



Aquatic Invasive Species (AIS) Control Plan: European Water Chestnut

This control plan is a living document and will be updated, as needed, to reflect the status of the species within Pennsylvania.

Natural History

Description: The European Water Chestnut (*Trapa natans*) is a rooted, annual aquatic plant with both submersed and floating leaves and a distinctive seed pod/nut. This plant is sometimes confused by name with the Chinese Water Chestnut (*Eleocharis dulcis*) an unrelated species which produces tubers commonly used in Asian-American cooking (Hummel and Kiviat, 2004).

Taxonomy

Common name: **European Water chestnut**
Family: **Trapaceae**
Species: ***Trapa natans***
Integrated Taxonomic Information System (ITIS) Serial Number **27170**

Morphology: This plant contains glossy green floating leaves, 2.0 to 4.0 cm (~ 0.75 to 1.6 inches), that are triangular with toothed edges and form rosettes around the end of the stem (Figure 1). The stem anchors into the mud by numerous branched roots and extends upward to the surface of the water. This plant contains cord-like stems that are spongy (for buoyancy) and can reach lengths of up to approximately five meters (16 feet). Single, small, white flowers with four 0.8 cm (~0.33 inch) long petals sprout in the center of the rosette. The

fruit is a large seed pod or nut with four sharp spines (Figure 2).

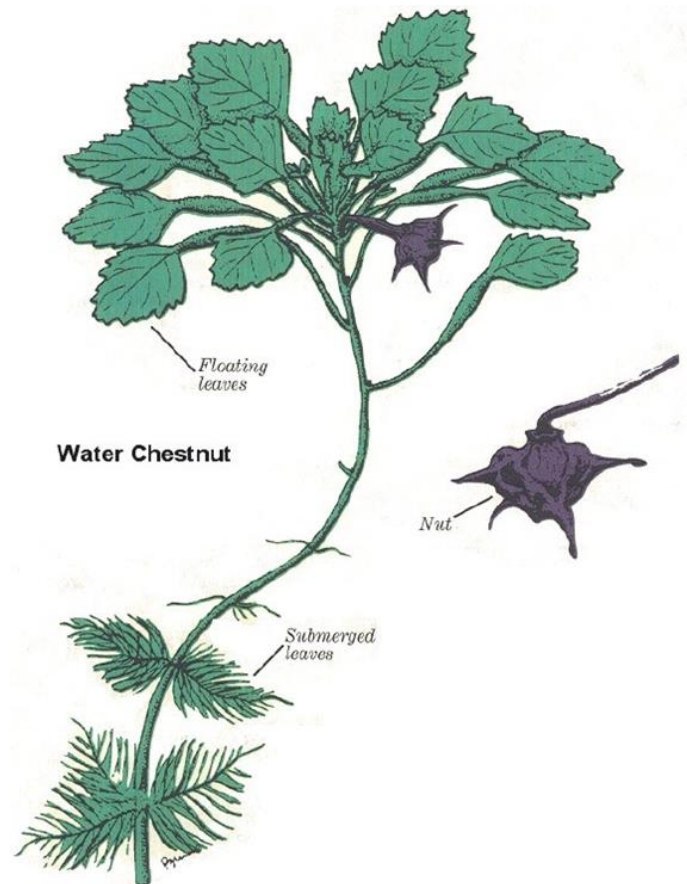


Figure 1. Diagram of a European Water Chestnut plant (*Trapa natans*). Courtesy of the Maryland Department of Natural Resources.

Origin: The European Water Chestnut is native to Eurasia. It was first introduced to North America in the 1870s, where it is known to have been grown in a botanical garden at Harvard University in 1877. The plant had escaped cultivation and was found growing in the Charles River by 1879 (Hummel and Kiviat 2004; Ling 2009).

Food Preferences: Photosynthetic organism preferring nutrient-rich water.



Figure 2. European Water Chestnut seed pods. Courtesy of Michigan State University.

Reproduction: Seeds germinate in the spring with each seed producing 10 to 15 rosettes and each rosette capable of producing up to 20 seeds. The plants begin to produce hard, nut-like seeds in mid-summer with the seeds ripening in approximately a month. Overwintering of populations is accomplished when the mature, greenish brown seeds sink to the bottom where they can remain viable in the sediment for up to 12 years. The plant spreads either by the rosettes detaching from their stems and floating to another area, or by the seed pods being swept by currents or waves to other parts of the lake or river (O'Neill 2006).

Notable Characteristics: Mature seeds are very hard, with sharp points easily capable of piercing light footwear (Hummel and Kiviat 2004).

Historic Vectors: Escape from horticultural collections, sold as ornamental plant, escape from the aquarium trade, and hitchhiker in ballast water.

Current Pathways/Vectors: Seed dispersal by animals, human dispersal via the ornamental plant trade, escapes from ornamental ponds, or hitchhiker on recreational equipment (Hummel and Kiviat 2004; Eyres 2009).



Figure 3. European Water Chestnut bed. Courtesy of Michigan State University.

Preferred Habitat: European Water Chestnut grows best in shallow (less than five meters deep), nutrient-rich lakes and slow-moving streams and rivers with soft muddy bottoms (Figure 3). It is generally found in waters with a pH range of 6.7 to 8.2 and alkalinity of 12 to 128 mg/L of calcium carbonate (Ling 2009). It is tolerant of slightly brackish waters (Hummel and Kiviat 2004).

Distribution and Status

Distribution: While established in the northeastern United States since the late 1800's, European Water Chestnut continues to spread within portions of the United States, particularly in New England and the Mid-Atlantic Region (Figure 3). Water chestnut can now be found in Connecticut, Maryland, Massachusetts, New York, Pennsylvania, Vermont and Virginia and in the Canadian Province of Quebec (Ling 2009).



Figure 3. Distribution of European Water Chestnut in the United States. Source: USGS.

Within Pennsylvania, European Water Chestnut has been reported in at least 11 counties (Figure 4). Infestations are concentrated primarily in the southeast, with numerous records from waterways, lakes, and ponds in Bucks and Montgomery counties. Other records from the southeast include isolated records in Berks, Chester, and Northampton counties. Isolated records of European Water Chestnut are known from Luzerne, Pike, Susquehanna and Wayne counties in northeastern Pennsylvania. In the southwest, records are known from several locations in Warren County and from a single site in Mercer County.

Pennsylvania Legal Status: As of November 2020, European Water Chestnut is presently not regulated in 58 Pa. Code §71.6 and §73.1. However, Water Chestnut is presently regulated as a Class A Noxious Weed under Pennsylvania 2017 Act 46.

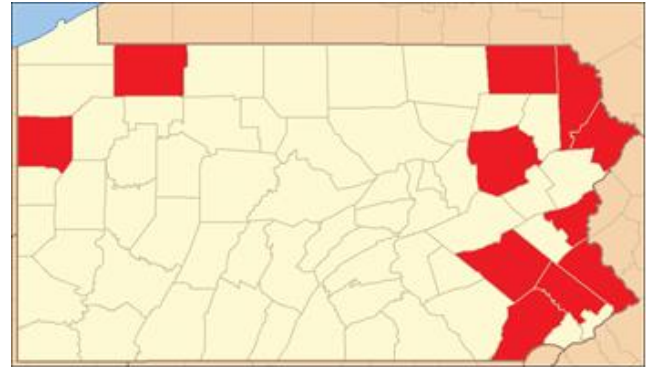


Figure 4. County-level distribution of European Water Chestnut in Pennsylvania (November 2020).

Threats

Water chestnut out-competes native plants for sunlight and is a fierce competitor in shallow waters with soft, muddy bottoms (Hummel and Kiviat 2004). This aggressive species is a prolific reproducer. One acre of water chestnut can produce enough seeds to cover 100 acres the following year (Maryland Sea Grant 2009). Dense mats of European Water Chestnut contribute to low levels of dissolved oxygen in aquatic ecosystems, which can be harmful to aquatic life (Hummel and Kiviat 2004). European Water Chestnut is considered of little value to most native wildlife (Hummel and Kiviat 2004; O’Neill 2006).

Water chestnut infestations can create major issues for boating and other aquatic recreation. The dense mats make navigation difficult, while the spiked seeds, capable of puncturing shoe leather, are a danger to bathers and beach users (Hummel and Kiviat 2004). When the plant occupies a site, most recreational activities such as swimming, fishing from the shoreline, and the use of small boats are eliminated or severely impeded (Ling 2009).



Management

Management Goals: European Water Chestnut presently has limited (i.e., concentrated largely in the south and northeast), but expanding, distribution in Pennsylvania. Therefore, the primary management goal is to contain or eradicate infestations.

Containment and Prevention Actions:

- Coordinate with Pennsylvania state agencies, watershed associations, and volunteer groups to locate infestations.
- Initiate a public education effort to acquaint the populace with the threat of and measures to prevent the spread of European Water Chestnut.
- Consider installing specific signage and/or boat/gear cleaning equipment at high-use public access points within infested waters.
- Evaluate inclusion of European Water Chestnut on the invasive species lists in 58 Pa. Code §71.6 and §73.1.
- Encourage the incident reporting of aquatic invasive/nuisance species such as European Water Chestnut within Pennsylvania. Online reporting can now be conducted at the following PFBC web site:
<https://pfbc.pa.gov/forms/reportAIS.htm>
as well as PA iMapInvasives at:
<https://www.paimapinvasives.org/>
and at the national level, USGS Nonindigenous Aquatic Species website:
<https://nas.er.usgs.gov/SightingReport.aspx>

- Keep informed with research concerning the use of biological/chemical controls.
- Monitor water chestnut infected waters and inventory nearby or suspected waters.
- Monitor infected waters that have been exposed to eradication procedures for a minimum of 15 years.

Rapid Response Options:

- Consider and encourage eradication efforts in localized, new invasions
- European Water Chestnut infestations should be eradicated before seed release in early summer. Each infestation will need to be assessed for removal options that may include hand pulling by boat, the use of mechanical harvesters, and/or chemical eradication with the herbicide 2,4-dichlorophenoxy acetic acid (Hummel and Kiviat 2004). Due to the fact seeds may persist in sediments for a number of years, all of the above control methods typically must be repeated yearly over a long-term period to successfully control infestations. Additionally, combinations of hand pulling and/or mechanical harvesting are typically coupled with herbicide treatments for effective management. Grass Carp have been used as a biological control with limited success (Hummel and Kiviat 2004).

References

- Eyres, W. 2009. Water Chestnut (*Trapa natans L.*) Infestation in the Susquehanna River Watershed:



Population Assessment, Control, and
Effects, Occasional Paper No. 44,
Biological Field Station, Oneonta, NY,
SUNY at Oneonta.

Hummel, M., and Kiviat, E. 2004. Review
of world literature on water chestnut
with implications for management in
North America. *Journal of Aquatic Plant
Management*. 42: 17-28.

Ling, C. 2009. *Trapa natans*. USGS
Nonindigenous Aquatic Species
Database, Gainesville, FL.
([http://nas.er.usgs.gov/queries/FactSheet.aspx](http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=263) ?Species ID=263, April 26, 2010).

Maryland Sea Grant. 2007. Invasive Species
in the Chesapeake Watershed, Water
Chestnut (*Trapa natans* L.)
(http://www.mdsg.umd.edu/issues/restoration/non-natives/workshop/water_chestnut.html)

O'Neill, C.R., Jr. 2006. Water Chestnut
(*Trapa natans*) in the Northeast. New
York Sea Grant, Invasive Species
Factsheet Series: 06-1. New York Sea
Grant, SUNY College at Brockport.
(<http://www.seagrant.sunysb.edu/ais/pdfs/WaterChestnutFactsheet.pdf>).