered in protective mucous. These leaves are heavily armed with spines and are often called "spines," they help prevent the seeds from being dispersed by the wind.

U. inflata reproduces from seeds, fragments, tubers, and small coiled winter buds, which are called turions. Turions are tightly packed, ball-shaped groups of concave leaves covered in protective mucous. These are heavy with starches and sink to the bottom of the water column where they remain dormant in the sediment until the plant is completely out of water. At that point, the leaves are covered in protective mucous. These leaves are heavily armed with spines and are often called "spines," they help prevent the seeds from being dispersed by the wind.

Tubers of U. inflata are produced when the plant becomes stranded on the bottom of the water column where they remain dormant in the sediment until the plant is completely out of water. At that point, the leaves are covered in protective mucous. These leaves are heavily armed with spines and are often called "spines," they help prevent the seeds from being dispersed by the wind.
parts of the plant appear to decay and the branch tips separate, remaining dormant until the next growing season.

Swollen Bladderwort is a stated caustic, carnivorous and obtains nutrients via photosynthesis, absorbing nutrients from the water column and by consuming minute invertebrates and minute fish that it captures in its bladders. The bladders of carnivorous Utricularia species are 10% - 50% of the total biomass of the plant (Adamec, 2006). When mature, the bladders are approximately 3 mm. long (Reinert et al., 1962). FIG. 2 Close-up of Utricularia inflata bladder showing trigger hairs. Courtesy of The Nature Conservancy.

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FIG. 2 Close-up of Utricularia inflata bladder showing trigger hairs. Courtesy of The Nature Conservancy.
Due to their ability to capture live prey, they are able to flourish in both oligotrophic and eutrophic lakes. This, combined with their tolerance for a wide range of water chemistry conditions, gives them a competitive edge over many native plants.

Optimal conditions for aquatic bladderwort species are warm, shallow, oxygen-deficient waters that are acidic. Some species do well in more acidic waters and others require a high pH. (Dite et al., 2006) It prefers slow moving and still waters and can create dense mats that shade out native vegetation. It’s wide range of tolerances and ability to utilize resources gives it advantages in the unlikeliest of locations. At least one documented instance was located in an unnamed drainage pond beside a highway in Thurston County, Washington. It was the only aquatic bladderwort species present in the pond.

Figure 3: Utricularia inflata stems and bladders
Bladderworts in their native ranges provide important food, habitat, and protection for fish and aquatic invertebrates. Waterfowl and another highly invasive species, the muskrat, also consume them. Although it flowers during the winter in its native range, it flowers much later, from June to July, in Washington. When not in flower, it is difficult to distinguish from our native bladderworts, but when in flower, the muskrat, also consume them. Although it flowers during the winter in its native range, it is not likely to be confused with our native bladderwort species.
Ecology.


FIG. 4. Map showing current United States distribution of Utricularia inflata. Courtesy of the USDA.

The plant's history of invasiveness is equally as difficult to nail down as its original distribution. At this time experts seem unsure if the plant is native to New York or whether it may have been introduced to the state as early as the mid-nineteenth century, or as late as the 1990s. Its resemblance to other Utricularia species again may present a confusing factor in determining its actual native and invaded habitats. Utricidaria radiata is sometimes treated as Utricularia inflata var. radiata adding even further confusion.

Invasion Process:

Infestation appears to be in its early stages in Washington State. The first plants collected in Washington State were in Horseshoe Lake in Kitsap County in 1980. Although those specimens were sterile they did display the winter-coiled buds used for reproduction. Specimens have now been found in Cowlitz, Kitsap, Mason, Pierce and Thurston Counties, including both the Puget Sound and Deschutes drainages.

Information on its introduction is limited. Jenifer Parsons, sponsor of U. inflata on Washington State's noxious weed monitor list and an aquatic botanist with the Washington State Department of Ecology, noted that the infestation could not have happened much earlier than 1980 as Adolph Ceska was extensively studying U. inflata in British Columbia and the Pacific Northwest in the 1970s. Eventually, Ceska's research culminated in the publication of a key to the Utricularia species of the PNW that did not include U. inflata. Several sources, including the Washington State Department of Ecology, the Missouri Botanical Garden Database, the Western Aquatic Plant Management Society, and the International Carnivorous Plant Society suggest that a carnivorous plant enthusiast may have introduced the plant to Washington State. It could also have been introduced as either an aquarium plant or water garden plant. In Washington it has been found in small isolated ponds that are unlikely to have seen much, if any, boat traffic and so it is more likely that the plants are now being spread via waterfowl. Infestation appears to be in its early stages in Washington State. The first plants collected in Washington State were in Horseshoe Lake in Kitsap County in 1980. Although those specimens were sterile they did display the winter-coiled buds used for reproduction. Specimens have now been found in Cowlitz, Kitsap, Mason, Pierce and Thurston Counties, including both the Puget Sound and Deschutes drainages. Information on its introduction is limited. Jenifer Parsons, sponsor of U. inflata on Washington State's noxious weed monitor list and an aquatic botanist with the Washington State Department of Ecology, noted that the infestation could not have happened much earlier than 1980 as Adolph Ceska was extensively studying U. inflata in British Columbia and the Pacific Northwest in the 1970s. Eventually, Ceska's research culminated in the publication of a key to the Utricularia species of the PNW that did not include U. inflata. Several sources, including the Washington State Department of Ecology, the Missouri Botanical Garden Database, the Western Aquatic Plant Management Society, and the International Carnivorous Plant Society suggest that a carnivorous plant enthusiast may have introduced the plant to Washington State. It could also have been introduced as either an aquarium plant or water garden plant. In Washington it has been found in small isolated ponds that are unlikely to have seen much, if any, boat traffic and so it is more likely that the plants are now being spread via waterfowl.
Mitchell postulates that New York's Spruce Pond location is equally as unlikely a destination for boaters (1994) and in that case waterfowl is also the likeliest culprit. Given that the plant has not been discovered in any locations between Texas and Washington this does tend to indicate that the initial introduction was more likely caused by humans than waterfowl.

**Potential Ecological and/or Economic Impacts:**

The impact of *U. inflata* can be extensive. Its ability to form dense cover, utilize both dissolved nutrients and live prey, and its tolerance for a wide range of temperatures and water chemistry makes it easy for this invasive species to out-compete native plants. In addition, it has been shown that carnivorous plants show an increase in reproductive success over those that rely solely on photosynthesis, competition with native plants. In addition, it has been shown that carnivorous plants show increased photosynthesis and water chemistry makes it easy for this invasive species to out-compete both dissolved nutrients and live prey, and its tolerance for a wide range of temperatures and water chemistry makes it easy for this invasive species to out-compete native plants.

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Experiments have also shown evidence of leaf lengthening in E. aquaticum in the presence of U. inflata but this was apparently not sufficient to overcome the effects of shading. In some invaded Adirondack lakes, native macrophyte species have been reduced by as much as a third, from 18 to 12. In addition, another 9 species were reduced by as much as a third, from 18 to 12. In addition, another 9 species were reduced by as much as a third, from 18 to 12. Inclusion of aquatic insects may be affected by excess vegetation and potential water quality and decrease of vegetation can lead to safety concerns for swimmers. In addition to the economic impacts, L. inflata can also have significant ecological impacts. L. inflata can also have significant ecological

Management Strategies and Control Methods:

Management efforts have included hiring school kids to rake and pull each plant from the water. This treatment can have adverse effects, however, as some control/management efforts have included hiring school kids to rake and pull each plant from the water. This treatment can have adverse effects, however, as
Macrophyte in Silver Lake, Cowlitz County and experts have advised that the grass carp does not prefer floating plants. Another control method suggested by Massachusetts state authorities has been the use of benthic barriers, but these can prove problematic by limiting light and upward growth of native benthic macrophytes and may have negative effects on other benthic organisms. They also require near constant maintenance to retain their usefulness. According to the Massachusetts website there is no known biological control for this species. Massachusetts has no known biological control for this species.

Conclusion: U inflata is illegal to buy, sell, or transport in the state of Washington and it is on the state's noxious weed monitor list. Given this plant's ability to adapt and utilize resources that native plants cannot access, this may be insufficient to stop its eventual spread. The plant was discovered in Spruce Pond in New York (1994), and it was already well-established and covered perhaps 10 acres. It spread so rapidly that when U inflata was discovered in Silver Lake, Cowlitz County, experts advised that the grass carp does not prefer floating plants. Another control method suggested by Massachusetts state authorities has been the use of benthic barriers, but these can prove problematic by limiting light and upward growth of native benthic macrophytes. The carp does not prefer floating plants.
attempted to actively eradicate the plant from any area in Washington State are the residents of Limerick Lake. Given the plant’s potential impacts, this seems a grave oversight.

In a final act of irony, although Swollen Bladderwort is considered invasive in Maryland, it has been deemed endangered in at least 3 other areas; Michigan and New York (USDA website). This is doubly ironic as *Utricularia inflata* is not native to Michigan, the most likely explanation for this is the sometime continuous listing of *Utricularia radiata* as a subspecies of *U. inflata*. Clearly, information on *U. inflata* can be fragmentary and contradictory.
Currently it is listed as both invasive AND endangered in New York. The official website for the USDA's National Agriculture Library, a site that lists legal definitions of invasive species, white papers, concepts, terms, and contexts, does not currently have a listing for Utricularia inflata as an invasive plant.

Current research and management efforts, and expert contact information in the PNW

With the exception of listing the species on the state's noxious weed monitor list and its inclusion by the Washington State Department of Agriculture on the prohibited plant list, there are no current management efforts in place. U. inflata was found to be present in a wetland adjacent to Silver Lake in 2005 and it is believed that once the introduced grass carp die off the plant will likely return to that lake. There does not appear to be a plan to continue stocking grass carp in Silver Lake. I have been unable to determine if eradication efforts are still ongoing at Limerick Lake but it seems likely as it is an effort spearheaded by local residents rather than any state or local governing body. The local experts I contacted were not aware of any recent efforts to suppress or eradicate this plant in the PNW.

For further information regarding U. inflata or to report a possible sighting, you may contact:

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Literature Cited:

Internet Publication/Online Document; www.gardenguides.com

Internet Publication/Online Document; USDA National Agricultural Library


Other key sources of information:


