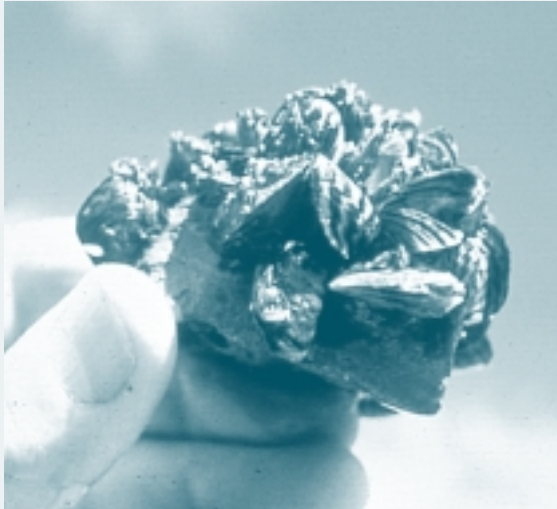


# MANAGING NONNATIVE AQUATIC NUISANCE PLANTS AND ANIMALS

## GOAL

Control the introduction, spread, and impact of nonnative aquatic nuisance species in order to preserve the integrity of the Lake Champlain ecosystem.

Sea Grant



Since they were first discovered in Lake Champlain in 1993, zebra mussels have spread throughout nearly all of the Lake.

At least 22 nonnative aquatic nuisance species are known to have been introduced and dispersed into waters of the Lake Champlain Basin. Nonnative aquatic nuisance species that become established in the Basin can pose serious threats to indigenous fish and wildlife populations and impede recreational activities. In some cases, they have substantial ecological and economic impacts. These “nuisance” species typically enter Lake Champlain through interconnected waterways, such as the Champlain Canal and Richelieu River, and overland through human activities, such as boating and bait transport. The interconnected waterways involved transcend the authority of any single state or jurisdiction, necessitating coordination among the different management agencies. Examples of nonnative aquatic nuisance species include zebra mussels, Eurasian watermilfoil, water chestnut, alewives, and sea lamprey. Gizzard shad and white perch are also examples of recent nonnative fish introductions to the Basin that could become nuisances.

## ISSUES

### Implementing a Comprehensive Management Program

The *Lake Champlain Basin Aquatic Nuisance Species Management Plan* was approved by the Aquatic Nuisance Species National Task Force in May, 2000. The plan identifies priority actions to be implemented within its first two years. Ongoing implementation of the nonnative aquatic nuisance species plan should reduce and slow the introduction and spread of nonnative aquatic nuisance species to the Basin. This

plan is an important companion document to *Opportunities for Action*, as priority actions in both documents are closely aligned.

The *Aquatic Nuisance Species Management Plan* calls for technical and financial assistance to local groups working in partnership with regional, state, provincial, and federal resource management agencies, as well as strong public involvement. Elements of this program include selecting target nonnative aquatic nuisance species in the Basin or with the potential to enter it, filling information gaps, evaluating management alternatives, and implementing controls.

## Improving the Information Base

Management of nonnative aquatic nuisance species is complicated by limited knowledge concerning the presence and extent of many of these species within the Basin and the impact that introduced species have on indigenous species, habitats, and the food web. Adequate information, based on surveys and monitoring programs, is essential to forming effective management strategies for nonnative aquatic nuisance species.

Evaluating technologies that exclude or eliminate these species and coordinating with research and management efforts in areas outside the Basin are also important in implementing the *Aquatic Nuisance Species Management Plan*. A central nonnative aquatic nuisance species database is essential to these pursuits. The LCBP maintains a current list of known aquatic nuisance species found in the Basin on its website. This information has been compiled with input from the VTDEC, NYSDEC, and Québec Ministry of Environment. The Adirondack

Park Agency's Invasive Aquatic Plant Monitoring Program, which includes plant inventories and related data for the Adirondack Park, is one of several nuisance plant monitoring projects in the Basin.

## Evaluating and Demonstrating New and Existing Control Technologies

Understanding the effectiveness, cost, and secondary impacts of control strategies provides a

sound basis for management decisions. Sea lamprey are primitive parasitic fish that feed on the body fluids of other fish, resulting in reduced growth and even death of the host fish. Although the status of the sea lamprey as a marine invader is the subject of some scientific debate, a substantial body of evidence collected on Lake Champlain indicates sea lamprey have a profound negative impact upon the fish populations. Their presence has thwarted efforts to establish and restore new and historical sport fisheries. In 1990, the USFWS, NYSDEC, and VTFWD—which together form the Lake Champlain Fish and Wildlife Management Cooperative (LCFWMC)—initiated an eight-year experimental sea lamprey control program. It included monitoring and assessing of the effects of sea lamprey reduction on certain fish populations, the sport fishery, and the regional economy. The LCFWMC developed a long-term sea lamprey control program. The new program widens the scope of sea lamprey management to include additional infested tributaries and additional management techniques to strengthen the biological and economic benefits of sea lamprey reduction.

Zebra mussels obstruct residential, municipal, and industrial intake pipes; foul boat hulls and engines; colonize recreational beaches and lake bottoms; obscure underwater and archeological artifacts; and damage native mussel populations. Since their arrival in the Great Lakes in 1988, the combined impacts of zebra mussels have resulted in millions of dollars of damage and lost revenues. Zebra mussels may also have long-term effects on the aquatic food web by disrupting the food base of fish, fish-eating birds, and mammals. Zebra mussel

USFWS



Sea lamprey attacks on the Lake's sport fish have limited the fishery and impaired recreational and associated economic opportunities.

densities have increased dramatically since their discovery in Lake Champlain in 1993. Zebra mussel studies have yet to yield effective strategies for controlling zebra mussel populations within waterbodies. Management actions have focused on controlling the mussels' attachment to surfaces and water intake pipes and on preventing further spread. Additional effort is needed in each of these areas, particularly in educating people about zebra mussel issues. The impacts of zebra mussel infestations on the ecosystem are also not well understood.

Eurasian watermilfoil, first discovered in the Basin in 1962, now occupies an extensive range throughout the Lake and at least 40 other waterbodies in the Basin. Detailed watermilfoil surveys have been conducted for many Lake Champlain bays and other lakes, but many areas have little or no study regarding the presence and extent of infestation. New infestations of Eurasian watermilfoil are discovered nearly every year. Because Eurasian watermilfoil is spread by plant fragments transported by waves, wind, currents, people, and to some extent, animals, its spread is not easily controlled. Water clarity improvements resulting from the spread of zebra mussels may have improved growing conditions for Eurasian watermilfoil, especially in the southern Lake, and may contribute to the plants' rapid growth and spread. Controls include mechanical harvesting, diver-operated suction harvesting, hydro-raking, installation of bottom barriers, lake level drawdown, fragment barriers, biological controls, and hand-pulling. An experimental program to control Eurasian watermilfoil with the chemical Sonar was conducted in the Lake Champlain Basin on Burr Pond and Lake Hortonia in 2000. Results are currently being evaluated.

Like Eurasian watermilfoil, water chestnut displaces other aquatic plant species, is of little food value to wildlife, and forms dense vegetative mats that change habitat and interfere with recreational activities. The VTDEC conducts regular surveys in Lake Champlain, and established populations have been found as

## OBJECTIVES

*(not listed in priority order)*

- 1) Document the extent of infestation for nonnative aquatic nuisance species in the Lake Champlain Basin.
- 2) Prevent the introduction and the spread of nonnative aquatic nuisance species and control, where possible, nonnative aquatic nuisance species that currently or potentially may damage to the social or biological benefits of the Lake Champlain Basin.
- 3) Manage nonnative aquatic nuisance species using current and new technologies.
- 4) Through education and signage, increase public understanding of, and involvement in, spread prevention and control of nonnative aquatic nuisance species.



NYSDEC

In 2000, a new mechanical water chestnut harvester, jointly funded by the NYSDEC and NYSCC, began operating in the South Lake.

far north in the Lake as Charlotte, Vermont; watermilfoil has also been found in a few other lakes in the Basin. The most extensive infestations are limited to southern Lake

Champlain. In 1998, a population was discovered in the South River, a tributary of the Richelieu River in Québec. In 1999, small amounts of water chestnut were discovered in the Richelieu River, and in 2001, in the Pike River, which flows into Missisquoi Bay. Despite a lakewide spread prevention and control program of surveying, mechanical harvesting, and handpulling of water chestnut since 1982 on Lake Champlain, budget constraints in the 1990s impaired the effective management of the plant (see Figure 8). The South Lake infestation severely restricts boat navigation and other recreational use. Water chestnut continues to spread in the Basin.

Biological controls can provide a cost-effective, environmentally safe means of managing some invasive species. However, use of biological control agents requires a systematic review and understanding of the complexities of this management tool, its reliability and predictability, and any undesirable consequences. Use of biological controls creates the potential to introduce nonnative aquatic species that may become invasive or create other problems. Once introduced, these agents may not be easily removed or controlled. While promising, widespread use of biological control agents poses unique challenges to the ecosystem-based approach in place in the Lake Champlain Basin. Each potential biological control agent should be thoroughly evaluated before a control program is implemented. The VTDEC has conducted experimental research on Eurasian watermilfoil control in some Vermont lakes in the Basin using a native aquatic weevil. The LCBP is funding research currently underway to assess the effectiveness of a native aquatic moth for watermilfoil control.

## HIGHEST PRIORITY ACTIONS

*Implement the Lake Champlain Basin Aquatic Nuisance Species Management Plan, including the following:*

### 1) Prevent the Spread and Control the Population of Water Chestnut Within Lake Champlain and Elsewhere in the Basin

Since 1991, the LCBP has allocated funds to support the water chestnut management program coordinated by VTDEC to prevent the spread of

this species lakewide and to reduce existing populations through mechanical controls and handpulling in Lake Champlain and other waters of the Basin (see Figure 8). Because water chestnut populations pose challenges in New York and Québec as well as Vermont, effective management, coordination, and consistent funding are keys to long-term results.

**Potential key LCBP partners:** VTDEC, NYSDEC, QC MENV, TNC, QC SFP, USFWS, LCRC, USACOE, academic institutions, NYS Canal Corporation, volunteers

**Cost estimate:** \$700,000 per year

**Potential funding source:** State and federal appropriation, private foundations

**Time frame:** Ongoing

**Benchmark:** Decrease water chestnut in the Lake and reduce their spread from the south or the north, conduct demonstration projects, and control water chestnut in Québec before it spreads into northern Lake Champlain

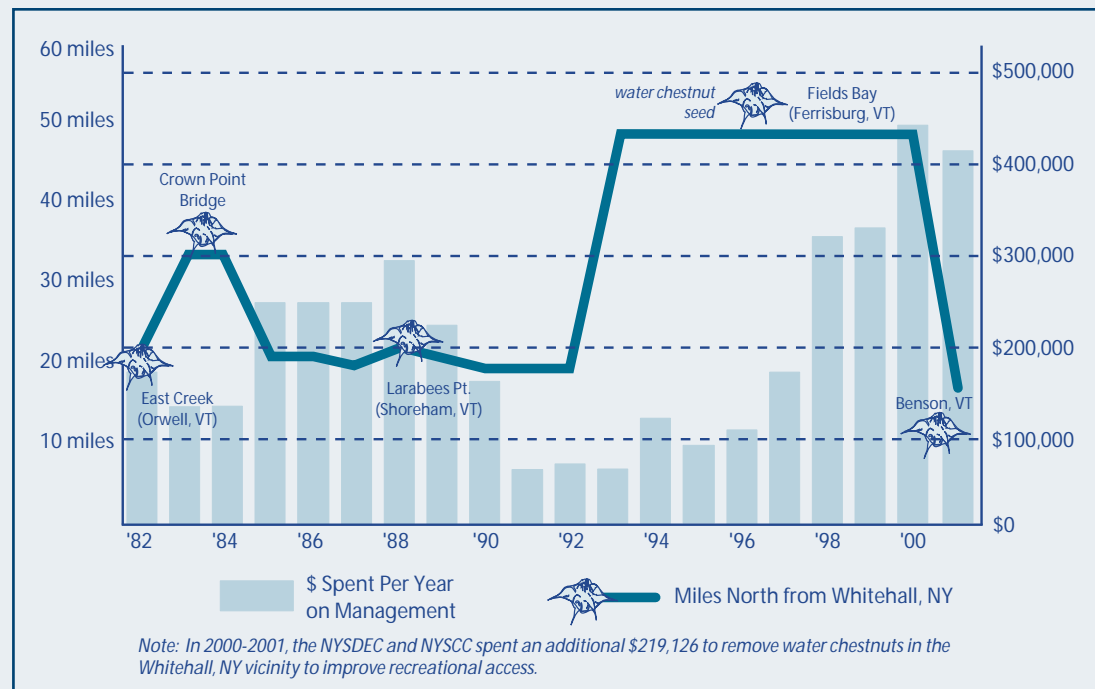


Figure 8. Lake Champlain water chestnut management: annual funding and northernmost mechanical harvesting site. Data source: VTDEC.

## 2) Support Implementation of a Long-term Sea Lamprey Control Program

This action supports aggressive implementation of a long-term control program that integrates adaptive management techniques and encourages multiple control strategies, including lampricides in appropriate locations. Sea lamprey management is a tool to protect and enhance the Lake Champlain ecosystem while providing public benefit through the reestablishment of native fish populations. Decreasing the deleterious effects of sea lamprey is a critically important part of the natural resources conservation management effort to improve the form, function, and structure of the Lake Champlain ecosystem. Successful efforts to reduce sea lamprey populations in the Lake were implemented in an eight-year experimental control program initiated by the bistate Lake Champlain Fish and Wildlife Management Cooperative (LCFWMC) in 1990. In 2001, the LCFWMC released a Supplemental Environmental Impact Statement (SEIS) in accord with the National Environmental Policy Act (NEPA). The NEPA Record of Decision supported the preferred alternative of implementing an extensive integrated long-term sea lamprey control program. The SEIS evaluated the feasibility of lampricides, barrier dams, trapping, pheromone attractants, and other control strategies. To date, the LCBP has funded the installation of two barrier dams on Lake Champlain tributaries, and the implementation of state-of-the-art sea lamprey assessment methodology and analysis of control alternatives for the Poultney and Pike Rivers. Opportunities to evaluate and demonstrate new and existing control technologies will also be developed.

**Potential key LCBP partners:** USFWS, NYSDEC, VTANR, SFP, LCFWMC, QC MENV, LCRC, academic institutions, TNC  
**Cost estimate:** \$633,000 per year

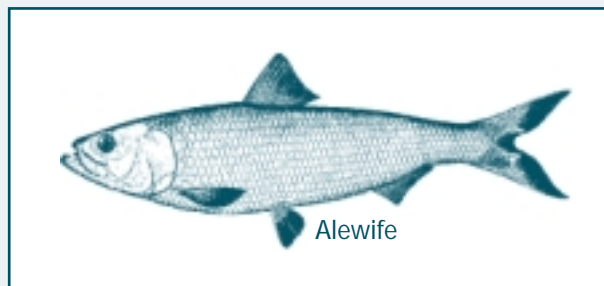
**Potential funding sources:** State and federal appropriations

**Timeframe:** Ongoing

**Benchmark:** Implementation of long-term control program beginning in 2002

## 3) Prevent the Spread of Alewives Within and Beyond the Lake Champlain Basin

Alewives were discovered in 1997 in Lake St. Catherine, which is connected to Lake Champlain by 30 miles of outlet flow and canal. This aquatic nuisance species poses a serious threat to other fish species in Lake Champlain. The VT Fish and Wildlife Department has reviewed several potential control strategies and is evaluating their applicability to Lake St. Catherine. Educational outreach is needed to prevent the accidental and/or intentional overland spread of alewives to other waterbodies in the Basin, including Lake Champlain. If alewife populations become established in Lake Champlain, it will be important to assess their potential impacts on ecosystem health and recreation. Elements of this action include:



*a) Assess the potential control strategies identified by the VTFWD and their applicability to Lake St. Catherine. Implement appropriate strategies in as timely manner as possible.*

*b) Evaluate the ecosystem impacts of a potential alewife infestation in Lake Champlain.*

*c) Identify potential management strategies that could be considered if alewives spread throughout Lake Champlain.*

*d) Assess the potential economic impacts on recreation of an alewife infestation in Lake Champlain.*

*e) Design and implement educational and outreach activities to curtail the spread of alewives within and beyond the Lake Champlain Basin.*

**Potential key LCBP partners:** VTFWD, USFWS, VTDEC, LCFWMC, LCRC, academic institutions, USACOE, Sea Grant, USEPA, QC MAPAQ, QC FAPAQ, local groups (i.e. lake/fishing groups) and marinas

**Cost estimate:** To be determined

**Potential funding sources:** State and federal appropriations

**Timeframe:** Immediate

**Benchmark:** Curtail the spread of alewives to the extent possible

## 4) Prevent the Spread of Zebra Mussels to Other Basin Lakes

While research and technologies to control and/or eradicate zebra mussels are continuously under development, preventing their spread to other lakes in the Basin is also critically important. Since their discovery in 1993, zebra mussels have rapidly colonized the entire Lake (Figure 9) and spread to other waterbodies.

## ACCOMPLISHMENTS

### COMPLETING ANS MANAGEMENT PLAN

The highest priority for aquatic nuisance species (ANS) prevention and control in 1996 was development of a Basin-wide aquatic nuisance species management plan for VT, NY, and Québec. With financial and technical support from LCBP, the *Lake Champlain Basin Program ANS Management Plan* was adopted in 2000. This plan has made Vermont eligible for USFWS funds to implement it. So far, \$205,000 has been received.

### REDUCING WATER CHESTNUTS

Five years of consistent funding from multiple sources have reduced the extent of the Lake's dense water chestnut population by 40 miles from Fields Bay to Benson, VT. Only handpulling controls are now needed north of Benson, instead of mechanical harvesting. Average annual funding of more than \$475,000 came from the states of Vermont and New York, Québec, LCBP, US Army Corps of Engineers, and The Nature Conservancy.

### CONTROLLING SEA LAMPREY

In 2001, the Lake Champlain Fish and Wildlife Management Cooperative

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**Potential Key LCBP partners:** VTFWD, USFWS, VTANR, NYSDEC, LCRC, academic institutions, USACOE, Sea Grant, USEPA, local groups

**Cost estimate:** \$50,000 per year

**Potential funding sources:** State and federal appropriations

**Timeframe:** Immediate

**Benchmark:** Reduce rate of spread of zebra mussels to other waterbodies

### 5) Update the *Lake Champlain Basin Aquatic Nuisance Species Management Plan* Regularly

This plan, cooperatively developed by partners from Vermont, New York, and Québec, was approved by the Lake Champlain Steering Committee in 2000. It needs to be periodically revised to remain current and to reflect changing priorities.

**Potential Key LCBP partners:** VTFWD, USFWS, VTANR, NYSDEC, LCRC, academic institutions, USACOE, Sea Grant, USEPA, local groups

**Cost estimate:** \$60,000 per year

**Potential funding sources:** State and federal appropriations

**Timeframe:** Ongoing

**Benchmark:** Biennial plan revisions

## HIGH PRIORITY ACTION

### 6) Create a Central Database for Nonnative Aquatic Nuisance Species and Establish a Process for Coordination and Data Sharing

Create a central repository of information on nonnative aquatic nuisance species of concern

to the Lake Champlain Basin, including emerging control strategies. Establish and maintain communication with experts and citizen groups in other locations.

**Potential key LCBP partners:** NYSDEC, VTANR, QC MENV, USFWS, LCRC, academic institutions, Sea Grant, USGS

**Cost estimate:** \$60,000 per year

**Potential funding sources:** State and federal appropriations

**Timeframe:** ongoing

**Benchmark:** Creation of an up-to-date database at a central location

## PRIORITY ACTIONS

*(not listed in priority order)*

### 7) Investigate the Ecological Implications of Nonnative Aquatic Nuisance Species in the Basin

Conduct research regarding the ecological role of nonnative aquatic nuisance species, including sea lamprey and zebra mussels, to understand ecosystem links with a focus on developing and employing effective control strategies. Assess the potential ecological consequences and impacts of nonnative aquatic nuisance species on native plants and animals, and recreation and cultural heritage resources. Specifically assess the potential effects of the proliferation of zebra mussels on the Lake Champlain food web, nutrient levels, and water clarity.

**Potential key LCBP players:** NYSDEC, VTANR, USFWS, LCRC, academic institutions, Sea Grant

**Cost estimate:** \$125,000 to \$250,000 per year

**Potential funding sources:** State and federal appropriations

**Timeframe:** Ongoing

## ACCOMPLISHMENTS

*continued from page 58*

completed an assessment of long-term sea lamprey control strategies. This program identifies a comprehensive, integrated approach to sea lamprey control and provides for cooperative federal-state management to reduce the impact of sea lamprey parasitism on fisheries.

### EXPLORING BIOLOGICAL SOLUTIONS

Since 1999, the LCBP has funded research on biological controls for nonnative aquatic nuisance species as an alternative to chemical treatment. For three years, research has been conducted in NY on a moth larva that eats watermilfoil.



Cornell University

The Lincoln Pond watermilfoil project in Elizabethtown, NY evaluated the ability of moth larva to reduce watermilfoil biomass and enhance native plant diversity.

**Benchmark:** Increase knowledge of ecological role and innovative control techniques for aquatic nuisance species

### 8) Evaluate and Demonstrate Zebra Mussel Control Strategies

Investigate the economic and environmental costs and benefits of existing zebra mussel anti-fouling and other population control strategies, and new technologies as they become available.

**Potential key LCBP partners:** USFWS, NYSDEC, VTANR, QC MENV, LCRC, academic institutions, Sea Grant, lake groups, marinas, water supply and wastewater treatment facilities

**Cost estimate:** \$100,000 per year

**Potential funding sources:** State and federal appropriations

**Timeframe:** Ongoing

**Benchmark:** Implementation of control projects

### 9) Evaluate and Demonstrate Eurasian Watermilfoil Control Strategies

Continue to implement Eurasian watermilfoil control techniques, such as use of the naturalized aquatic moth, *Acentria ephemerella*, and the native aquatic weevil, *Euhrychiopsis lecontei*. Investigate new Eurasian watermilfoil population control technologies as they become available. Include Eurasian watermilfoil in lakewide surveys for nonnative aquatic nuisance species.

**Potential key LCBP partners:** NYSDEC, USFWS, VTANR, LCRC, academic institutions, lake groups, Sea Grant

**Cost estimate:** \$175,000 per year

**Potential funding sources:** State and federal appropriations

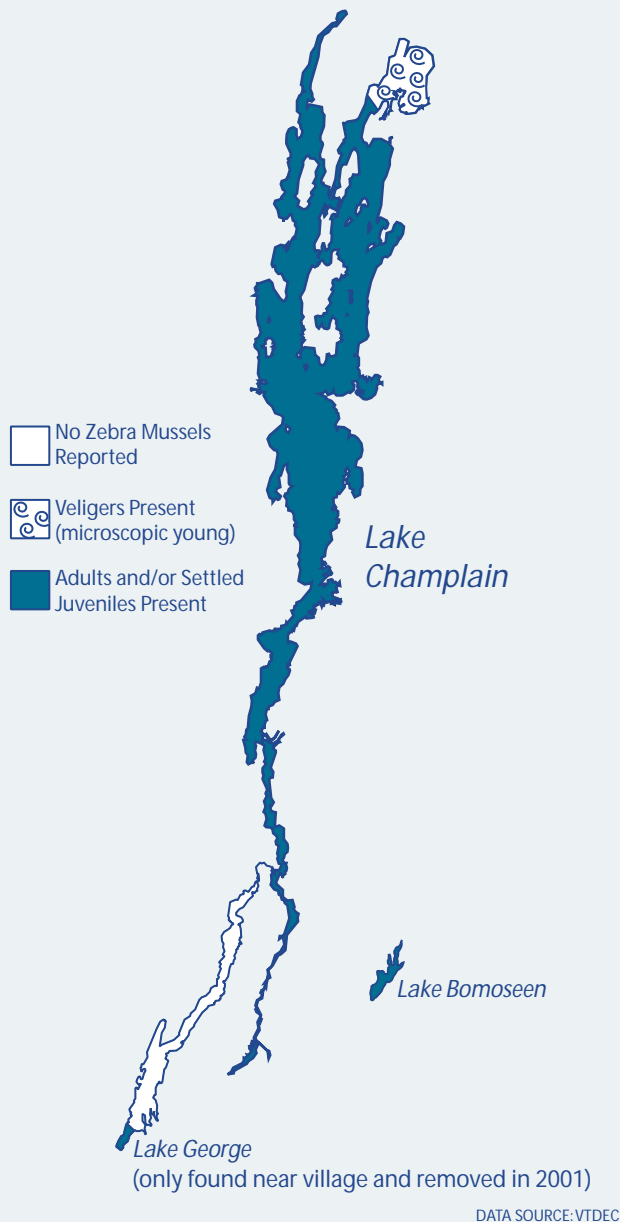


Figure 9. Zebra mussel distribution in the Lake Champlain Basin.

**Timeframe:** Ongoing

**Benchmark:** Discovery of new feasible control methods

## 10) Evaluate the Effectiveness of Biological Controls for Nonnative Aquatic Nuisance Species

Mike Hauser



Zebra mussels compete with the native mussels in Lake Champlain for food. They also encrust native mussel shells, resulting in their demise.

Investigate biological control agents, such as leaf-eating insects, aquatic weevils, beetles, and moths. Because biological control agents may have unanticipated negative effects on native species, their use must be carefully evaluated prior to introduction, and introductions should only be permitted following a clear determination of net benefit.

**Potential key LCBP partners:** USFWS, NYSDEC, VTANR, QC MENV, LCFWMC, LCRC, USEPA, academic institutions

**Cost estimate:** \$50,000 per year

**Potential funding sources:** State and federal appropriations

**Timeframe:** Ongoing

**Benchmark:** Completion of demonstration projects and slowing the spread of nonnative aquatic nuisance species

## OTHER ACTIONS FOR CONSIDERATION

*(not listed in priority order)*

### 11) Encourage Voluntary Efforts and Enforcement of Existing Laws to Control the Transport of Nonnative Aquatic Nuisance Species

*a) Coordinate new legislation controlling the propagation, sale, collection, importation, pur-*

*chase, cultivation, distribution, and introduction of nonnative aquatic nuisance species.*

*b) Review and improve consistency of existing nonnative aquatic nuisance species laws among the applicable jurisdictions in the Basin.*

*c) Encourage voluntary boat and trailer washing, and cleaning of vegetative debris by hand, to reduce transport of nonnative aquatic nuisance species to and from boat launch areas.*

*d) Encourage enforcement of existing laws regarding the transportation or spread of nonnative aquatic nuisance species.*

**Potential key LCBP partners:** USFWS, NYSDEC, VTANR, SFP, local government, NYSDOT, VTrans, VTDAFM, NY State Police, VT State Police, lake groups, local law enforcement officials, QC MENV, sporting groups

**Cost estimate:** In-kind participation

**Potential funding sources:** Same as potential key partners

**Timeframe:** Ongoing

**Benchmark:** Reduction in the number and spread of nonnative aquatic nuisance species in the Basin

### 12) Evaluate and Demonstrate Exclusion Devices for Nonnative Aquatic Nuisance Species

Investigate the broad applicability of electronic and other control alternatives, such as exclusion devices, for nonnative aquatic nuisance species in the Lake Champlain Basin.

**Potential key LCBP partners:** NYSDEC, USFWS, VTANR, LCRC, academic institutions, USACOE

**Cost estimate:** \$150,000 per year

**Potential funding sources:** State and federal appropriations

**Timeframe:** Ongoing

**Benchmark:** Development and demonstration of the effectiveness of exclusion techniques