

Three Years of Water Chestnut (*Trapa natans*) Management in New York's Lower Hudson Valley

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Background

Water chestnut (*Trapa natans*) is a prolific aquatic invader that spreads rapidly once introduced. It forms dense surface mats that reduce sunlight penetration through the water column, shading out submersed aquatic plants; it also reduces dissolved oxygen, hosts low invertebrate levels, provides unsuitable fish habitat, and can entangle animals (Hummel & Kiviat 2004). Water chestnut monocultures likewise create hazards for recreational users. With these detrimental impacts, water chestnut management is critical to protect aquatic ecosystems, yet managing remains difficult, as seeds remain viable in sediment for up to 12 years (Kishbaugh & McGlynn 2020).

Water Chestnut in the Hudson Valley

Water chestnut was intentionally introduced into the state of New York as an ornamental plant in the late 1800s and reached the Hudson River by the 1930s. It became well-established by the 1950s and has remained so in the Hudson River today (Hummel & Kiviat 2004). Younger populations of water chestnut are also present within inland waterbodies throughout the Lower Hudson Valley region in varying densities.



Figure 1. Examples of dense water chestnut infestations at an inland lake (left) and the Hudson River (right). Photos: Lower Hudson PRISM

Our Program

The Lower Hudson PRISM Aquatic Invasives Strike Force (AISF) is committed to preventing the spread of aquatic invasive species through outreach to active users of New York's waterways while supporting management efforts through early detection surveys and manual removal of target species, with significant effort going toward water chestnut control. Control includes:

- Manual hand-pulling from inland lakes and priority Hudson River sites from the end of June-early August
- Effort from the AISF crew, site staff, and volunteers
- Removal of all plant parts (rosettes, stems, roots, seeds)
- Removed biomass collected in garbage bags or left to decompose at least 100 feet away from shoreline

Is Management Feasible?

While water chestnut is classified as a Tier 3, or established, plant species within the Lower Hudson region (Fig. 2) due to its decades-long infestation of the Hudson River, younger populations found in inland lakes have the potential for eradication or suppression via hand-pulling programs, as demonstrated by our program.

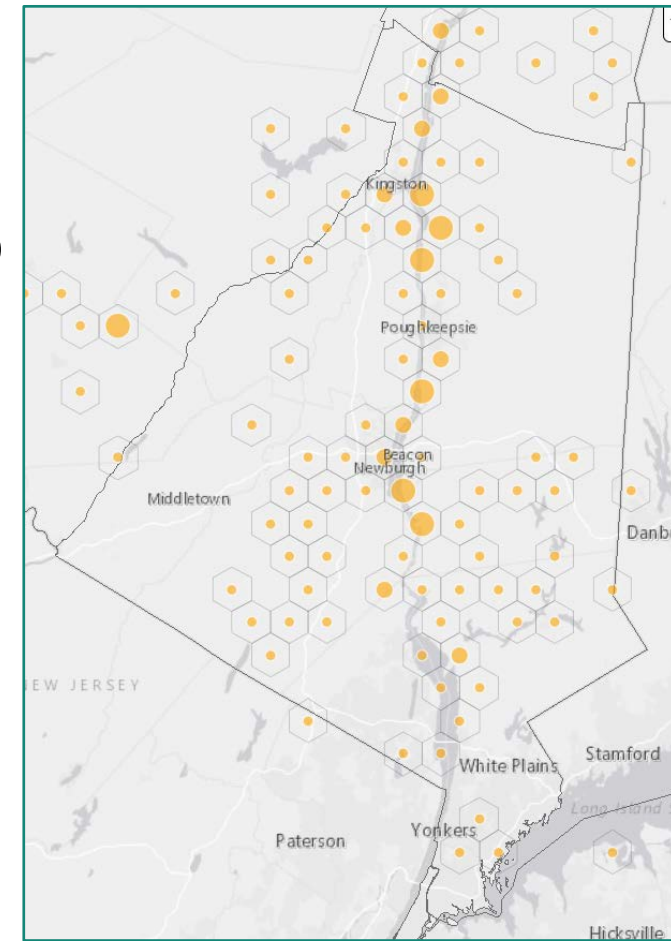


Figure 2. Current distribution of water chestnut in the Lower Hudson PRISM, as reported in iMapInvasives. © 2021 NatureServe

Management Goals

Eradication:

- Less than 5 acres and/or trace to sparse in density
- Potential for complete treatment (all plants removed)
- Determined successful once infestation decreases to zero upon defined follow-up

Suppression:

- Greater than 5 acres and/or moderate to dense in density
- Cannot be fully treated
- Treated to assist with public access, suppress further spread, and/or protect defined conservation targets
- Determined successful if there is a reduction in percent cover or infestation size does not increase upon defined follow-up



Figure 3. The 2019-2021 AISF Crews removing water chestnut throughout the Lower Hudson Valley with the help of community volunteers. Photos: Lower Hudson PRISM

Metrics Collected

During AISF's water chestnut pulls, specific metrics are documented in accordance with statewide management metrics and PRISM guidelines. Metrics include:

- Extent of infestation
- Acreage of treatment area
- Density of infestation
- Effort in hours
- Number of plants removed
- Approximate biomass removed

Water Chestnut Management in the Lower Hudson Valley (2019-2021)

The Aquatic Invasives Strike Force performed annual removals of water chestnut between the end of June and the beginning of August from 2019 to 2021. Water chestnut was removed from 14 sites in 6 counties (Westchester, Putnam, Ulster, Rockland, Dutchess, and Orange) over a total of 45 days. 276,000 plants (or 50,500 pounds of wet biomass) were removed from 49 acres.

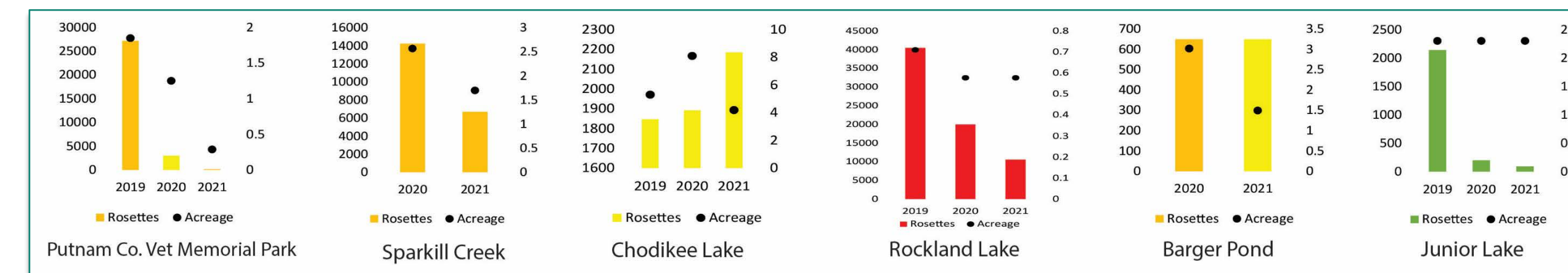


Figure 4. Rosettes and surface area (acres) removed from priority sites from 2019-2021. Density of infestation is represented by color; trace (green), sparse (yellow), moderate (orange), and dense (red). Only sites with multiple years of treatment are included.

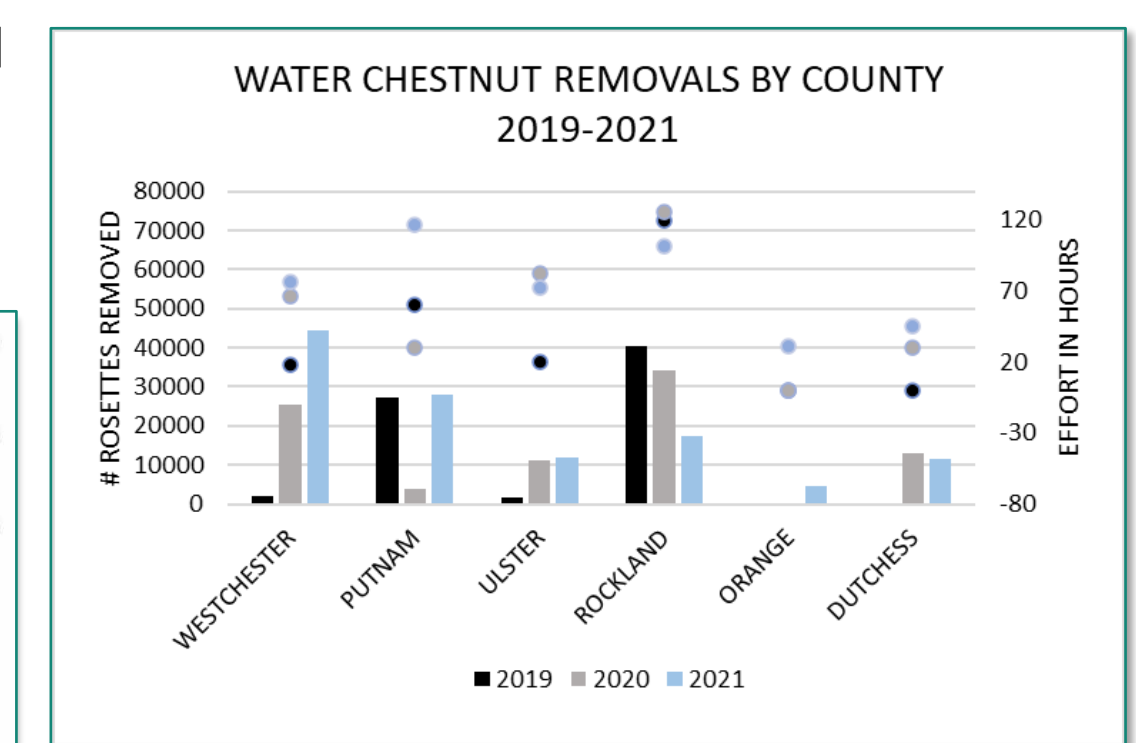


Figure 5. Plants removed by county, plotted against effort in hours.

Stories of Success

The AISF's rapid response efforts using manual removal techniques have been effective at successfully reducing the size or preventing the expansion of six water chestnut populations, including priority sites in Putnam County Veterans Memorial Park and Rockland Lake State Park.

Putnam County Veterans Memorial Park

Water chestnut was unintentionally introduced into a small lake that has public swimming access in 2017 or 2018. Due to the sharp, four-horned outlets that began to litter the beach area and create a safety concern, removal efforts were needed to prevent the young infestation's continued growth. Although this site has not yet reached zero water chestnut plants, it demonstrates that rapid response efforts using manual removal techniques of younger populations can be successful in reducing and even eradicating infestations.



Figure 6. The lake at Putnam County Veterans Memorial Park has experienced a 99% decrease in water chestnut after three years of management. The AISF crew pulled 27,159 plants in 2019, 3,056 in 2020, and just 180 plants in 2021. Photos: Lower Hudson PRISM

Rockland Lake

The AISF began treating Rockland Lake in collaboration with the New York State OPRHP Water Quality Unit in 2019. Since then, the primary focus for management has been in the section of the lake nearest to the public boat launch to keep this area accessible as well as suppress the continued expansion of the infestation. We have observed a notable decrease in the abundance of water chestnut near the boat launch since 2019. This is a promising sign that the infestation is not expanding, demonstrating that manual removal can be successful at preventing further spread of water chestnut populations.



Figure 7. The AISF crew and OPRHP staff pulled 40,468 plants in 2019, 19,960 in 2020, and 10,525 plants in 2021. Photos: Lower Hudson PRISM

Looking Ahead

These findings support the need for continued expansion of agency and non-governmental organization programs to more effectively deploy early detection-rapid response management teams to prevent the continued spread of water chestnut throughout New York state.

For the AISF's ongoing and future projects, a framework will continue to be followed to evaluate timelines and successes:

- Year 1: Removal performed and record entered into iMapInvasives
- Years 2-5: Same as Year 1, with additional follow-up site checks and removals if necessary; project reassessment to determine feasibility of continue manual treatment in Year 3
- Year 6+: Project re-assessment or moves into post-treatment monitoring stage

References

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

Kishbaugh, S. A. & McGlynn, C. (2020). Waterchestnut. In Gettys, L.A., Haller, W.T., & Petty, D.G. (Eds.). *Biology and Control of Aquatic Plants: A Best Management Practices Handbook* (Fourth Edition) (pp. 65-70). Aquatic Ecosystem Restoration Foundation (AERF).

iMapInvasives: NatureServe's online data system supporting strategic invasive species management. © 2021, NatureServe. Available at <http://www.imapinvasives.org>. (Date accessed: 08/11/2021.)

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