Capital Region PRISM
Partnership for Regional
Invasive Species Management

capitalregionprism.org

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Water Chestnut (*Trapa natans*) Response Guidelines for Mechanical Harvesting

Water chestnut (*Trapa natans*) is a high threat aquatic invasive species that can have considerable ecological and economic impacts. The following Aquatic Invasive Species (AIS) Response Guideline outlines the steps for the mechanical control of large (>0.50 acre) water chestnut infestations. The procedures outlined within this document are meant to serve as a guide for municipalities, lake associations, or other entities to follow when designing and implementing a control project.

The goals and objectives for conducting a mechanical response should be well defined with clear objectives and anticipated outcomes. Harvests to control water chestnut require sustained efforts and funding over time for success. Please reach out to the CR-PRISM for assistance when starting a control project. Volunteer groups or community scientists seeking to conduct small novel removals of water chestnut should consult the CR- PRISM's "Water Chestnut Response Guidelines for Manual Removal Efforts."

The Capital Region Partnership for Invasive Species Management (CR-PRISM) is a collaborative organization created to address the threat of invasive species. CR-PRISM is a not-for-profit hosted by the Cornell Cooperative Extension of Saratoga County. The CR-PRISM strategically operates across eleven counties and is financially supported by the Environmental Protection Fund as administered by the New York State Department of Environmental Conservation (NYS DEC). The CR-PRISM is one of eight Partnerships for Regional Invasive Species Management in New York State. The CR-PRISM works in collaboration with partner groups to promote prevention, education, and outreach strategies, create early detection and response networks, and execute best management practices for invasive species control including post-treatment monitoring and restoration actions. The goal of these efforts is to protect conservation targets within our communities and slow the spread of aquatic and terrestrial invasive species.

Topics in this response guideline include the following information.

- Statement of problem, water chestnut biology, and background.
- Procedures and methods to conduct a mechanical harvest through a framework of response.

Step 1. *Identifying Management Goal & Objectives*
Step 2. *Determine the Size and Distribution of AIS*
Step 3. *Identifying Funding Opportunities*
Step 4. *Permissions and Permitting*
Step 5. *Equipment and Materials*
Step 6. *Scheduling Event*
Step 7. *Methodology*
Step 8. *Disposal and Permitting*

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Water Chestnut Biology and Background

Water chestnut is a New York State Prohibited Invasive Species and cannot be knowingly possessed with the intent to sell, import, purchase, transport or introduce. The New York State Natural Heritage Program Tier Rankings lists water chestnut as a high threat tier four (widespread) aquatic invasive species with significant negative impacts.

Water chestnut (*Trapa natans)* colonizes areas of freshwater lakes and ponds and slow-moving streams and rivers, where it can form dense mats of floating vegetation. These floating dense mats cause problems for boaters and swimmers and negatively impact aquatic ecosystem functions. They can cause a decrease of dissolved oxygen content in the water column, alter submersed plant and animal communities, and decrease biodiversity by outcompeting native aquatic plants. Water chestnut may reduce real estate values and economically impact businesses and marinas. The aquatic invasive plant was introduced to the northeast more than a century ago and is widespread. Water chestnut grows in the littoral zone; this is the shallow area surrounding a waterbody that leads to land.

Water chestnut is an annual, rooted floating aquatic invasive plant species. Water chestnuts typically surface in late May to mid-June in the Capital Region. It has both submerged and floating leaves which are different in appearance. Submerged leaves are feather-like and somewhat delicate and can resemble a milfoil; triangular floating leaves are more easily identifiable with their toothed edges and inflated stems (petioles). The plants grow in water up to 0.3-2.0 meters deep and their stems can be up to five meters long. The floating leaves form a rosette around the central stem.

Each rosette has the capacity to produce twenty seeds (also known as fruits or nutlets). Mature seeds are light green and typically mature by late July to mid-August within the CR-PRISM. The seeds are easily identifiable with four sharp barbs and may be transported by waterfowl, floating dispersal, boats/trailers, fishing equipment, and improper disposal. Seeds fall from the rosette into the sediment and contribute to the "seed bank." Because seeds remain viable for up to 12 years, management of water chestnut requires a long-term commitment.

Procedures and Methods to Conduct a Mechanical Water Chestnut Harvest

Step 1: Identifying Management Goals and Objectives

In the initial planning stages of a water chestnut control project, a framework of response should be thoroughly vetted for sustainability. Stating clearly defined goals and objectives is paramount prior to committing to a mechanical harvest. Success is dependent on identifying available resources, setting realistic targets for removal, and constructing a scope of work that is clearly defined over time. Control projects typically can be justified based on a need to improve one or more of the following factors. The ecological significance of the environment, recreational benefits for the public, economic vitality of an area, and emergency access to the water. The Capital Region PRISM uses a Water Chestnut Prioritization for internal work efforts and maybe of value in creating a scope of work. The size, density, and longevity of preexisting sites are also considered. Populations less than

(≤0.50 acre) in size can typically be locally eradicated using manual pulling techniques. Larger populations with high densities require mechanical (harvesters/hydro rakes) or chemical controls.

In all cases, control requires commitment, resources to perform the work, and funding to support the project over time. Annual harvest will need to be executed over time to deplete the seed bank. A reduction in plant density and abundance can become apparent after 2-3 years depending on site characteristics.

Example goals:

- *Clear an area for recreational purposes.*
- *Create a pathway for emergency access.*
- *Clear a boat launch, slip, or floating dock.*
- *To protect a conservation target or threatened species in critical habitat.*
- *To prevent the spread of the aquatic invasive species into an uninvaded area*

Step 2: Determine the Size and Distribution of the Infestation

Setting a goal requires one to assess the size and extent of the infestation targeted for removal. Monocultures greater than a half-acre (> 0.50 acre) or multiple sites greater than a half-acre are best controlled through mechanical harvesting. Monocultures are typically very dense mats that are entrenched within an area. Note the photograph below. Trace or sparce populations may be removed by hand depending on the size of area covered by the plant.

Documenting the size of the infestation will aid in understanding the feasibility of a control project, the best management approach, and potential commitment of time. Pre- and post-treatment assessments of the size of an infestation can also help determine if control efforts deployed are an effective tool relating to project goals.

To determine the size and distribution, a small watercraft may be required for shoreline access. A step-by-step guide is available on the iMapInvasives, Documenting Water Chestnut Efforts webpage. iMapInvasives is a free statewide database for reporting invasive species and management. The CR-PRISM is available on a limited basis to assist with the initial delineation of an infestation.

Step 3: Identifying Funding Opportunities

Aquatic invasive species management can be costly over time. Sources for funding projects should be identified early in the pre-planning phase. Entities selected to conduct a mechanical harvest will need to draft a budget schedule. A quick quote for bids based on a draft scope of work can be solicited from contractors to provide the true cost for developing a budget. A draft template for an RFQ/RFB can be obtained from the CR-PRISM office. The CR-PRISM can assist entities seeking to control water chestnut by helping with start-up recommendations, grant applications, monitoring, and volunteer engagement for community outreach.

A budget schedule should at minimum have a breakdown of cost and services for:

Budget Schedule	
1. Cost per Acer or Cost Per Hour for Treatment	*Year 1,2,3…. (ex $3,625/Acre)*
2. Period for Services to be Completed	*Year 1 July, August, etc.*
3. Method of Removal	
4. Insurance Costs and Incidentals	
5. Permitting Fees	
6. Disposal Method, Transportation, & Other Fees	

Funding sources do exist for invasive species management. Funding opportunities from various entities are open annually and sometimes rotationally every two to three years depending on the originating source. Funding sources, when announced, typically will open application windows for submission in a brief period of time, usually between 3-6 weeks. A recommendation is to seek out appropriate funding sources prior to an announcement several months in advance. Using past funding applications, segments of a request can be made well ahead of deadlines ensuring that a quality proposal is submitted.

Example funding sources: (*Subject to change over time*)

- USDA National Invasive Species Information Center
  Funding Available for Tools and Projects that Eradicate Invasive Species. Recognizing the importance of eradication outcomes in invasive species management, the Department of the Interior has announced the availability of up to $3 million in funding from the Bipartisan Infrastructure Law for projects that seek to eradicate invasive species. While control and suppression of invasive species are important in many cases, the emphasis of this funding opportunity is on eradicating them from a defined area where it is a feasible and achievable management goal.
  - *https://www.invasivespeciesinfo.gov/subject/grants-and-funding*

- Mohawk River Basin Program Watershed Grants
  DEC provides funding through the Mohawk River Basin Program to implement priorities outlined in the Mohawk River Basin Program Action Agenda aimed at conserving, preserving, and restoring the environmental quality of the Mohawk River watershed while managing the resources of the watershed for a sustainable future. Since 2012 over $400,000 has been awarded for projects that helped fulfill the goals and objectives of the Action Agenda within the geographic boundaries of the Mohawk River Watershed. The funding for this program is from New York State's Environmental Protection Fund. Read the Request for Applications (RFA) for more information.
  - *https://dec.ny.gov/nature/waterbodies/lakes-rivers/mohawk-river-watershed/grants*

- NYS DEC Invasive Species Grant Program
  The Invasive Species Grant Program Request for Applications (RFA) provides details on the project objectives, application process, eligible expenditures, evaluation criteria, and contractual requirements. Release of funds is intermittent about every three years.
  - *https://dec.ny.gov/nature/invasive-species/resources-regulations/invasive-species-grant-program*

Step 4. Check for Permissions and Permitting to Perform the Work

Dependent on the type of waterbody, private, local, state, and/or federal permits may or may not be needed. All permits should be obtained at least three months prior to an activity. Access points and written permissions should also be secured depending on ownership. Secure written permission from all property owners from access points, right aways, and landowners including those who own property below the water's surface. Identify and follow all local municipality ordinances.

In addition, checks for rare, threatened, or endangered species in the control area should be explored. Contact the New York State Natural Heritage Program or discuss with your local PRISM to determine if species of concern or high conservation values are present to take necessary precautions to protect those assets. The lead entity is responsible for obtaining the proper permits. Consult with the New York State Department of Environmental Conservation Regional Permitting Office to determine what permits may be required.

Resources for Permitting

1. DEC Statewide Offices Contact Information
   - For questions contact your Regional NYS DEC Permit Administrator!
2. General Permit for Management of Invasive Species
   - Types of: General Permit For the Management of Invasive Species (GP-0-15-005/GP-0-21-004)
   - General Permit Application: GP-0-21-004
   - Protection of Waters Program: Article 15
3. Freshwater Wetlands Permitting
   - ECL Article 24 Freshwater Wetlands
   - Freshwater Wetlands Joint Application Form
4. The Environmental Resource Mapper (ERM) can be used to identify protected streams based on their classification and to create simple maps as part of the permit application process if needed.
5. Additional permitting may be required for the disposal and/or transportation of plant material. Please refer to the end of this document for additional information.

Step 5. Equipment and Materials

Larger infestations in open water or coves will require mechanical harvesting techniques. There are several different types of aquatic harvesters available to remove aquatic invasive species. Various mechanized harvesters will have advantages and disadvantages of use based on shoreline and open water depths. The type of machinery selected should be based on available finances for equipment or services, desired goal of removal project, and bathymetry of the location.

Equipment procurement, maintenance, and operation of machinery can be done internally by an entity or subcontracted to a commercial business. Procurement of a harvester or the subcontracting of business to do the work will have different cost and price points depending on availability of services. The different actions of machinery that pulling, dig/dredge, or cutting biomass may trigger different permitting requirements. Products and services can readily be identified through web-based internet searches or contact your local PRISM for assistance. The general description of mechanical harvesters and methods below are provided to help in the initial planning stages of a removal effort.

Large Infestations Consider:

Aquatic harvesters are for large infestations in bigger waterbodies and are used to remove floating and submerged aquatic weeds (such as water chestnut, water hyacinth, and Eurasian watermilfoil).

- Equipment is typically large and handles higher volumes of biomass.
- Does not work well in shallow shoreline environments.
- Will require a method to offshore AIS collected.
- Higher cost for operation and maintenance.
- Potentially can remove beneficial native aquatic plants.

Moderate to small shoreline Infestations Consider

Hydro-raking (mechanical raking) is used as an effective technique for selective removal of nuisance and rooted vegetation. The hydro-rake can also be used to clear accumulations of unconsolidated materials and detritus (i.e., decaying leaves, peat, etc.) from the lake or stream bed. Hydro-raking can be effective in removing all organic debris from the bottom of a water body.

- Operates in water depths ranging from eighteen inches to ten feet.
- Removes plants, roots systems, as well as decaying organic matter.
- Can be used to dump Aquatic Invasive Species Waste on shore into a roll off container for disposal.
- Clears selective areas including beaches as well as boating lanes.
- Removes plants and debris at the sediment-water interface.
- May cause heavy siltation and turbid waters.
- May trigger the need for a Protection of Waters Program Permit as the bed of a stream may be disturbed like dredging. If in a Freshwater Wetland a Permit may also be needed.
- Potentially can remove beneficial aquatic plants.

Aquatic Weed Cutters (mechanical cutting) cut the surface layer of floating vegetation. These amphibious devices mow and collect aquatic invasive species that are on the surface.

Removes plant debris from the surface.

- Compact small and efficient form of a hydro-rake.
- Does not cause as much siltation and works in shallow water.
- Can be used to dump aquatic invasive species waste on shore into a roll off container for disposal.
- Treatment window for surface cutting is critical for management.
- Removes smaller shoreline infestations.
- Potentially can remove beneficial aquatic plants.

Aquatic Weed Conveyers

Offloading conveyors function as an unloading bridge between land and water for harvesters. Conveyers elevate aquatic biomass from a mechanical harvester up into a waiting dump truck or roll off dumpster cart for disposal. Aquatic invasive species should not be released back onto the environment after removal. All materials should be rendered non-viable and disposed of properly to prevent their re-release back into the environment.

Chemical Treatments

No single herbicide is appropriate for controlling all invasive aquatic plants (or nuisance growths of native aquatic plants), in all situations. An herbicide may perform differently depending on the waterbody, its use, the time of year or even the time of day. Therefore, aquatic plant managers must have a thorough understanding of how each herbicide acts. In general, chemical controls can be successful at reducing water chestnut, and typically utilize 2,4-D or triclopyr herbicides. Several years of treatments are necessary to kill seedlings as they re-populate the area.

In 2008, USEPA approved the use of imazamox for the control of vegetation in and around aquatic sites and terrestrial non-crop sites. Imazamox is herbicidally active on submerged, emergent, and floating broadleaf and monocot aquatic plants in and around standing and slow-moving water bodies. Other products should be reviewed for consideration.

Step 6. Timing for Conducting a Harvest or Treatment

Early in the season (May/June): Water chestnuts emerge from seed.

- Plant growth will emerge from germinated seeds in bottom sediment. Small floating rosettes will be observable on the water surface.
- Seeds will be immature and still secured to the underside of the floating rosette.
- Harvest done in the early season may not be as productive or effective as reemergence can occur from the seed bank.

Mid to Late Season (July/August):

- Seeds may be maturing and not fully secured to the floating rosette.
- Recommended window for removal.

Late Season (**mid-August to early September**):

- Mature seeds will start to fall from the rosette in Late July to Early September. Management during this time is ineffective to reduce the population size but can be effective to maintain access. The timing of seed fall can be site dependent.

Step 7. Methodology

Prioritize the work effort. Begin with low density satellite populations, then move into the core of an infestation.

- Strategy prevents smaller manageable infestations from becoming larger.
- This strategy starts with less difficult removals to those more intensive, expensive, and time consuming.

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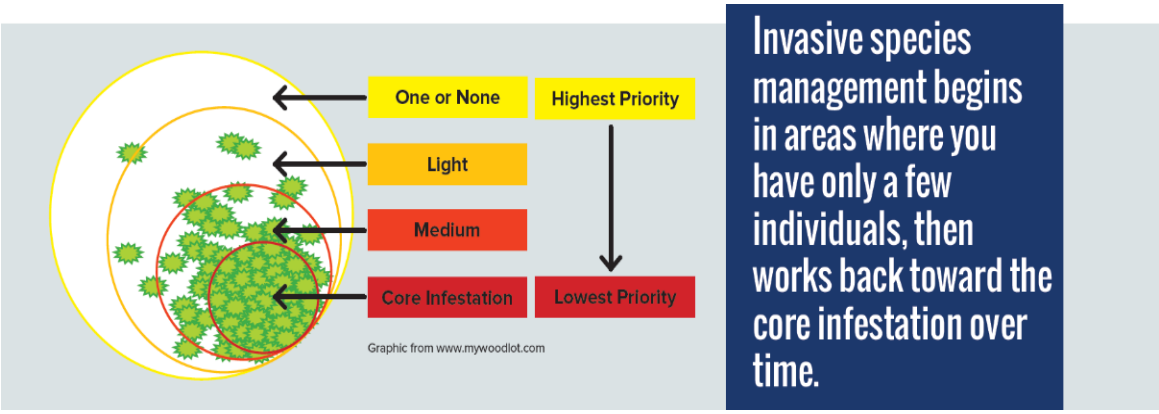

The New York State Department of Environmental Conservation "Managing Invasive Plants in Riparian Areas"

Identify the outer edge of the plant bed and work inward towards the center of the population over time, making sure to remove trace/sparse amounts that are away from the larger floating mat(s). Consider rotational harvests in a single year depending on time commitment and support. Repeat yearly at the same location to reduce the size of the infestation. Over time the seed bank will decrease, and response efforts will be able to become less frequent. Please note that upstream sources of water chestnut may serve as a seed source and continued efforts will be needed. In such cases maintenance of a plant bed for annual weeding may be the management goal as opposed to local eradication.

Step 8. Disposal Permitting

Additional permits may be needed for the proper disposal of invasive species and should be considered early in the planning process.

- Application and Permit : Possess with Intent to Sell, Import, Purchase, Transport, or Introduce a Prohibited Invasive Species for Research, Education, or Other Approved Activity.
- Check with your regional NYS DEC Permitting Office to see if this is needed.
- The disposal method for permitting should describe the release location, or the methods you will use to dispose of the listed invasive species. Proposed disposal methods and protocols should render the invasive species non-viable and prevent the re-introduction and spread of the invasive species during transport to a disposal facility.

When disposing of AIS consider the following:

Securing a vehicle to transport aquatic invasive species biomass.

- AIS should be covered or contained during transport.
- Decontamination of equipment using high pressure hot water (140 Degrees °F).
- Identify fees for needed disposal and budget.

A site for disposal must be identified prior to management.

- Consider composting with a local municipality.
- Burial as compost with a local farm.
- Burial at a reclamation/recovery site for retired mines.
- Processed as biofuel if a biodigester is present.

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Disposal of water chestnut should be organized 4-6 weeks prior to the removal. All fees and costs should be determined and budgeted appropriately. Points of contact for disposal should be provided with an estimated biomass amount and a drop off time. Multiple trips to the disposal site may be necessary. Compost facilities at municipality transfer stations accept this material on a limited basis, it is recommended to contact your local facility. Farmers/landowners will also occasionally accept the material if there is need for compost.

The Capital Region PRISM is here to help serve our communities, please reach out to our staff for assistance.

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