

Managing Aquatic Invasive Species

A Resource Guide for Vermont Lake Managers

AQUATIC INVASIVE SPECIES LAWS

On June 8, 2017, the Vermont Legislature enacted new rules regarding aquatic invasive species to:

Protect water resources, public health and the environment.

Prevent infestations and proliferation of invasive species that result in negative impacts.

Initiate a rapid response to contain and control new aquatic species infestations.

Minimize economic, social, and ecological impacts caused by AIS.

Regulations Include:

Aquatic Plant Transport
Transporting aquatic
plants and plant parts is
prohibited, except for
activities to control their
growth.

Vessel Inspections
All watercraft operators
are required to inspect
their watercraft for
invasive species.

Draining of Vessels
All watercraft operators
are required to drain
their vessels and trailers
of water

10 V.S.A. Chapter 50 § 1451



Effectively Managing Aquatic Invasive Plants

Invasive species are nonindigenous plants, animals, algae, fungi or pathogens that threaten the diversity and survival of native species or the stability of ecosystems, or commercial, agricultural, or recreational activities dependent on these natural resources. Understanding effective ways to manage invasive species within a waterbody can reduce these impacts and threats.



Considerations for Successful Invasive Plant Control:

- 1. **Prevention and Early Detection.** This is the most effective strategy to prevent the spread of invasive species. Encouraging public participation and volunteers to learn to identify the potential threat, consistently search for, and stop new infestations from starting or expanding is an essential step.
- 2. Assess the Situation. A plant survey can provide baseline data that can then be monitored annually. Mapping the areas of native and invasive species and analyzing the extent of the populations will help to inform specific management actions and gauge progress.
- 3. **Develop a Management Plan.** Once an invasive species takes hold, a long-term management plan should be developed that outlines appropriate treatments for specific densities while also considering physical, social, and economic impacts, as well as financial constraints.
- 4. Understand the Management Options. Treatments differ depending on the type of invasive species and the size and extent of the population. Each treatment has certain benefits, risks, and long-term effects. Weighing the options and understanding the realistic annual and long-term strategies from the onset will help achieve the end goals.
- 5. **Timing is Vital.** As populations increase, the costs of removal and deleterious effects also increase. Implementing an early treatment response to a new or expanding infestation is critical. Depending on the treatment method, State Aquatic Nuisance Control permits must first be sought and secured.







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Benefits of Aquatic Vegetation

A healthy lake ecosystem supports a diverse array of aquatic plants, animals, and algae that occur naturally in all water bodies. Generally, this growth is desirable and beneficial. Algae are a primary food source for zooplankton, which provide food for insects and fish. Aquatic plants are crucial to Vermont's fisheries as they provide spawning and nursery areas and shelter from predators. Aquatic plant diversity increases the variety of wildlife in a lake or pond that in turn supports Vermont's revered animals such as loon, moose, and otters. Vegetation in and



around a waterbody provides shade which maintains cold temperatures and oxygen rich waters. Aquatic plants also provide physical structure which stabilizes sediments and prevents erosion.

Aquatic "Nuisance" Vegetation

In most cases of excessive plant and algae growth (non-native or otherwise), nutrients (which can be derived from farm run-off, failing septic systems, and eroding soil) are often the root of the problem. Managing the sources of nutrients provides an effective long-term solution to nuisance plant growth; short-term solutions are addressed in this publication. Although in-lake management tactics for native species is not recommended, there are situations in which it can be considered. But it should be kept in mind that it is not possible or beneficial to attempt to eliminate all aquatic plants or algae, as lakes, ponds, and their inhabitants need aquatic vegetation to remain healthy.



Effects of Aquatic Invasive Species

Many invasive species (those non-native to the state) exhibit characteristics that make them especially able to severely limit the recreational uses of a waterbody, including boating, fishing, hunting, and swimming. This in turn can lead to economic challenges both in the reduction of income from recreational activities, decline in property values, and an increase in costs associated with management.



Invasive species outcompete beneficial native plants and decrease the optimal habitat for aquatic animals. In some cases, growth can limit fish spawning,

habitat and foraging success, and restrict access to areas for fish, birds, amphibians, and mammals. This can have a profound effects on the ecosystem food web. Excessive growth can also make swimming and boating difficult, and decrease the overall aesthetic value of a waterbody. More problematic events such as fish kills, algae growth, and additional invasive species introductions can also occur due to the effects that invasives have on the ecosystem.

The information in this document is intended to guide management of aquatic invasive plants, and determine which control methods require a State permit. Management of nuisance native plant growth is also discussed, but it is important to remember that some amount of plant growth is beneficial and desirable for a healthy lake.



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Aquatic Invasive and Nuisance Species Management

The Vermont Department of Environmental Conservation Lakes and Ponds Program provides technical assistance to lakeshore owners, lake associations, and municipalities to address their options for in-lake management. Potential methods for both invasive and native aquatic vegetation management are listed in the following pages. VT DEC recommends using a holistic approach to sustain the natural ecological function and benefits that plants provide. Therefore, the Lakes and Ponds Program recommends using options that *preserve the quality of the receiving waters, protect the public health, and minimize the impact on the nontarget environment.*



Aquatic Invasive Species Program

The Aquatic Invasive Species Program coordinates management activities associated with both aquatic invasive and nuisance species. Staff survey, monitor, and maintain aquatic invasive population information, as well as implement management and spread prevention

efforts to prevent negative effects associated with nuisance species. The program works collaboratively with other divisions of the Department, the Vermont Department of Fish and Wildlife, and various partners to provide guidance and technical and financial assistance to municipalities, lake associations, and stakeholders. For more information, visit the Program's website at:

http://dec.vermont.gov/watershed/lakes-ponds/aquatic-invasives.

Vermont Lake Assessment & Water Quality Monitoring Program

The primary function of the lake assessment program is to monitor the status and trends of Vermont's waters, including inland waterbodies and Lake Champlain and its tributaries. DEC scientists annually monitor, survey, and assess various parameters to measure the condition and trends of Vermont waterways. These assessments provide the foundation for the EPA National Aquatic Resource Surveys, water quality standards development, surveillance and enforcement actions, and inform public information efforts. Assessment results are uploaded to the Vermont Inland Lake Score Card, a user-friendly interface to share available data on overall lake health with lake users.

http://dec.vermont.gov/watershed/lakes-ponds/data-maps/scorecard.

Lakes and Ponds Permitting

The Vermont Department of Environmental Conservation is responsible for administering the Aquatic Nuisance Control Permit Program as authorized under Title 10, Chapter 50 Management of Lakes and Ponds. A permit is required to use pesticides, chemicals other than pesticides, biological controls, bottom barriers, structural controls or powered mechanical devices for the control of nuisance aquatic plants, insects or other aquatic life including lamprey in waters of the state, and for dredging activities. The Lakes and Ponds Program also oversees the permitting of lake encroachment and shoreland development projects. More information concerning Lake and Ponds Program permits can be found at: http://dec.vermont.gov/watershed/lakes-ponds/permit.



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Aquatic Invasive Plant Management Options

Monitoring for Invasive Threats. The best management tactic is to be on the alert for the introduction of invasive species within a waterbody. Volunteer monitors are the first line of defense, and can provide valuable information by completing annual surveys and patrolling the waters. If a new introduction is confirmed, patrollers can also monitor plants and help to limit the spread, can hand-pull when applicable, and help get the word out for more public involvement. VT DEC trains volunteers annually to join in on efforts to patrol lakes for invasive species while also monitoring native plant health. For more information, go to the



Vermont Invasive Patrollers webpage at: dec.vermont.gov/watershed/lakes-ponds/aquatic-invasives/monitoring/vips.



Spread Prevention. Whether a waterbody does or does not contain an invasive species, a spread prevention program is highly recommended. Education initiatives, Public Access Greeter Programs, and watercraft decontamination stations can assist in stopping the introduction of new invasives through outreach and active watercraft inspection and cleaning. More information on these programs is available at dec.vermont.gov/watershed/lakes-ponds/aquatic-invasives/spread-prevention/.



Hand Pulling Removal. Small patches and early infestations can be removed adequately by hand-pulling the entire plant, roots, shoots, and capturing any fragments. This is appropriate for



relatively small patches, areas around docks, or swimming areas. The frequency with which this task should repeated varies depending on the species, patch size, and the effectiveness of the removal. In deeper water, harvesting by snorkelers or divers can be the most effective removal strategy. This option is minimally invasive to the ecosystem and can specifically target invasive species without disturbing beneficial native plants. Hand-pulling is the recommended option for both invasive and native aquatic plants.

Special Use Permit for Vermont Department of Fish and Wildlife Access Areas

A permit is required to station a Greeter Program at a State-owned public access area. The Vermont Department of Fish & Wildlife Department (VTDFW) requires a Special Use Permit (SUP) to be applied for every season at least thirty-days prior to the implementation of such a program. Contact Mike Wichrowski, VTDFW Facility and Lands Manager, at mike.wichrowski@vermont.gov or call (802) 917-1347 with questions. SUPs can be applied for at https://anrweb.vt.gov/FPR/FPRLicensing/.



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Aquatic Invasive and Nuisance Species Management Options VT DEC Aquatic Nuisance Control Permits Required

Bottom Barriers. Several different barrier materials can be anchored to the lake bottom to effectively eliminate plant growth in the covered area, making this method ideal for small areas around docks and beaches. While effective for small patches of invasive species, when used to control native plants, their elimination may provide an open area for invasive species to colonize. Somewhat expensive in large quantities, bottom barriers are often not feasible for large areas. Bottom barriers must be installed within a certain time period, maintained, and removed prior to winter. Active maintenance is required for this method to be successful.



Suction Harvesting. This method is most effective in removing a targeted species, as trained scuba divers remove plants, roots, and fragments with an underwater vacuum as a collection device. The collected plants are then deposited onshore for composting or removal. Most applicable for rapid response to a new introduction, this option's highly selective methods are capable of containing a population and preventing spread within a waterbody. This method can also be used to harvest small patches within a broader lake management plan and can be used in conjunction with other methods listed here. Because it can be costly to implement, it is often suggested to supplement suction harvesting efforts with volunteer hand-pulling in shallow areas.



Mechanical Harvesting. For large-scale, temporary reduction of nuisance aquatic plant growth, mechanical harvesters provide an option to maintain travel lanes. However, this method can be detrimental in spreading aquatic plant material, which can spread invasive plants to new areas. Therefore, this method is only applicable in limited situations. Harvesters cut vegetation five to eight feet under the water, and then transport the materials to an approved disposal site. Plant beds are generally cut two to three times each summer. Harvesting machines are expensive, often require full-time personnel, and are usually only appropriate for large lakes. This method has been used successfully by the State of Vermont to reduce nuisance water chestnut growth in southern Lake Champlain.



Chemical Treatment. Chemical control using herbicides to treat large in-lake infestations is not a frequently used method in Vermont. However, it can be an effective tool for treating small areas. Considerations for chemical use include social and environmental concerns and acceptance, high costs, and securing a licensed aquatic applicator. Herbicides rarely effect the target species only and continued use is often necessary for desired levels of control. The use of chemical treatments requires comprehensive water quality tests.





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Dredging / Hydro Raking VT DEC Aquatic Nuisance Control Permit Required

Dredging and hydro raking equipment are used by some lake managers to maintain navigation channels and other open-water conditions. They are not appropriate tactics for whole-lake vegetation management as the many negative effects of dredging far outweigh the benefits. Dredging is normally quite expensive, negatively impacts aquatic and terrestrial non-target organisms, and does not provide for long-term control. In case studies, dredging caused unintended secondary invasive species to propagate in the managed areas. Hydro Raking can be used in limited areas to control dense growth.



Bio-controls are employed in some states to manage invasive species by introducing a predatory control that exists in the species home-range. Some bio-controls, however, have the secondary challenge of introducing yet another non-native species to an ecosystem. In some cases, the control species becomes a nuisance as well. The costs associated with research, rearing, transport, and monitoring may also be high, thereby reducing the cost effectiveness for this method over time.



Milfoil weevil (Eurychiopsis lecontei)

After promising research findings in 1989, VTDEC supported the study and use of the native watermilfoil weevil as a control for Eurasian watermilfoil infestations through rearing and stocking programs. However, ongoing research has determined that despite the time and effort, weevil populations were unpredictable and that they were unreliable control agents. Research continues on this potential bio-control, as it has shown promise in some situations. At this time, it is not a recommended effective control method.



Triploid Grass Carp (Ctenopharyngodon idella)

Several states support the introduction a non-native fish originating from China and Russia to control invasive plant growth. While grass carp are herbivores, invasive plant species like Eurasian watermilfoil and water chestnut are consumed at similar rates to beneficial native vegetation. High density stocked populations may eliminate *all* the aquatic plants from a waterbody. This effect has been shown to cause significant negative changes such as increased turbidity caused by the lack of rooted plants, changes in food web dynamics, and increased nutrient levels from excess waste. The introduction of these fish or any other non-native fish into Vermont waters is strictly prohibited.

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INVASIVE Eurasian Watermilfoil (*Myriophyllum spicatum*)



Background Information. Eurasian watermilfoil is a nonnative aquatic plant known for its rapid growth and ability to spread easily by fragments just a few inches long, which can drift away, sink, develop roots, and grow into new plants. Fragments occur both naturally and as a result of human activity. Within a lake, wind and waves may break plants loose. Boating activity through dense Eurasian watermilfoil beds also contributes to fragmentation and spread. It can form dense beds throughout the water column.







NATIVE LOOK ALIKE Northern Watermilfoil (Myriophyllum sibiricum)

Background Information. Northern watermilfoil is a native aquatic plant that resembles the invasive, though it's normally smaller, and has 5-15 leaflets (*M. spicatum* usually has more than 12). Northern watermilfoil provides important habitat for many aquatic animals.

INVASIVE Curly-Leaf Pondweed (*Potamogeton crispus*)

Background Information. This distinct plant can be easily identified by its noticeably wavy leaf edge that has



finely toothed serrations. It is a submersed perennial plant, found in freshwater lakes, ponds, rivers, streams, and slightly brackish waters. It is tolerant to low light and low temperatures. This species gets a jumpstart on the growing season, growing in the spring and early summer before conditions are favorable for most other species. By mid-July, it begins to die back.







NATIVE LOOK ALIKE Fern Pondweed (Potamogeton robbinsii)

Background Information. Fern pondweed is a native aquatic plant that resembles the invasive, though it lacks the curling along the leaf edge, and has rigid frond-like leaves. Fern pondweed offers good cover and foraging opportunities for fish, particularly Northern pike.



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INVASIVE Water Chestnut (Trapa natans)



Background Information. Water chestnut is one of the few invasive plant species that only reproduces by seed (as opposed to by fragmentation, as do variable-leaved and Eurasian watermilfoil). As such, if the plant can be harvested before it drops mature seeds, it can be effectively controlled. Once established, however, it has the potential to rapidly reproduce. The plants have two types of leaves, submerged leaves are featherlike and oppositely paired along the stem and floating triangular shaped leaves that collectively form a circular rosette on the surface.







NATIVE LOOK ALIKE Floating Pondweed (Potamogeton natans)

Background Information. Floating pondweed is a native aquatic plant whose growth form only resembles the invasive plant as the leaf types are significantly different. Like many pondweeds, Floating pondweed has an elongated leaf that floats above the water, and submerged leaves below the water. Portions of the plants are foraged on by muskrat, beaver, moose, and waterfowl.

INVASIVE Brittle Naiad (Najas minor)



Background Information. While there are several native naiad species in Vermont, this species is an invasive. The easily visible serrations along its leaf margin differentiate this species from its native relatives. It prefers alkaline waters of streams, ponds, and lakes. Initially found in the southern half of Lake Champlain, it was later found in several other lakes within the basin. As its names suggests, the stems are stiff, brittle, and fragment easily, attributing to its spread.







NATIVE LOOK ALIKE Nodding Waternymph (Najas flexilis)

Background Information. Nodding waternymph is a native aquatic plant whose growth form resembles the invasive though the leaf edges are smooth and the plant is flexible. It is an important food for many waterfowl, muskrats, and fish.



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List of Vendors/Contractors: Aquatic Plant Management Contractors

The Vermont Department of Environmental Conservation compiled this list to assist in locating vendors who provide a variety of aquatic plant management services. This list is not all-inclusive and does not represent an endorsement of the companies or products by this Department. The Department encourages you to speak directly with the contractors listed to evaluate their experience, compare costs and request references. This list is updated periodically. Please contact VTDEC if you have any questions, changes or additions.



Aquatic Plant Surveying

AB Aquatics Inc., 86 Maple Street, Henniker NH 03242 (603) 475-1503 bob.patterson@abaquatics.com
Arrowwood Environmental. 950 Bert White Road, Huntington VT 05462 (802) 434-7276 www.arrowwoodvt.com
Darrin Freshwater Institute. 5060 Lake Shore Drive, Bolton Landing NY 12814 (518) 644-3541 eichll@rpi.edu
SOLITUDE Lake Management. 590 Lake Street, Shrewsbury MA 01545 (508) 885-0101 www.solitudelakemanagement.com

Benthic Barrier Installation Services

AB Aquatics Inc. 86 Maple Street, Henniker NH 03242 (603) 475-1503 bob.patterson@abaquatics.com
AE Commercial Diving Services. PO Box 417, Manchester Center VT 05255 (802) 362-7234 aediving@gmail.com
Aqualogic Inc. 120 Hoyt Road, Gilford NH 03249 (603) 410-7413 info@aqlogic.co www.aqlogic.co
Aquatic Concerns. 165 Sunrise Drive, Fairlee VT 05045 (802) 461-3606 acdiver@yahoo.com
Invasive Aquatics. (802) 498-4183
Lighthouse Marine, LLC. PO Box 74, Hydeville VT 05750 (802) 558-5453 lighthousemarinellc@gmail.com
Shawn L. Bickford. PO Box 655, Derby VT 05829 (802) 673-6128 shawnbickford@hotmail.com
SOLITUDE Lake Management. 590 Lake Street, Shrewsbury MA 01545 (508) 885-0101 www.solitudelakemanagement.com

Chemical Application Services

Aquatic Analysts, Inc. PO Box 66, Middleville NJ 07855 (973) 383-6264 SOLITUDE Lake Management. 590 Lake Street, Shrewsbury MA 01545 (508) 885-0101 www.solitudelakemanagement.com

Hand Removal Services via SCUBA Divers

AB Aquatics Inc. 86 Maple Street, Henniker NH 03242 (603) 475-1503 bob.patterson@abaquatics.com
AE Commercial Diving Services. PO Box 417, Manchester Center VT 05255 (802) 362-7234 aediving@gmail.com
Aqualogic Inc. 120 Hoyt Road, Gilford NH 03249 (603) 410-7413 info@aqlogic.co, www.aqlogic.co
Aquatic Concerns. 165 Sunrise Drive, Fairlee VT 05045 (802) 461-3606 acdiver@yahoo.com
Aquatic Invasive Management, LLC. 52 Burt Lane, Au Sable Forks NY 12912 (240) 818-1070 andrew@milfoilremoval.com
David Burrows. 12 Cottage Street, Ashland NH 03217 (603) 707-6787 D_burrow@plymouth.edu
Lighthouse Marine, LLC. PO Box 74, Hydeville VT 05750 (802) 558-5453 lighthousemarinellc@gmail.com
M&K Commercial Diving, LLC. 164 Meadowcrest Drive, N. Clarendon VT 05759 (802) 775-7744 www.mkdiving.com
Morin's Dive Centers. 20 Warren Street, Glens Falls NY 12801 (518) 761-0533

Hand-held Cutter/Raking Device Distributors

Outdoor Enterprises, Ltd. PO Box 160, Greenville MI 48838 (616) 754-3333 Shoreline Industries Inc. 199 College Street, Pine River MN 56474 (218) 587-8700, (888) 298-9702



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List of Vendors/Contractors: Aquatic Plant Management Contractors (Continued)

Mechanical Harvesting Equipment Distributors

Alpha Boats Unlimited. PO Box 690, West Weedsport NY 13166 1-877-627-3084 www.alphaboats.com
Aquamarine Eastern Region Sales. 7285 Baldwin Road, Cayuga NY 13034 (315) 253-4270 www.weedharvesters.com
Aquarius Systems. PO Box 215, 200 N Harrison Street, North Prairie WI 53153 1-800-328-6555 www.aquarius-systems.com
Hockney Underwater Weed Cutter Company. PO Box 414, Delavan WI 53115 (414) 889-4581 http://weedcutter.com
Inland Lake Harvesters Inc. 3011 Knollcrest Drive, Burlington WI 53105 (262) 763-3620 www.inlandlakeharvester.com
PMC Production LLC. Aquatic Plant Harvester Division. 309 Second Street, Los Altos CA 94022. (916) 638-8990 www.pmcproduction.com
UMI United Marine International. 1750 Madison Avenue, New Richmond WI 54017 (715) 243-2140 www.trashskimmer.com

Mechanical Harvesting Services

Aquatic Analysts, Inc. PO Box 66, Middleville NJ 07855 (973) 383-6264 SOLITUDE Lake Management. 590 Lake Street, Shrewsbury MA 01545 (508) 885-0101 www.solitudelakemanagement.com

Suction Harvesting Services

AB Aquatics Inc. 86 Maple Street, Henniker, NH 03242 (603) 475-1503 bob.patterson@abaquatics.com
AE Commercial Diving Services. PO Box 417, Manchester Center VT 05255 (802) 362-7234 aediving@gmail.com
Aqualogic Inc. Hoyt Road, Gilford NH 03249 (603) 410-7413 info@aqlogic.co www.aqlogic.co
Aquatic Concerns. 165 Sunrise Drive, Fairlee VT 05045 (802) 461-3606 acdiver@yahoo.com
David Burrows. 12 Cottage Street, Ashland NH 03217 (603) 707-6787 D_burrow@plymouth.edu
Invasive Aquatics. (802) 498-4183
Lighthouse Marine, LLC. PO Box 74, Hydeville VT 05750 (802) 558-5453 lighthousemarinellc@gmail.com

Helpful Links and Additional Resources:

State of Vermont Department of Environmental Conservation

The State of Vermont Department of Environmental Conservation website provides an overview of the Vermont Aquatic Invasive Species Program providing links of invasive species found in Vermont, educational materials, and links to grant opportunities. http://dec.vermont.gov/watershed/lakes-ponds/aquatic-invasives

State of New Hampshire Department of Environmental Services

The State of New Hampshire Department of Environmental Services website contains a great overview of information on their Exotic Species Program including fact sheets, curriculum, and training opportunities. A webpage also list control activities and lists the advantages, disadvantages, and approximate costs of each technique. https://www.des.nh.gov/organization/divisions/water/wmb/exoticspecies/index.htm

State of Washington Department of Ecology

The State of Washington Department of Ecology website contains in-depth descriptions of aquatic plant control techniques including manual, biological, and chemical methods, case studies, a list of advantages and disadvantages, and estimated costs. http://www.ecy.wa.gov/programs/wq/plants/management/index.html

