



## MUSSEL MANIA — WHAT IS IT?

By Andy Kronwall

Lake Geneva Country Club is an 18-hole private country club nestled along the southern shore of Geneva Lake. The club was established in 1896, with construction of the golf course beginning that year. The construction of the course took considerable time because the work was done by hand and with horses. Nevertheless, by 1898 eighteen golf holes were completed. During the depression years laborers were hired for \$1 per day to install drainage lines and an irrigation system. Three water towers were constructed and a pump house was built along the lakeshore to utilize the pristine waters of Geneva Lake. Although the irrigation system has been updated several times, we still use Geneva Lake as our sole water source for golf course irrigation.

Zebra Mussels were first observed in Geneva Lake on rocks and pier posts at the east end of the lake in the fall of 1995. By mid-summer 1996 moderate sized colonies had spread to about the mid-point of the lake (the narrows), and smaller colonies were observed at the west end. The lake is nine miles long and the current flows from west to east, so it is presumed that the original contamination took place on the east end of the lake and has slowly moved against the current to the west end.

Zebra Mussels (*Dreissena polymorpha*) are small clam shells (1/2 - 2 inches) which attach to any solid object with tufts of fiber called "byssal threads." They are native to the Caspian Sea region of Asia, and were introduced into North America in the mid 1980's via transoceanic ships that discharged ballast water into Lake St. Claire, near Detroit. Tolerant of a wide range of environmental conditions, Zebra Mussels have extended their range to parts of all the Great Lakes and much of the Mississippi River. They are beginning to infest inland lakes and rivers as well, primarily transported by careless boating enthusiasts and waterfowl.

Quagga Mussels (*Dreissena bugensis*) are related to the Zebra Mussel, and much of the information I am presenting applies to the Quagga Mussel as well. The Quagga Mussel has only been found in the St. Lawrence Seaway, Lake Ontario, Lake Erie, and Saginaw Bay in Lake Huron, so for this article I will only refer to the Zebra Mussel.

I became concerned about water quality in Geneva Lake not only because it's the source of water for my golf course irrigation, but my family uses it for boating, fishing, and swimming. Geneva Lake is also vital to the economic success of my community, bringing in millions of tourist dollars annually.

I soon learned the seriousness of this mussel menace when my new irrigation pumping station was not working properly. I disassembled a high pressure relief valve and found it to be plugged with Zebra Mussels. It was then that I decided to learn as much as I could about Zebra Mussels. At that point in time I had a new irrigation system plan, and installation of the new pump station was already

completed. Installation of the rest of the irrigation system was to take place in the fall of 1998. I didn't want to contaminate the new system, so we put all plans on hold until we formulated a strategy for Zebra Mussel control.

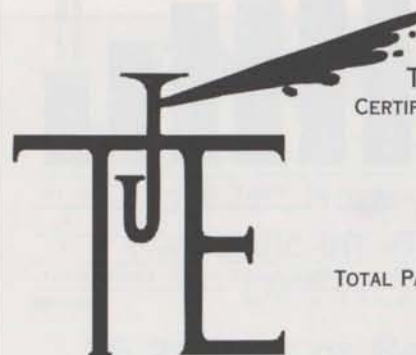
The mature female Zebra Mussel will produce up to one million eggs per season. Egg release starts when the water temperature warms to about 54 degrees Fahrenheit and continues until the water temperature drops to below 54 degrees Fahrenheit. Eggs are fertilized outside the mussel's body and within a few days develop into free-swimming microscopic larvae called veligers that soon develop miniature bivalve shells. Mussels become adults when they reach sexual maturity, usually within a year. Zebra Mussels are bivalve shells that use cilia on their gills and body to pull water into the shell cavity through an "incurrent siphon" to extract particulate matter. The newly particle-free water is then discharged out the "excurrent siphon," as are feces from the intestine and urine from the kidneys. Each adult mussel is capable of filtering one or more liters of water each day.

Since the Zebra Mussel is not native to this region it has had a negative impact on our ecosystem. This will affect the way we use our lakes and streams for irrigating golf courses, food crops, and industry such as power plants and paper mills.

### HOW WILL THEY AFFECT YOUR COURSE?

Zebra Mussels will attach themselves to anything that is not toxic to them, including attaching to other Zebra Mussels. This characteristic will have the biggest impact on golf course irrigation systems. Zebra Mussels are sucked into the intake pipes of our irrigation system when

(Continued on page 47)



THOMAS J. EMMERICH  
CERTIFIED IRRIGATION DESIGNER

\*GOLF COURSE  
\*COMMERCIAL  
\*RESIDENTIAL  
\*MASTER PLANNING  
\*SYSTEM EVALUATIONS  
TOTAL PACKAGE DESIGN SERVICES

T.J. EMMERICH ASSOCIATES, INC.

IRRIGATION CONSULTANTS  
30556 BETTE ANN DRIVE  
HARTLAND, WISCONSIN 53029

414-966-1051



(Continued from page 45)

they are in the free-swimming veliger stage (white blood cell size). They then attach themselves to the pipe and begin to grow. The irrigation cycles continue to bring in food needed for their survival and take away the waste generated by them. The perfect environment! As weeks pass, the pipe becomes lined with Zebra Mussels, and the second generation attaches to the first generation. As this process continues, the pipe becomes so restricted the water supply is reduced to only a fraction of its original capacity. Another problem which is typically noticed first is the clogging of small orifices of the metering valves and sprinkler heads. Each unit has to be disassembled, cleaned, and reassembled, which uses hundreds of man hours and costs immeasurable inconvenience. If undetected and/or steps are not taken to control Zebra Mussels, they could permanently cripple a golf course irrigation system in a very short period of time.

Currently there is not much documentation of successful Zebra Mussel control methods for golf course irrigation systems. Most research has been aimed at power plants, paper mills, and fire protection systems. I used research done by universities and corporate studies, as well as discussions with WI DNR, US Sea Grant, and local environmental specialists to come up with a Zebra Mussel control plan. Some of the best information came from Canadian and Michigan Golf Course Superintendents who have been dealing with Zebra Mussels since 1988. I originally made contact with those superintendents by posting a question on the GCSAA Internet site. The internet is an excellent source of information for any subject you can imagine.



## Fairway Aerification

We use the

- CUSHMAN GA-60 AERATOR
- CUSHMAN TURF TRUCK

- Our clients are Extremely Pleased with the superior hole quality this unit produces!
- Daytime and Evening Service
- Serving Wisconsin and Northern Illinois
- Prompt and Efficient Service

**(414) 392-3444**

- References are Available
- Fall 1996 & Spring 1997 Dates are Available

Within closed loop systems, injection of molluskicides have produced some of the best results in Zebra Mussel control. Some that have been tried are Chlorine @ 0.25 ppm (turfgrass injury at >50 ppm), Calgon H-130 @ 5 ppm, Potassium @ 30 ppm or 40 ppm, and pH regulation. All of these methods were tried individually and had varied degrees of success.

I chose to try a combination of pH control and potassium injection. This method had not been tried yet to the best of my knowledge, but I felt it would work best for my situation. The agencies involved thought that my suggestion of pH control by monocarbamide dihydrogensulfate (MCDS is marketed commercially under the name of PHAIRWAY) injection and potassium injection could be a viable control system. I added two *Neptune* injection pumps with *Stranrol series 840* controllers into my irrigation pump station. With this system the pH level is monitored through a sensor inside the irrigation system. It will inject MCDS only during a pumping cycle to correct the pH level according to my chosen setting (6.5). Zebra mussel physiology requires an environment with a pH of more than 7 to survive. The injection system for the potassium is metered for 30 ppm. My source for potash is through a local farm service supplier and is very inexpensive. I chose this system based on my needs to control the zebra mussels, but also considered some of the additional benefits of correcting the pH level of my irrigation source, which is 7.8. The ability to inject potassium was also attractive because my soil tests consistently show deficiencies in potash.

Since the installation of this system I haven't had any clogging of irrigation equipment due to mussels. Whether this system will continue to be effective in controlling Zebra Mussels only time will tell. I am confident that what I am doing is the best available solution to my immediate problem with the least environmental impact. Since there are so many unknowns in Zebra Mussel control, I consider this a short term solution to a long term problem. I am currently working on a plan to create a lake on our course as well as installing a high volume well to use for water supply for my new irrigation system. If contamination were to occur in this much smaller lake, I will be able to control them in this micro-environment without the use of any molluskicides.

(Continued on page 49)

## FOR SALE

1990 Jacobsen Turfcut Diesel  
T4220 72" Rotary Mower  
hydraulic lift, 600 hrs.  
**LIKE NEW**

**\$6,200.00 or Best Offer**

Contact Don Butzin  
**(414) 544-1555**



(Continued from page 47)

I have given an extremely brief overview of the information I was able to obtain and how I applied it to my situation. For additional information on Zebra Mussels, you can contact the Wisconsin Sea Grant Advisory Service, Cliff Kraft (414) 465-2795, or Michigan Sea Grant Communica-

tions Office at (734) 764-1118. For those that are on-line there are a few sites dedicated to Zebra Mussels containing large volumes of information. A good start is [www.nfrcg.gov/zebra.mussel](http://www.nfrcg.gov/zebra.mussel). Much more information has been published since I did my research, so I would suggest that if you are now pumping from a lake, stream, or irrigation pond you review the new information. ♣

## UPCOMING EVENTS

May 6	Snow Mold Field Day	Gateway GC, Land O' Lakes
May 11	WGCSA May Meeting	Cedar Creek CC, Onalaska
May 20	SuperPro	Lawsonia GC, Princeton
June 5	John Deere Tourney	Old Hickory CC, Beaver Dam
June 8	WGCSA June Meeting	Browns Lake GC, Burlington
July 14	WGCSA July Meeting	Monroe CC, Monroe
Aug 10	WGCSA August Meeting	Edelweiss Chalet CC, New Glarus
Aug 12	WTA Summer Field Day	Noer Facility, Verona
Sept 21	WGCSA September Meeting	Koshkonong Mounds CC, Fort Atkinson
Oct 2, 3	WGCSA Couples Weekend	Riverview CC, Appleton
Oct 12	WGCSA October Meeting	Timberstone GC, Kingsford, MI
Nov 3, 4	Wisconsin Golf Turf Symposium	Milwaukee
Jan 12, 13	WTA EXPO	Marriott Middleton

## *Spray in the wind with the WINDFOIL*



**Windfoil**  
**PROLAWN®**

*Commercial Turf Equipment and Supplies®*

1-800-292-3628 (414-782-8869)

**"DEMONSTRATION DRIVEN"**

- ▶ Reduce Environment, Public Pesticide Exposure
- ▶ Increase Productivity / Stay on Schedule
- ▶ Maintain on Target Applications
- ▶ Increase Public Confidence
- ▶ Adapt to your Current Sprayer
- ▶ Current Customers Thru-out Wisconsin

