Trapa natans L.

Water chestnut

Family: Trapaceae
Range: Not yet present in the western United States. Currently invasive in the northeastern United States, but is expected to eventually be introduced into other areas of the country.
Habitat: Lakes, ponds, canals, and slow water; grows best in shallow, nutrient-rich lakes and rivers.
Origin: Originally thought to be native to warm temperate parts of Eurasia and Africa; more recent work considers it of Asian origin. *Trapa natans* produces a nut-like fruit that can be cooked or eaten raw and has been cultivated in China and India for at least 3,000 years. 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 escaped cultivation and was found growing in the Charles River by 1879.
Impacts: Water chestnut is very competitive with desirable aquatic species in shallow waters with soft, muddy bottoms. It can develop nearly impenetrable mats across wide areas of water, which can block light penetration, reduce oxygen levels leading to fish kills, and impact fishing and recreational activities. The nuts drift to shore where their sharp spines may hurt bare feet.
Western states listed as Noxious Weed: Arizona, Oregon, Washington

Water chestnut is an annual aquatic weed with a submerged stem anchored to the mud and extending upward to the surface of the water. The plant has both submersed and floating leaves. The feathery submersed leaves form whorls around the stem. The floating leaves are fan-shaped, triangular with toothed edges, 0.75 to 1.5 inches long, forming rosettes which float on the surface. Each leaf has a spongy inflated petiole that enables the rosette to float. The plant produces new leaves from a central terminal meristem in the rosette. The plant's cord-like stems are spongy and buoyant and can reach lengths of up to 16 ft (more typically six to eight feet). The stems are anchored to the substrate by a branched system of fine, long, profuse roots.

Inconspicuous flowers are borne in the axils of younger leaves above the water, in the center of the rosette. The flowers have four white petals 0.3 inches long. Once the flowers are pollinated by insects, the flower stalks curve downward and the fruit develops under water. Each flower produces a large, woody nut with four barbed spines derived from the flower sepals. When mature, the fruits fall from the plant and sink to the bed where they have a dormancy period of 4 months. The horns may act as anchors to limit the movement of the seeds, keeping them in suitable depths of water. The seeds overwinter at the bottom of the water body and germinate during the warm season. The newly developed shoot grows to the water surface, where the rosette is formed. A single seed may give rise to 10 to 15 rosettes, each producing up to 15 to 20 seeds. Reports indicate that seeds can remain viable for 5 to 12 years. However, most seeds probably germinate in the first 2 years. Water chestnut can disperse both vegetatively and by seed. The rosettes can detach from their stems and float to another area, or more often the nuts are dispersed by currents or waves.

NON-CHEMICAL CONTROL

Mechanical (pulling, cutting, disking)	Hand removal is an effective means for eradication of smaller populations; *Trapa natans* roots are easily pulled. It is important to remove the whole plant because floating plants can spread seeds downstream. The potential of *Trapa natans* seeds to lay dormant for up to 12 years makes total eradication difficult. Hand harvesting from canoes and raking have been effective and are a means to promote community involvement.
Cultural	The aggressive and competitive characteristics of *Trapa natans* make cultural practices problematic.

	Dewatering alone has not been found to destroy the seed bank. Prevention of new infestations and early detection are the best approaches. Since the *Trapa* genus contains plants that are in the food trade, public education about the risk and impacts of releases can help prevent introductions.
Biological	A leaf beetle (*Galerucella birmanica*) and moth (*Nymphuline pyralid*) found feeding on water chestnut in its native range were thought to have biocontrol potential but were found to be generalist feeders. Other insects observed feeding on the plant have not been shown to give effective control. The grass carp *Ctenopharyngodon idella* can be used to control water chestnut but is a nonselective herbivore that will almost certainly harm native species.

CHEMICAL CONTROL

The following specific use information is based on reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use.

GROWTH REGULATORS	
2,4-D *Weedar 64, Aqua Kleen*	**Rate:** Broadleaf foliar treatment: 2 to 4 pt product/acre (0.95 to 1.9 lb a.e./acre) in a 100 to 400 gal solution/acre. Granular (*Aqua Kleen*) treatment: 100 to 200 lb product/acre **Timing:** Postemergence, to foliage or as granular treatment from spring to summer. **Remarks:** Check label for restrictions and limits of 2,4-D in water used for various purposes. 2,4-D is typically used only by state and federal action agencies or state and federal programs. Check for changes in labeling for other herbicides such as ALS inhibitors. Triclopyr has also been used for controlling water chestnut, but the efficacy is similar or worse than 2,4-D.

RECOMMENDED CITATION: DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.