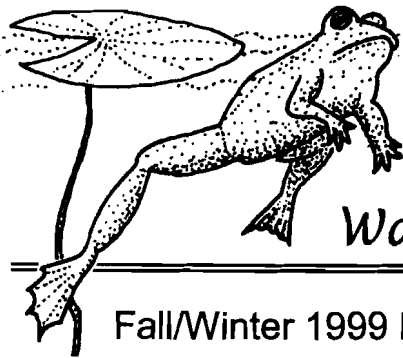


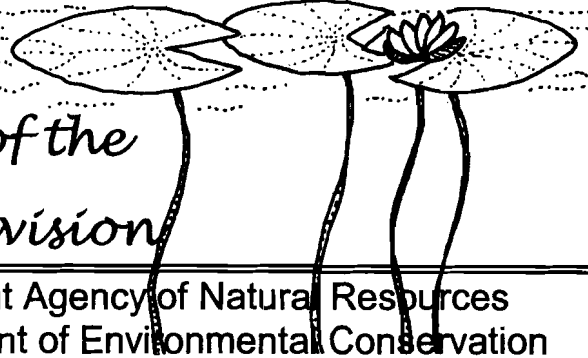
# Out of the Blue



Hey Ho  
Happy 2000



## A Newsletter of the Water Quality Division



Fall/Winter 1999 No. 19

Vermont Agency of Natural Resources  
Department of Environmental Conservation

### More Than a Millennium Look at Water Through Time

Where did the water you used to brush your teeth this morning come from, and where will it be tomorrow? The chances are that you brushed your teeth with water once slurped by dinosaurs, or was bound in a glacier for thousands of years. In celebration of the MILLENNIUM, here is a look back at Vermont's waters and the role time played in changing them.

Vermont's geology tells the story of Vermont's waters. At the formation of the earth, four and a half billion years ago, the earth's waters were salted by the original materials of geological processes. During the days of the ancient Iapetus Ocean ("father of the Atlantic") 500 million years ago, tons of sediment was deposited. Through this sedimentary process and other geological events, rocks were formed that are the foundation bedrock of Vermont. Today in the Champlain Valley many fossils can still be found from the Iapetus Ocean time period. Low lying lands and millions of years of accumulated sediment protected these ocean bottom deposits from severe metamorphism (see pictures of fossils on page 5).

Plate tectonic forces (the theory for how the earth's crust moves around), eventually pushed Vermont upward and the Iapetus Ocean (and several smaller oceans) disappeared completely about 350 million years ago. At this time, Vermont, attached to northern Europe and Africa, was probably left as a high mountainous region, with its first lakes and streams catching fresh water.

Plate tectonics split the supercontinent again, two million years ago, moving North America away from Europe. Vermont was left in the middle of

See "Water Through Time" page 4



A spiraled shell,  
class Gastropod



A mussel,  
class Plecypod

### Fossils Found in the Lake Champlain Region from the Iapetus Ocean Time Period

#### In This Issue...

Purple Loosestrife Bio-Control Program Update..	2
Aquatic Nuisance Species Highlights .....	3
Living on the Water: Comments from Lay Monitors .....	6-8
Aquatic Nuisance Species on the Move in Vermont in 1999.....	8-9
"Natural Channel" Restoration of Trout River ....	10
Have You Looked at Your Gravel Road or Driveway Lately? .....	11

## OUT OF THE BLUE

is produced semi-annually by the Lakes and Ponds Section. Our purpose is to share information on lake environments, water quality and state activities through articles on lake ecology and Section programs. Feel free to let us know what articles you would like to see in future issues. To be placed on the mailing list, or to receive extra copies, please contact:

Vermont Agency of Natural Resources  
Dept. of Environmental Conservation  
Water Quality Division  
Lakes and Ponds Section  
103 S. Main Street, 10 North  
Waterbury, VT 05671-0408  
(802) 241-3777

<http://www.state.vt.us/anr>

### NEWSLETTER STAFF

Amy Bentley Picotte, Editor  
Ann Bove  
Susan Warren

### CONTRIBUTORS

Amy Bentley Picotte  
Shayne Jaquith  
Michael Hauser  
Annie Morse  
Susan Warren

### ARTWORK and Maps

Amy Picotte  
Peter Stangle  
Susan Warren

*The Vermont Agency of Natural Resources, Department of Environmental Conservation, is an equal opportunity agency and offers all persons the benefits of participating in each of its programs and competing in all areas of employment regardless of race, color, religion, sex, national origin, age, disability, or other nonmerit factors.*

## Purple Loosestrife Bio-Control Program Update

The Vermont Wetlands Office continued the Purple Loosestrife Bio-Control Program during 1999. Purple loosestrife is an invasive, non-native plant that grows in wet soils from roadside drainage ditches to pristine wetlands. Since 1996 the Wetlands staff have been using bio-control to decrease the plant's density to allow native plant species to thrive.

Bio-control uses a species natural enemies to control it. The beetles used for purple loosestrife bio-control come from Europe, where loosestrife is native. These insects were studied intensively before being released in North America to ensure they would not damage the ecosystem. To date 91,079 beetles have been released into 491 acres of purple loosestrife in Vermont.

The beetle populations are increasing in size and are starting to have an effect on purple loosestrife populations in Vermont. Bio-control takes time to be successful, but it is long-lasting in that beetles do not completely obliterate the plant population, but leave enough plant material to sustain a small beetle population. This type of control allows the beetles to feed on any future seedlings arising from the plant's seed bank, which is often large and viable for years. Furthermore, bio-control does not disturb habitat, and once the beetles are reared and released, the only staff effort needed is to monitor the sites (much easier than digging plants!) Unfortunately, currently purple loosestrife is spreading faster than it can be controlled in Vermont. With limited personnel and resources, agencies, organizations, and concerned citizens must learn to collaborate on reducing this plant's spread. There are many ways to get involved such as:

- spreading the word to friends (especially gardeners -- those "sterile hybrids" sold in nurseries can produce viable seed!);
- notifying the Wetlands Program of purple loosestrife populations (particularly those not within site of roads);
- recommending groups who would be interested in the Loosestrife Slide Show;
- volunteering to help establish a community-based beetle rearing program.

For more information, please visit the VTDEC Aquatic Nuisance website. [www.anr.state.vt.us/dec/waterq/ans/ans-index](http://www.anr.state.vt.us/dec/waterq/ans/ans-index).



## Happenings

### New England Chapter of the North American Lakes Management Conference

June 1-3, 2000 (Thursday through Saturday)

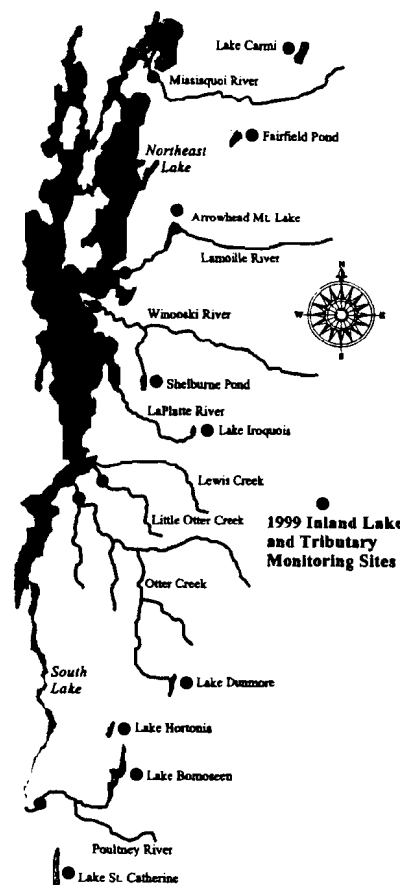
University of Connecticut, Storrs, CT

For more information, please contact George W. Knoecklein, Northeast Aquatic Research, Tel. # (860) 456-3179, or E-mail: [knoecklein@juno.com](mailto:knoecklein@juno.com)

# Aquatic Nuisance Species

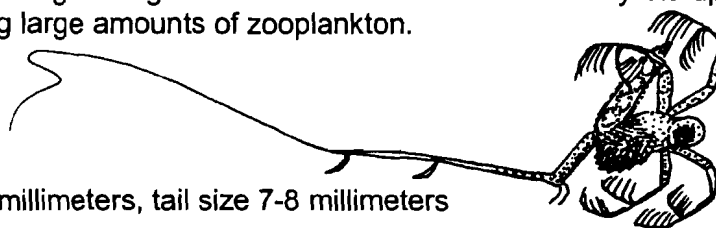
## HIGHLIGHTS

- ♦ **Zebra Mussels.** Zebra Mussels have been found in inland lakes in Vermont for the first time. During the summer of 1999, adult zebra mussels were found in Lake Bomoseen, and veligers (larvae) were found in Lake Hortonia and Lake Dunmore. (see story on page 8 for more information)
- ♦ **Zebra Mussels.** The range of adult zebra mussels in the northeast arm of Lake Champlain has expanded to include St. Albans Bay, Lapans Bay, Burton Island, Savage Island, and the Appletree Bay area north of the sandbar causeway.
- ♦ **Eurasian Watermilfoil.** During the 1999 summer season Eurasian watermilfoil was discovered in Lake Willoughby, Indian Brook Reservoir, and Seymour Lake, bringing the statewide total of lakes and ponds with Eurasian watermilfoil to 49. (see story on page 8 for more information)
- ♦ **Water Chestnut.** A population of water chestnut has been identified in the South River, a tributary to the Richelieu River in Noyan, Quebec. The population is just four miles from Missisquoi Bay, Lake Champlain, which currently is not infested with water chestnut.
- ♦ **Good News!** For the first time in several years water chestnut was not found in any new Vermont bodies of water. Additionally, recent increases in funding for the Lake Champlain water chestnut harvesting program and substantial volunteer assistance from The Nature Conservancy appears to have halted the northward expansion of the plant in Lake Champlain.
- ♦ **New Funding.** The U.S. States Congress has appropriated \$400,000 in the Energy and Water FY2000 Appropriations Bill for aquatic plant control in the Champlain Basin in Vermont.
- ♦ **New Species.** Be on the lookout for the fishhook flea (*Cercopagis pengoi*), a tiny crustacean native to Russia and Ukraine. It was first found in Lake Ontario in 1998 and has already spread to Lake Michigan and six of New York's Finger Lakes. Its spread is facilitated by a long barbed tail which gives it the ability to glom onto fishing line and other things moving through the water. The fishhook flea may disrupt lake food webs by consuming large amounts of zooplankton.

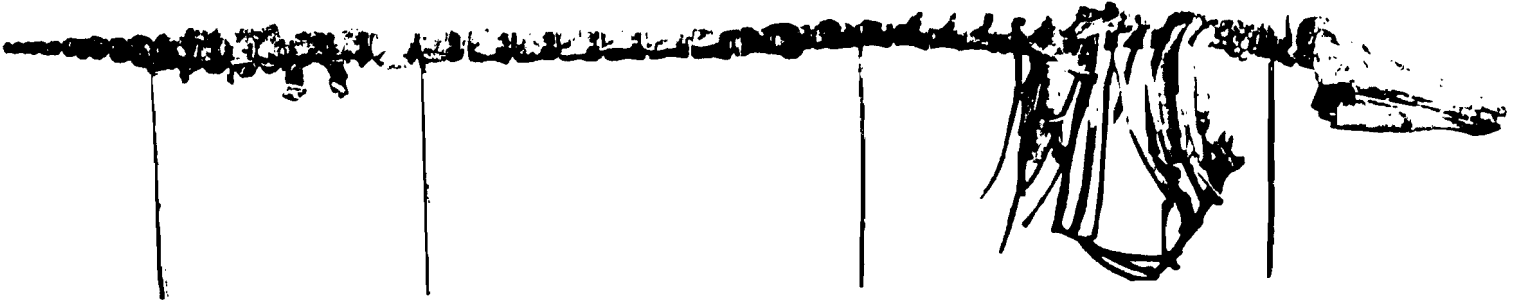


### Fishhook Flea

actual size 1.5 millimeters, tail size 7-8 millimeters



## Water Through Time (continued from page 1)



Picture of the skeleton of the Charlotte whale, mounted in the State Museum in Montpelier. Photograph from Perkins (1908)

what we know today as the Appalachian Mountains. Due to the intense heat and pressure of plate tectonics and glacial erosion forces, these mountains tell us very little about what happened in Vermont from two million years ago up through the glacial age. Whether or not creatures such as dinosaurs lived in Vermont can not be determined because there are no known preserved fossils for this time period.

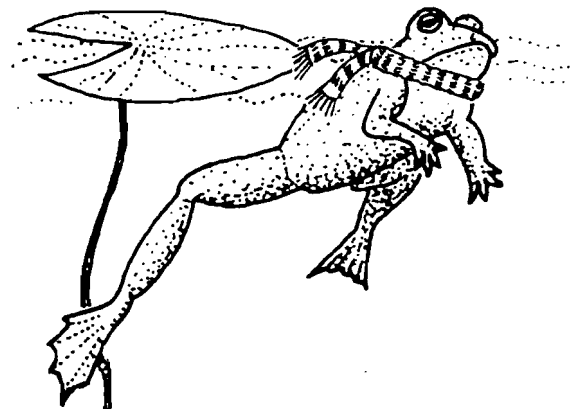
Starting sometime during the glacial period of two million years ago, Vermont was covered by a succession of huge glacial ice sheets that advanced and retreated over the land. Some of the ice sheets were in excess of a mile in thickness and the weight of this enormous mass depressed the surface of the land in much the same way that a floating log sinks some with the weight of a turtle on it. About 12,500 years ago, just south of the last retreating glacier, the earth's crust was depressed enough to allow Lake Vermont to form. Lake Vermont drained south into the Hudson Valley and extended across the Champlain Valley from the Green Mountains on the east to the Adirondacks on the west.

As this last glacial sheet retreated far enough north, exposing more sunken earth and altering the drainage flow, it allowed the waters of the Atlantic Ocean to flood into the Champlain Basin, forming the Champlain Sea. For 2,500 years the Champlain Sea, an arm of the Atlantic Ocean, housed marine animals, such as mollusks, sea urchins, squid, herring cod, salmon, seal and even white whales! Yes, there were once whales in Vermont! (See fossils on next page.)

After the last glacier receded some 10,000 years ago, the land in the Champlain Valley had

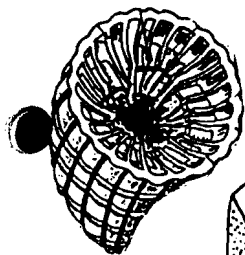
rebounded sufficiently, similar to how a log floats higher once the turtle jumps off, to raise it above sea level and to allow the brackish water of the basin to slowly be replaced by fresh water from the local rivers and streams. At this time, the present Lake Champlain and the rest of Vermont's lakes were formed.

So, if the MILLENNIUM seems like a long time to you, just imagine being a water molecule on earth for more than a billion years! The water you used today to brush your teeth may very well have been slurped by a dinosaur, once spent millions of years exploring the deep ocean depths, traveling in a cloud over Asia, wiggling through soil particles deep underground, swimming in a fast-moving mountain stream, and trapped for hundreds of thousands of years in a glacier. In just another few million years who knows how climate and plate tectonics will continue to change and influence Vermont's waters. But in the meantime, HAPPY MILLENNIUM everyone and thank you for doing your part to protect Vermont's waters from today's threats!



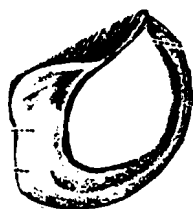
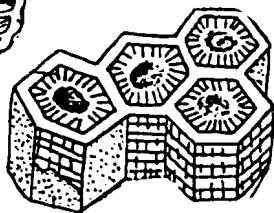
## Fossils of the Lake Champlain Region

These animals lived here more than 400 million years ago, when the area that is now the Lake Champlain Basin was part of the Iapetus Ocean.

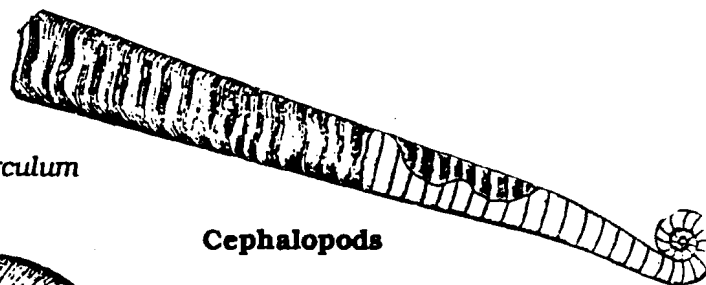


**Coral**

Corals are tiny flower-like animals that live in colonies. They are soft-bodied but secrete hard outer skeletons that form coral reefs. The fossils found in Vermont represent the first known species of coral.

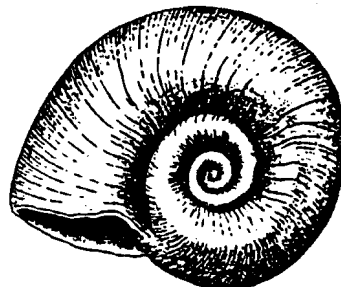


*operculum*



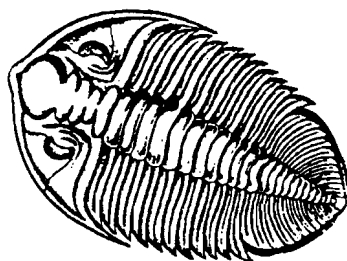
**Cephalopods**

Cephalopods are related to gastropods. Cephalopods lack feet and their shells are chambered. The cephalopods fossilized here are related to the chambered nautilus of today.



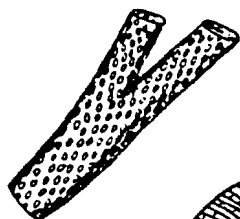
**Gastropods**

Gastropods or snails can be found in almost any habitat. All snails have a well-defined head with eyes and tentacles, a main body that houses the internal organs, and a foot. Many of the snail fossils of Lake Champlain are large. Sometimes all that remains is the operculum, a hard covering that protects the foot of the snail.



**Trilobites**

Trilobites, ancient lobster-like creatures, are true representatives of their time. They first appeared about 520 million years ago, reached their height about 440 million years ago, and were extinct 400 million years ago. Like lobsters and crabs, they shed their shell to grow, leaving behind many fragments to fossilize.



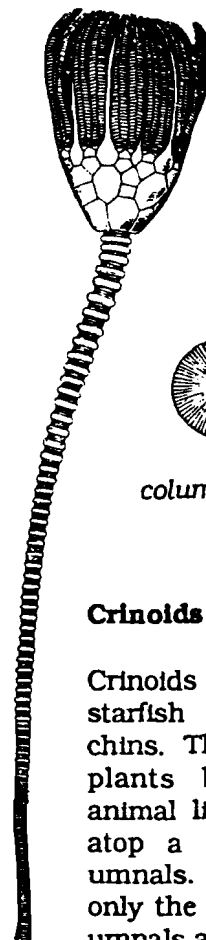
**Bryozoans**

Bryozoans are commonly called moss animals because of their appearance. Like coral, they are tiny soft-bodied animals that live in colonies. Each animal lives in its own chamber, giving the colony a honeycomb appearance. The most common bryozoan fossils here resemble twigs and gum drops.



**Brachiopods**

Brachiopods are one of the easiest fossils to find. A brachiopod shell looks like a clamshell, but has a distinct ridge running down the center. There are brachiopods living today.



*columnals*

**Crinoids**

Crinoids are related to starfish and sea urchins. They look like plants because the animal lives in a cup atop a stalk of columnals. Most often, only the fossilized columnals are found.

Fossil summary sheet by  
Ivy Frignoca and  
Laura Hollowell

## Living on the Water: Comments from Lay Monitors

At the end of the 1999 Lay Monitoring season, all Lay Monitors received a questionnaire asking them for their comments on what makes Vermont lakes and ponds so special. Although the responses ranged from recreation, history, water conditions, to the unique ecology, almost all monitors expressed a sense of home (belonging) or well-being they feel from spending time on their lake. Presented below are excerpts from Monitors that describe something special about their lake or pond.

"In the 1940s when I was a teenager, I fished, swam, and aqua-planed with my friends at Thompson's Point on Lake Champlain. I remember diving to recover a lure for a hapless fisherman-friend of my dad's, a man who maintained that this feat occurred in 16 or more feet of water. With fond memories and eager anticipation, I returned from out of state to retire with my husband in an idyllic spot on the lake, about 30 miles south of Thompson's Point." *Sally and Evan Littlefield from Lake Champlain's Larrabees Point*

"Water is calming, washing clean the mind

and soul. Lake Iroquois is peace, shining diamonds in the sunlight, moon beams glistening towards the shore. Midnight geese honks, fish splashing, canoe paddles breaking surface, skiers laughing. Lake Iroquois is home to me as I swim, paddle, or observe from swing or Adirondack chair." *Ginger Johnson from Lake Iroquois*

"Stef & I each grew up loving water, he on ponds & lakes, I as a swimmer. He has been teaching at Colchester H.S. for 17 years, so the Bay has been home. We literally live on the water on our houseboat in the summer and truly love the Bay and are ever mindful of its health and status." *Steffen and Kathryn Parker from Lake Champlain's Inner Malletts Bay*

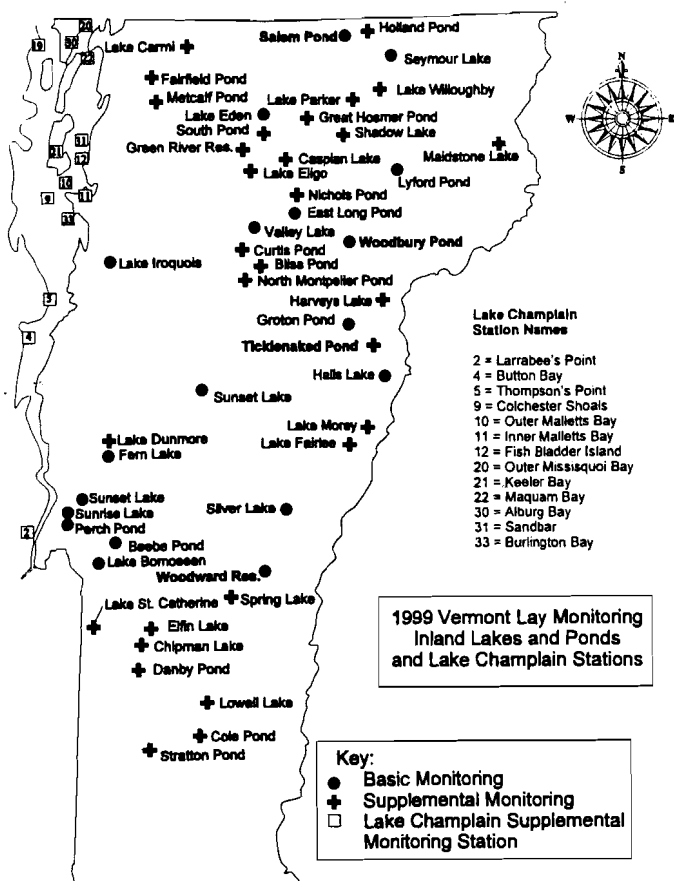
"My first visit to Lake Champlain was on my honeymoon in 1965." *Dick Harter from Lake Champlain's Button Bay*

"Lake Champlain is very beautiful along all its shoreline - amazing rock cliffs, flourishing farms, small beaches for swimming & boats to pull up - to many tributaries (especially the Otter Creek) which excite exploration and history researchers." *Nina and Jason Bacon from Lake Champlain's Thompson Point*

"Every weekend my three year old son Wilder, our dog Marley, and recently my two year old daughter Lydia and I put our canoe in Metcalf's placid waters for an early morning sample and paddle. Many mornings the only noise is the laughter coming from Wilder & Lydia as they make believe they are catching fish from the strings that dangle over the sides of the canoe. I love these times and hope that my kids will continue to join me in canoeing Metcalf Pond for many summers to come." *Brian Picotte from Metcalf Pond*

"I am on the lake because I enjoy sailing. There are few lakes in the world with two mountain ranges on each side almost close enough to touch. The water usually warms up enough for swimming in late June. Fishing is good. It is a unique recreational facility." *John Wood from Lake Champlain's Outer Malletts Bay*

"My Parents were one of the first families to build a camp on Maquam shore back in 1937. We moved our camp across the road and built a year round home where the camp use to be in 1989. Obviously, I have a deep attachment to this part of Lake Champlain..." *Dave Reissig from Lake Champlain's Maquam Bay*



"My first time at Sunset Lake was as a Boy Scout in 1972. When I went looking for a camp [years later] a miracle occurred and I found one for sale on Sunset Lake." *Jamie Longtin from Sunset Lake, Benson*

"...for 70 years a girls camp was successful. The camp closed in the early 60s and now there are 40-50 homes & cottages. We continue the camp tradition by swimming across & back every morning at 7:30 from mid May to late September! We call ourselves the turtles after the shape of the lake." *Mary Sondergeld from Beebe Pond*

"We are always so excited to see loons on our lake." *Leon & Marilyn Rank from Harvey's Lake*

"Lowell Lake is near our home and has a largely undeveloped shoreline - very unique for this part of the state." *Kevin and Sharon Beattie from Lowell Lake*

"As a child our family always rented a camp on Shadow Lake for two weeks to visit with many family members who lived in the Glover area. My Dad never bought a camp when they were \$1,500. When I introduced my husband to Shadow Lake he loved it and shortly we found a place to buy. The camp was the first house we ever bought - remember always buy your vacation home first - never regretted it at all!" *Sara Gluckman from Shadow Lake*

"The best water skiing lake in southern Vermont!" *Joe Frankiewicz from Chipman Pond*



"Perch Pond is peaceful and quite - Paradise is often used to describe it. As we lay in our hammocks by the pond it's as close to heaven as we can be." *Harriet and Gordon Mitchell from Perch Pond*

"Great Hosmer Pond is very important economically in Craftsbury and Albany. Two businesses rely on its well being - Windridge Tennis Camp and the Craftsbury Outdoor Center. We are very determined to keep it in good shape." *John Brodhead from Great Hosmer Pond*

"Valley Lake had the first business in Woodbury - a saw mill. Valley Lake is also known as Dog Pond. From the air the lake looks like a dog." *Arthur Orlandi from Valley Lake*

"My pond provides me with a sense of place in all seasons, whether it's summer swimming and monitoring, fall foliage reflections, winter ice skating and cross country skiing, and in spring I keep track of ice out year after year; the pond helps record the seasons of my life."

*Virginia Rasch from Bliss Pond*

"I have always thought that living on a lake would be wonderful & I was right! The wildlife is fantastic I have seen ducks (of course), kingfishers, otters, beavers, moose, and osprey. My all time - lifetime - favorite was watching a bald eagle eating a fish through a telescope!"

*Bobbie Cummings from Salem Lake*

"It's like heaven here. Charming, picturesque, quiet and quaint." *Dolores Mobilio from Sunrise Lake*

"My family has had a camp on Nichols Pond for many years. I have many childhood memories of family gatherings there. Our camp is at the mouth of the brook that feeds the pond and is much used by wildlife-otter, beaver, ducks, heron, loons, etc." *Michael Gray from Nichols Pond*

"My family has been at South Pond since the 1950's. It's a very quiet, unspoiled place to go to regenerate. At night we listen to the frogs and loons. My children lived summers there from the time they were born. It is our paradise." *Chandler and Madonna Parker from South Pond*



*continued on next page*

## Living on the Water: Comments from Lay Monitors *(continued from page 7)*

"It has always been my dream to have a place on the lake having spent my childhood on lakes. The lake virtually has no restrictions on uses - this can be good and bad. Luckily traffic is not high. The lake is special because my kids grew up to enjoy its uses." *David Jones from Lake Carmi*

"Lake Eden is very special to our whole family as it gives us a place to go and relax and enjoy the summer months." *Steven and Teela Leach from Lake Eden*

"In our search for a suitable and available location to start a summer camp program centered on crafts, wood lore, and trips (canoe & hikes) we felt this area was ideal- It was!" *Bob Easton from Danby Pond*

"I've lived in town for about 15 years. I am not sure about the complete history [of Elfin Lake]. I became interested in the LMP study due to being a teacher at the local high school. I use the data in my environmental science class." *Michael Bird from Elfin Lake*

"Sunset Pond is the site of Brookfield's famous floating bridge. ...it is the object of considerable tourism (as well as fishing and swimming)."



*Ed Koren from Sunset Pond (Brookfield)*

"Mary's grandparents and mother lived in Groveton, NH and purchased a camp on the lake in 1947. She has been "going to camp" since she was two weeks old. Lee began "coming to camp" in 1968. We are so lucky that as they grew up our children loved Maidstone as

much as we did." *Lee and Mary Stewart from Maidstone Lake*

"...to go canoeing and enjoy Woodward Reservoir." *Betsy Shands from Woodward Reservoir*

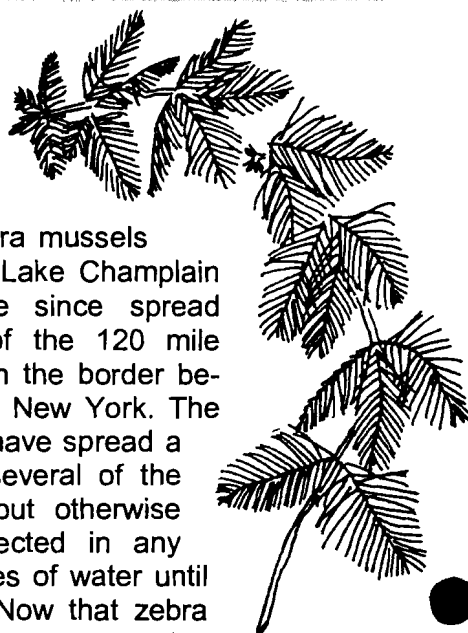
"Caspian Lake is special to me because of its beauty, particularly on a "mountain day" when the winds are from the north, or early in the morning when it is calm and the loons are calling." *George Hasen from Caspian Lake*

"Lake Morey was originally called Fairlee Pond but should not be confused with Lake Fairlee which was then Fairlee Lake. It was named for the local entrepreneur - inventor Samuel Morey who, in addition to inventing the carburetor, competed with Robert Fulton in the creation of the steamboat." *Don Weaver from Lake Morey*

## Aquatic Nuisance Species on the Move in Vermont in 1999

Vermont state biologists and lake users were hoping to enter the new millennium with Vermont's inland lakes free of zebra mussels. However, those hopes were dashed in late June, when a seven year old boy found a single adult zebra mussel in Lake Bomoseen, one of the state's largest lakes. Aquatic Biologists from the VTDEC later located several more adult zebra mussels in the same vicinity. Zebra mussel veligers (larvae) were then detected in plankton samples collected from Lake Dunmore in mid July, and Lake Hortonia in early August. Snorkeling surveys of both Lake Dunmore and Lake Hortonia failed to locate any adult zebra mussels, but the lakes are considered to be infested. Lake Bomoseen and Lake Hortonia are located in Rutland County in west central Vermont. Lake Dunmore is located just to the north in Addison County (see map on page 3).

All three newly infested lakes are within 15 miles of Lake Champlain which contains a large population of zebra mussels. Zebra mussels were discovered in Lake Champlain in 1993 and have since spread throughout much of the 120 mile long lake located on the border between Vermont and New York. The nonnative mussels have spread a short distance up several of the Lake's tributaries, but otherwise had not been detected in any other Vermont bodies of water until this past summer. Now that zebra



*continued on next page*



The 1999 summer season also saw the discovery of Eurasian watermilfoil in three more Vermont lakes, bringing the statewide total to 49 infested lakes and ponds. In mid June, Eurasian watermilfoil plants were discovered scattered throughout Indian Brook Reservoir located in Chittenden County. In August, a well established population was found near the public boat access area on Lake Willoughby in Orleans County, and in September an angler pulled a single plant from Seymour Lake, also in Orleans County. The Lake Willoughby and Seymour Lake findings are particularly troublesome because they put Eurasian watermilfoil within close proximity to many other lakes in the northeast region of the state where the plant has been relatively scarce.

It is encouraging that Vermont lake users have discovered and promptly reported many of the first sightings of aquatic nuisance species in Vermont waters. These actions suggests that the Vermont public is generally aware of and concerned about aquatic nuisance species. Unfortunately, the new introductions of zebra mussels and Eurasian watermilfoil further suggest that efforts to transform the concern into preventative actions have not been fully effective.

For more information about aquatic nuisance species in Vermont contact the Lakes and Ponds Section at 802-241-3777, or visit the VTDEC Aquatic Nuisance Species Website. [www.anr.state.vt.us/dec/waterq/ans/ans-index.htm](http://www.anr.state.vt.us/dec/waterq/ans/ans-index.htm)



**Note: At Fern Lake and Lake Seymour, only individual Eurasian watermilfoil plants were found and removed. No current milfoil populations are known to exist.**

## **"Natural Channel" Restoration of the Trout River**

The Agency of Natural Resource's newly adopted approach to river restoration and to reduce flood damage was demonstrated for the first time on an approximately one mile reach of the Trout River in the town of Montgomery during fall 1999. This new approach uses emerging techniques to reduce flood hazards and restore water quality, recreational values, and aquatic and riparian habitat functions. By understanding river morphology and addressing the systemic problems affecting the whole river segment rather than simply treating local erosion problems the river can more effectively be restored.

Historic changes in land uses in the watershed and recent flood events have resulted in extremely high rates of streambank erosion and sideways channel migration along an approximately one mile long reach of the Trout River immediately downstream of Montgomery Center. Consequently, very little mature streambank vegetation remains. Enormous quantities of sediment generated by bank erosion has severely degraded fish habitat. The result is excessive loss of agricultural productivity and property values along this reach of the river, instability of the Route 118 embankment, degraded natural resources, and loss of the river's fisheries and boating related values.

The project design for the Trout River focuses on restoring the stable width, depth, meandering form, slope and riparian vegetation

along the problem river stretch. Extensive survey of the river's existing dimensions and a comparison to those of stable rivers have served as a guide for the restoration design. Returning the width and depth of the river to their correct dimensions will allow the river to effectively transport the flows and sediments delivered to it without excessively eroding its bed or its banks. The goals of this project are to preserve agricultural lands, stabilize property values, protect Route 118, and shape a river that maintains its ecological and recreational values.

Fundamental to the success of the Trout River project is a high level of cooperation and coordination between the local community and the many state and federal agencies involved with river management in Vermont. Partners in the project include the town of Montgomery, adjacent landowners, the Federal Emergency Management Agency, the U.S. Fish and Wildlife Service, the Natural Resource Conservation Service, the U.S. Environmental Protection Agency, the U.S. Forest Service, the Lake Champlain Basin Program, the Vermont Agency of Natural Resources, the Vermont Agency of Transportation and the Missisquoi River Basin Association. This cooperation has provided the diverse knowledge base needed to restore stability to the Trout River and acts as a model to restore many more of Vermont's rivers in the future.



**BEFORE**



**AFTER**

work along the Trout River has  
re-established a single channel

## Have You Looked at Your Gravel Road or Driveway Lately?

Recent attention has focused on gravel roads and driveways as potential sources of sediment and phosphorus to lakes and streams. Every road or driveway can become a conduit for rainwater or snowmelt, eroding the road material and introducing it to nearby streams or lakes. It is critical to maintain driveways in the shoreland area due to their proximity to the lake. Here are some tips on evaluating your lakeshore driveway or private road to ensure it is not part of this erosion problem.

First, walk your driveway or road during a heavy rainfall or during the snowmelt period. Observe the flow of water along the road and note the following:

- Does any water run as channelized flow directly into the lake or to a inlet stream? If so, this problem is the highest priority to fix. Look uphill for ways to divert water into vegetated areas. Extreme situations may warrant moving the driveway back or redesigning it.
- Examine how the flow becomes channelized and concentrated. As the flow increases in volume it can erode more material.
- Is the water runoff carrying much eroded soil or gravel? This situation may indicate there are ditches, banks or backslopes that need stabilizing.
- Does the driveway or road have eroding gullies down the length of it? Does the water flow down the tire tracks? There are four basic principles to good road or driveway maintenance.

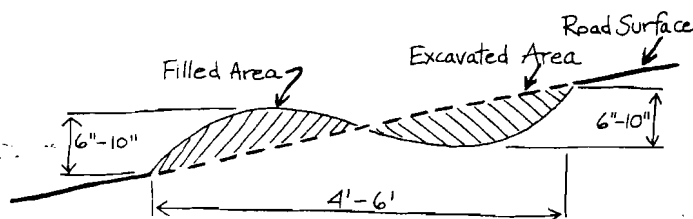
**1. Get water off the road as soon as possible.** Maintain a good crown on the road surface so that water runs off the edges of the road, rather than down the length of it. Waterbars are a good trick to use on steep slopes often found in private road or driveway situations. Three possible waterbar designs are below. Consider the quality of any new gravel you may add periodically; ask for quality "crusher run" gravel.

**2. Stabilize and revegetate bare areas.** These unstable areas often crop up around culverts, in ditches, and along backslopes. Simple rock headers can be built by hand on smaller culverts. Ditches with slopes greater than 5% should be rock-lined for stability.

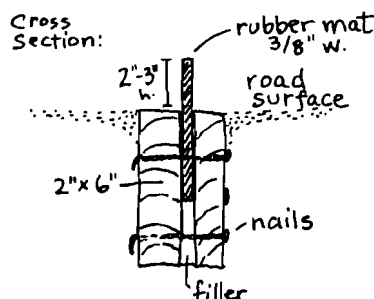
**3. Divert as much runoff as possible into vegetated areas.** A wooded area can absorb quite a bit of runoff, reducing surface flow and removing sediment. Divert the road runoff as often as possible by using turnouts, waterbars, and culverts. By doing this often, runoff volume can be kept low, increasing the effectiveness of vegetation and duff layers that absorb it.

**4. Good maintenance saves money over the long run.** Putting adequate money into a road improvement project at the beginning increases its longevity, thereby saving you money in the future. Plus, you will have the satisfaction of knowing you are protecting nearby streams and lakes.

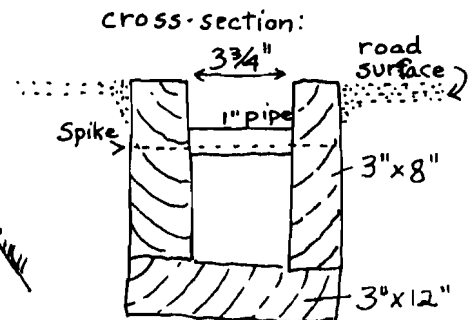
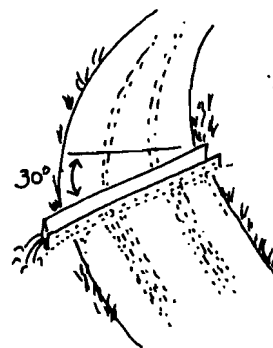
For more information, please contact the Better Backroads Program through the Lakes and Ponds Section at 802-241-3777.



**Waterbar:** Construct crossways on a slope, angled downhill, to direct runoff from the road into a vegetated area. Steep sections require deeper and more frequent waterbars.



**Rubber Bar Waterbar:** Construct with pressure treated wood; install at an angle, at road level; and nail layers through with 6 inch nails.



**Open Top Culvert Waterbar:** Construct with pressure-treated wood; install at an angle, at road level; clean regularly.

## Quotes About Water

***All the water that will ever be is, right now.***

National Geographic, October 1993

***Water is H<sub>2</sub>O, hydrogen two parts, oxygen one, but there is also a third thing, that makes water and nobody knows what that is.***

D.H. Lawrence (1885-1930), Pansies, 1929

***When the well's dry, we know the worth of water.***

Benjamin Franklin, (1706-1790), Poor Richard's Almanac, 1746

***Between earth and earth's atmosphere, the amount of water remains constant; there is never a drop more, never a drop less. This is a story of circular infinity, of a planet birthing itself.***

Linda Hogan, Northern Lights, Autumn 1990

***Children of a culture born in a water-rich environment, we have never really learned how important water is to us. We understand it, but we do not respect it.***

William Ashworth, Nor Any Drop to Drink, 1982

## Facts About Water

★ The amount of water is constant and recycled throughout time; actually, it is possible to drink water that was part of the dinosaur era.

★ The most common substance found on earth is water. Water is the only substance found naturally in three forms: solid, liquid, and gas.

★ One gallon of water weighs 8.34 pounds.

★ While usage varies from community to community and person to person, on average, Americans use 183 gallons of water a day for cooking, washing, flushing, and watering purposes. The average family turns on the tap between 70 and 100 times daily.

HAPPY NEW MILLENNIUM

Vermont Agency of Natural Resources  
Department of Environmental Conservation  
Water Quality Division  
Lakes and Ponds Section  
103 S. Main Street, 10 North  
Waterbury, VT 05671-0408

BULK RATE  
U.S. POSTAGE  
PAID  
WATERBURY, VT  
PERMIT No. 17

Address correction requested.