

Q&A

Copper and zebra mussels

Minnesota Department of Natural Resources
10/10/11

The Minnesota Department of Natural Resources (DNR) is planning on chemically treating a small area of Rose Lake in Otter Tail County in the hopes of eradicating a small number of zebra mussels that were recently introduced to the lake. Recent surveys suggest that the mussels seem to be isolated to a small area of the lake where they were introduced on an infested boat-lift. The size of the zebra mussels suggest that they are young and may not have reached reproductive maturity. This is a unique opportunity to attempt eradication. Once zebra mussels are established and widespread within a lake, there are currently no effective and safe options of eradication. The DNR has chosen to use a copper product to control the small number of zebra mussels in one isolated location in Rose Lake. Below is information on the use of copper to control zebra mussels.

Has copper been shown to kill zebra mussels?

Early laboratory studies (1993) by the US Fish and Wildlife Service showed copper to be toxic to adult zebra mussels, although higher doses were needed for short exposure times (2 days)

Later studies (2006) by the US Army Corps of Engineers researchers (funded by MN DNR) showed copper sulfate and chelated copper (Cutrine Ultra) were toxic at low doses to veligers and higher doses over longer exposures (4+ days) to adult mussels, with mortality increasing over time to adults.

MN DNR applied chelated copper to a 26 acre bay weekly over two seasons to attempt to control veliger movement out of Lake Ossawinnamakee (2004 and 2005). Veligers were killed in the bay waters, and settled attached mussels in the outlet stream were also killed by the copper.

Copper sulfate was applied twice (2008 and 2009) to the entire area of a small lake on Offutt Air Force Base, Nebraska to try to eliminate zebra mussels in the lake. Testing showed complete mortality of the adult mussels placed in cages during the treatment. While the treatments appeared to eliminate zebra mussels from the lake, they were discovered in sampling the year after treatment.

Are other aquatic animals impacted by copper?

Copper sulfate has been used to kill algae in lakes and will kill some of the plant plankton when used. It may also kill some aquatic plants. It also will kill some common animal plankton (such as Daphnia, common water fleas). It is also used to kill snails which may be contributing to swimmers itch problems. Studies in the stream after copper treatments in Lake Ossawinnamakee showed that some aquatic insects were also killed by copper. Insects such as mayflies, some caddisflies, freshwater snails and fingernail clams showed high mortality. If copper is applied to an entire lake or enclosed area, it can kill fish – researchers found large number s of dead fish after the entire lake treatment.

Is it harmful to animals like ducks or even humans?

At the application doses that the product is applied to lakes, there have been no impacts shown to waterfowl or humans.

If copper can kill fish, aquatic insects and algae, won't this application have a serious negative impact on the lake?

There should not be long-term, lasting impacts to the lake or the aquatic life in the lake. At this time of the season, there is little algae in the lake so the impacts to the algae will be small. Also, zooplankton numbers are low and the types of zooplankton killed by copper are few in the water now. For the vast majority of the treatment area, fish can freely swim out, so there should be little impact to fish. We may see small number of fish impacted where an enclosure will be placed around the immediate area where zebra mussel were found (less than a quarter acre in size). The large fish kill seen in Nebraska was a result of the entire lake being treated. Aquatic insects and freshwater snails in the treated area that are susceptible to copper will likely be killed. But aquatic insects can quickly move into this area from untreated areas of the lake and any impacts will likely be very short-term. Research on the aquatic insects impacted by copper in the stream flowing out of Lake Ossawinnamakee showed fast recovery of many of these insects soon after the copper treatments were ended.

Additionally, the area treated is a small part (approximately 10 acres out of 1200 total lake acres) of the entire lake. Any impacts that are seen in this small area would not likely be significant for the lake, and may not be noticeable in the next season.

Isn't there some other chemical that may not kill aquatic insects or cause less impact that could be used? Why choose copper?

There are few if any chemicals that can be used in lakes that will kill zebra mussels. Recent news stories have talked about a dead bacteria (Zequanox) used to kill zebra mussels. However, this product is not yet registered in the U.S. for use in lakes. In addition, little research has been done to show that the bacterial control is effective in natural lake situations. Obtaining a permit that would be needed to use this for the treatment would likely take more time than we might have, given the time of year. Similarly, potassium chloride was used by one state to kill zebra mussels in a small abandoned mine quarry. This chemical also is not registered for use in lakes, and would face the delay in the time for permits.

Recently a new product has been proposed for killing zebra mussels (Natrix). However, this product is currently only registered for use under a special local needs (SLN) permit for the state of South Carolina. It could not be used in Minnesota without a similar SLN permit. However, the active ingredient in this product is copper. In Minnesota, there are numerous copper products currently labeled and available for use in our waters without any delays that can arise from special permitting. When Natrix becomes registered through the normal process in our state, it will be another copper-based aquatic pesticide that can be used as a tool in special cases.

Copper has been shown by laboratory and two separate field studies to kill zebra mussels, both the larval and adult stages. It is registered for use in lakes, and has been used in lakes across the state and other parts of the nation as well. It is readily available, and requires no special permits for use – it can be used immediately. While some non-target impacts may happen, they are likely to be small and short-lived, and not affect the rest of the lake.

Once zebra mussels are established and widespread within a lake, there are currently no effective and safe options of eradication. Copper, however, gives the DNR the best chance to eliminate any mussels that may remain in this small area, without major significant long-lasting ecological impacts.

References:

Kennedy, A.J., R.N. Millward, J.A. Stevens, J.W. Lynn and K. D. Perry. 2006. Relative sensitivity of zebra mussel (*Dreissena polymorpha*) life-stages to two copper sources. *J. Great Lakes Res.* 32: 596-606

Montz, G.R., J. Hirsch, R. Rezanka, and D.F. Staples. 2010. Impacts of copper on a lotic benthic invertebrate community: response and recovery. *Jour. Fresh. Ecol.* 25(4): 575-587

<http://snr.unl.edu/invasives/documents/NebraskasZebraMusselInfestationandEradicationatLakeOffutt.pdf>

Nebraska power point presentation on zebra mussel control effort in Offutt Lake, 2010

For further information contact:

Gary Montz
Research Scientist 2, Aquatic Invertebrate Biologist
MNDNR - Division of Ecological and Water Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025
651/259-5121
email: gary.montz@state.mn.us