Water Chestnut (*Trapa natans*) in the Northeast

NYSG Invasive Species Factsheet Series: 06-1

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Introduction

If someone who owns shoreline property in New York or the Northeast complains to you about their water chestnut problem, don't think they are talking about Chinese takeout. The European water chestnut (*Trapa natans*), an invasive aquatic plant that was inadvertently released into waters of the Northeast in the late 1800s, is slowly, but inexorably, spreading throughout New York State, clogging waterways and ponds and altering aquatic habitats.

1. *Trapa* rosettes on water surface (TNC)

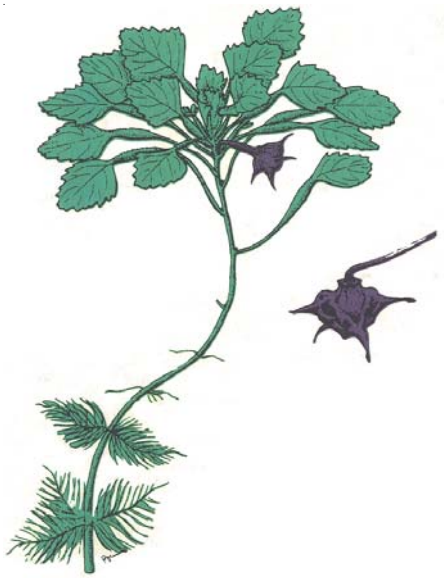
The water chestnut is native to Europe, Asia and Africa. In its native habitat, the plant is kept in check by native insect parasites. These insects are not present in North America and the plant, once released into the wild, is free to reproduce rapidly. *Trapa* colonizes shallow (less than 16 feet deep) areas of freshwater lakes and ponds, and slow-moving streams and rivers, where it forms dense mats of floating vegetation. Water chestnut favors nutrient-rich waters with a pH range of 6.7 to 8.2 and an alkalinity of 12 to 128 mg/l of calcium carbonate.

2. *Trapa* rosette showing nuts and inflated leaf petioles (USACE)

It should be pointed out that this plant species is not the same as the "water chestnut" (a tuber from a different plant) which can be purchased in cans at the supermarket and which is used in Asian cooking. The fruits of *Trapa natans*, however, are used as a source of food in Asia and have been utilized for their medicinal (and claimed) magical properties.

Identification and Biology

The European water chestnut is a rooted aquatic plant with submersed and floating leaves. The feathery submersed leaves form whorls around the stem; the 3/4 to 1 ½ inch glossy green floating leaves are triangular with toothed edges and form rosettes around the end of the stem. Single small, white flowers with four 1/3-inch long petals sprout in the center of the rosette.



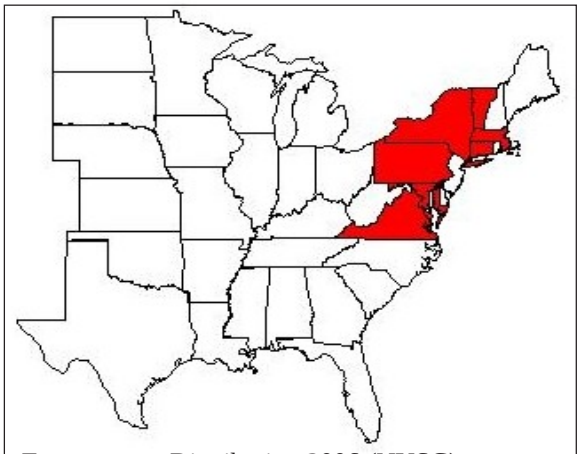
3. *Trapa*, showing floating leaves (top), submerged leaves (bottom left) and nut (right) (after: CTRIVCOORD)

The plant's cord-like stems are spongy and buoyant and can reach lengths of up to 16 feet (although typical lengths tend to be in the six to eight foot range). The stems are anchored to the bed of the waterbody by numerous branched roots.

Water chestnut is an annual that dies back at the end of each growing season. Seeds germinate in the spring with each seed producing 10 to 15 rosettes with each rosette capable of producing up to 20 seeds. The plants starts to produce hard, nut-like seeds in July with the seeds ripening in about a month. The inch to inch and a half wide fruits grow under water and have four very sharp spines, which can lead to injuries when stepped on. Overwintering of populations is accomplished through the mature, greenish brown seeds sinking to the bottom where they can remain viable in the sediment for up to 12 years. Old nuts, black in color, will float and are not viable.

Trapa seeds generally fall almost directly beneath their parent plants and serve to propagate the parent colony. Some seeds, however, or plant parts (rosettes) that still contain seeds, may be moved downstream in currents. Ducks, geese and other waterfowl may also play a role in the seeds' dispersal (the spiny nuts have been observed tangled in the feathers of Canada geese).

Distribution



Trapa natans Distribution 2006 (NYSG)

The water chestnut 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. The plant was introduced into Collins Lake near Scotia, NY (in the Hudson River-Mohawk River drainage basin) around 1884, possibly as an intentional introduction for waterfowl food or as a water garden escapee.

The first Great Lakes Basin introductions were sometime before the late-1950s in Keuka Lake (one of NY's Finger Lakes). *Trapa* can also be found in the Oswego River, a tributary of Lake Ontario; in Sodus Bay on Lake Ontario; in the Seneca River; and in Oneida Lake. These introductions may have been a result of transit through the Erie Canal, which connects to the Mohawk River.

A major infestation of more than 300 acres exists throughout some 55 miles of Lake Champlain between New York and Vermont. Water chestnut can now be found in Connecticut, Maryland, Massachusetts, New York, Pennsylvania, Vermont and Virginia, and in the Canadian Province of

Quebec in a tributary of the Richelieu River (most likely from a northward expansion of the Lake Champlain infestation).

Physical, Ecological and Economic Impacts

Water chestnut has become a significant nuisance throughout much of its range, particularly in the Hudson, Connecticut and Potomac Rivers, and in Lake Champlain. The plant can form nearly impenetrable floating mats of vegetation. These mats create a hazard for boaters and other water recreators. The density of the mats can severely limit light penetration into the water and reduce or eliminate the growth of native aquatic plants beneath the canopy. The reduced plant growth combined with the decomposition of the water chestnut plants which die back each year can result in reduced levels of dissolved oxygen in the water, impact other aquatic organisms, and potentially lead to fish kills. *Trapa's* rapid and abundant growth can also out-compete native aquatic vegetation.

4. Water chestnut infestation on Lake Champlain (USACE)

5. A major river infestation (Mehrhoff, IPANE)

Another effect of dense populations of water chestnut, related to the reduction in dissolved oxygen under the plant, is the migration of small fish from under the canopy to the edges of the vegetative mat. The resulting concentration of small fish can result in a concentration of larger game fish attracted to the veritable "smorgasbord" at the fringe. This can also result in recreational anglers being drawn to the concentration game fish.

Water chestnut has little nutritional or habitat value to fish or waterfowl and can have a significant impact on the use of an infested area by native species. As mentioned earlier, the sharp, spiny nuts can result in puncture injuries to swimmers and recreators walking along the shore of infested areas.

Because of its invasiveness and the severity of its impacts, the species has been listed under the federal regulations that prohibit the interstate sale and transportation of noxious plants.

Water Chestnut Control

It is much easier (and less expensive) to control newly introduced populations of water chestnut. Therefore, early detection and a rapid response are the key to preventing substantial, high-impact infestations. Small populations of water chestnut, found in the early stages of colonization, can be controlled by hand pulling by volunteers in canoes or kayaks. Kayaks are more maneuverable and can be used in shallower water; canoes can carry more vegetation.

Large infestations usually require the use of mechanical harvesters or the application of aquatic herbicides. Mechanical harvesting can remove the thick mats of vegetation in situations where boating and angling are negatively impacted. However, this is just a temporary measure as the plants will grow back the next season from seeds on the bed of the waterbody. Harvesting before the plant can form ripe

seeds can be part of a long-term control strategy, but due to the long time seeds can remain viable insediments, treatment generally is needed for up to 10 years to ensure complete eradication. The same holds for the use of herbicides. Long-term treatment (mechanical or chemical) can be very expensive. From 1982 through 2001, the states of New York and Vermont spent more than $4.3 million on *Trapa* control measures on Lake Champlain.

6. Hand pulling from canoes is a viable control of early infestations. (TNC)

Research is underway at Cornell University to find biocontrol insects from *Trapa*'s native China, where such predators help keep the plant in check. *Galerucella birmanica* appears to be a good candidate **if** it can be shown not to negatively impact native North American plants.

For more information visit the *Ecology and Management of Invasive Plants Program* at www.invasiveplants.net and the *NorthEast Water Chestnut Web* at www.waterchestnut.org.

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