Water Column

Winter 2013
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Road Salt Runoff: What's in Your Lake?

~ Julie Savia

This winter has been one of the coldest on record in Indiana with several record-breaking days of snow. But life goes on. We still have to get to work, get our children to daycare, buy groceries, and do all the other things that require travel from point A to point B. So we clear the streets and put salt on them. And then the snow melts and turns to ice overnight, so we put salt on that. Then it snows again and – you guessed it! – more salt. But where does the salt go when the snow melts? The water flows downhill, over the frozen ground, and ultimately finds its way into a lake or stream. And – you guessed it! – so does the salt (Figure 1).

Road salt is applied to roads in the winter months because it lowers the freezing point of water it comes into contact with. Because road salt can be any type of chloride salt, the technically correct term for it is "de-icer." Because of the low cost and ease of use and storage, rock salt (NaCl or sodium chloride, the same compound that makes up table salt) is the most commonly applied de-icer, despite the fact that it is only effective at temperatures above 15 °F.

The U.S. Environmental Protection Agency (EPA) recommends that chloride (when associated with sodium) should not exceed a four-day average of 230

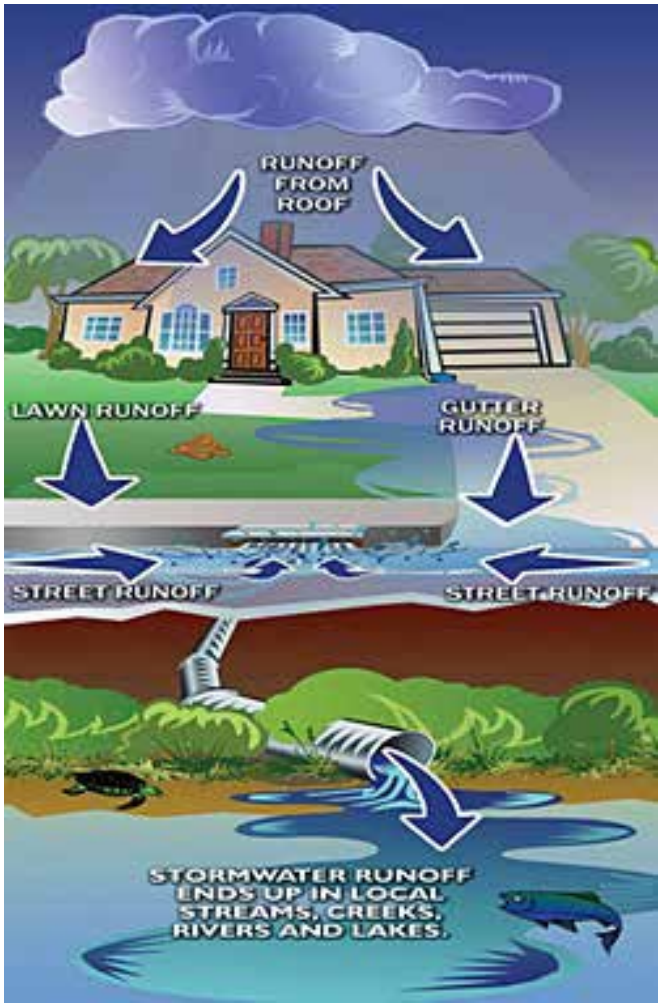


Figure 1. Road salt enters aquatic ecosystems as a non-point source.

mg/L more than once every three years in freshwater systems. However, EPA recommendations are not law, and the state of Indiana does not regulate chloride from non-point sources such as runoff from roads and other impervious surfaces. Further, there is no chloride monitoring program, so scientists know very little about how high chloride concentrations might become each winter or what the effects might be. Scientists are concerned about the potential negative effects this chemical could have on aquatic ecosystems; it is estimated that about 10% of aquatic species would be negatively affected by long-term exposure to 240 mg/L of chloride, a mere 10 mg/L above the EPA recommended maximum (Evans and Frick 2001).

In 2010, a study on the effect of road salt application on chloride levels and toxicity was completed by Kristin M. Gardner and Dr. Todd V. Royer using observations from South-Central Indiana streams. Gardner and Royer monitored four streams draining various proportions of developed land. During the winter months when rock salt was applied to the roads, distinct spikes in chloride concentrations were detected in the streams after precipitation events (Figure 2, redrawn from Gardner and Royer 2010).

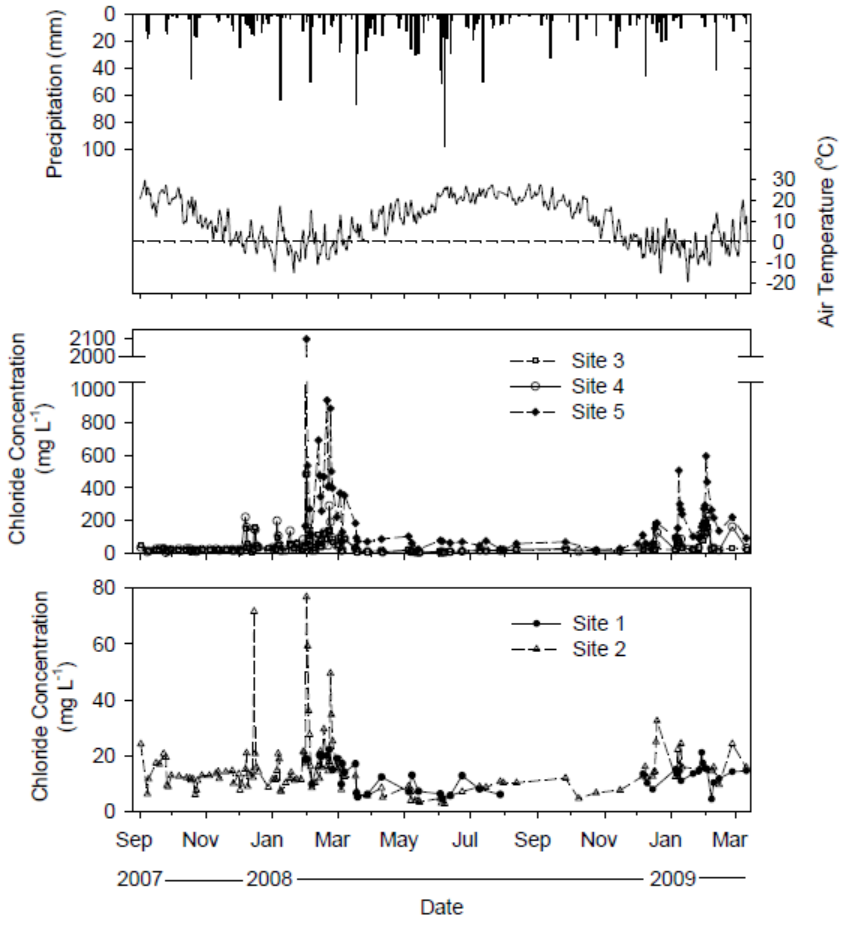


Figure 2. Precipitation, air temperature, and in-stream chloride concentration from September 2007 through March 2009 at the study sites in South-Central Indiana. Note the difference in scale of chloride concentration between the center and the lower graphs. Redrawn from Gardner and Royer 2010.

Not surprisingly, the site with the highest percentage of developed land (78.5%) had the highest chloride concentration observed in the study: 2100 mg/L. Gardner and Royer demonstrated that exposure to 1812 mg/L of chloride will kill 50% of water fleas (*Daphnia pulex*). Although the water flea may seem like an insignificant fauna to study, these zooplankton are a critical component of the aquatic food web. Further, the highest concentration of chloride found in the study is more than eight times the level estimated to negatively affect 10% of aquatic species after long-term exposure. Fortunately, the first-, second-, and third-most developed study sites routinely had concentrations of less than half the EPA recommended limits.

As the human population continues to grow, land will continue to be developed. This increase in impervious surfaces will likely lead to an increase in road salt application, and thus an increase in chloride. We have already seen this in some central Indiana streams (Gardner and Royer).

There are alternatives to rock salt available but all are still some form of salt; only salt will effectively lower the freezing point of water. Recently, beet juice has gained some attention, but it functions differently than salt and is more expensive than rock salt. Cheese and pickle brine are effective at lower temperatures than rock salt (-21 °F and -6 °F, respectively).

Private home- and lake-owners may choose to make their own more environmentally friendly de-icer. All you need to do is combine the green juice in pickle jars with some table salt in a spray bottle and spray your driveway. This brine reduces the amount of chloride that enters aquatic systems by 14 to 29 percent. While these alternatives may appear as ideal solutions to preventing chloride inputs, there is a significant concern regarding the potential nutrient inputs associated with the beet juice and brine. Homeowners need to ensure that by helping prevent one environmental problem, they don't create another.

Rock salt runoff negatively affects soil, vegetation, concrete, metals, and aquatic life. Human safety is of primary concern, but environmental effects need to be considered as well. This is the challenge of most of our lake management predicaments . . . finding the balance!

Literature Cited

Evans, M. and C. Frick. 2001. The effects of road salts on aquatic systems. National Water Research Institute. NWRI Contribution No. 02-308.

Gardner, K.M. and T.V. Royer. 2010. Effect of road salt application on seasonal chloride concentrations and toxicity in South-Central Indiana streams. Journal of Environmental Quality 39:1036–1042.

For more information on alternatives, go to:
http://news.nationalgeographic.com/news/2014/02/140204-melt-snow-ice-salt-beet-juice-pickle-brine/
or
http://chemistry.about.com/b/2010/12/09/what-is-the-best-deicer.htm

Stone Lake – Results of Summer Research and Fast Boats!

~ Ashlee Haviland

*[*Editors' note: *If you recall from the 2013 summer* Water Column*, Stone Lake was host to exciting boat races (Figure 3). Below is the executive summary of the summer research. If you'd like to read the whole report, please visit:* **http://www.in.gov/nrc/files/item_5_ac_jan_2014_report.pdf***.]*

Executive Summary

Stone Lake is a natural 150-acre public freshwater lake in LaPorte, Indiana. It is connected to 564-acre Pine Lake by a channel between the northern part of Stone Lake and southern part of Pine Lake. Stone Lake exhibits excellent water clarity when compared to other Indiana lakes. Secchi disk transparencies since 1975 have ranged from a low of 11.5 feet to a high of 22.0 feet (Baetis Environmental Services Inc. 2007). Other water quality and nutrient parameters have historically demonstrated high water quality at the lake.

The Indiana Department of Natural Resources (IDNR) Division of Law Enforcement held a public meeting regarding a high-speed boat race at Stone Lake and then a permit was issued. Local residents contested the issuance of the permit, due to the already established speed limit of 10 mph and the size of the lake itself. The case then went to Administrative Law Judge Stephen L. Lucas. The permit was issued to allow racing over a three-day period (May 31-June 2, 2013) subject to several conditions related to public safety and protection of water quality and aquatic habitat. Specifically, Judge Lucas directed IDNR, Division of Fish and Wildlife, to "work to assess the shoreline, vegetation, water quality and any other concerns prior to the event, during, and after." This report is presented in fulfillment of that requirement.

Aquatic plant surveys for emergent and submergent vegetation were conducted pre-race and post-race to determine what, if any, impacts were caused due to high-speed boating of Formula One Tunnel Boats. High species diversity of aquatic plants is present at this small lake and all but one species were found after the race compared to pre-race. A slight decrease in frequency of occurrence was observed for nearly 60% of the species encountered post-race. Floristic Quality Index was evaluated and indicated that Stone Lake is an excellent example of high-quality natural remnant community. Of the native plants present in Stone Lake, three are listed on the state "Endangered, Threatened, Rare, and Extirpated" list. White-stemmed pondweed and Beck's water marigold are listed as state threatened and critically imperiled in the state. Fern pondweed is state listed as rare and imperiled in the state. White water crowfoot is found in this lake, but is becoming less common in the state (Swink and Wilhelm 1994).

Dissolved oxygen levels in Stone Lake are sufficient to support fish down to 6 or 7 meters during summer stratification. Stone Lake tends to host relatively high dissolved oxygen numbers that spike deeper in the water column. Oxygen levels did not appear to be adversely affected by the weekend of racing.

Water chemistry analysis was performed to determine if any impacts to water quality had occurred as a result of the racing. Samples for water chemistry were performed pre-race, during the race, post-race, and two long-term samples to determine any late summer impacts to Stone Lake. Several water quality parameters were elevated post-race but most were within the range of those observed since 1989 by the Clean Lakes Program. The exceptions to this were nitrate and soluble reactive phosphorus, which were both far higher in August than what has ever been observed at Stone Lake.

Water clarity was measured during pre-race, racing, and post-racing activities. Stone Lake typically hosts high water clarity. Clarity was maintained during race weekend and increased on June 3, 2013 to 7.2 meters. Water clarity declined substantially during the samples in July

The Volunteer Lake Monitoring Corner

~ Sarah Powers

This winter has been a whirlwind between packing our lab for a summer move and the cold weather. I am really looking forward to spring. I will be finalizing 2013 data and sending it out in the very near future. We are planning for a busy summer sampling season and look forward to growing all of our volunteer programs.

As we finalize data we look to our volunteer surveys to help us follow up and monitor our progress from the previous year, so if you have not returned the survey, please do so soon. Those surveys help us modify the program to meet your needs! We have asked volunteers to let us know if their association would be interested in hosting an "Aquatic Invasive Plant Workshop."

We hope to have these workshops in May and June depending on availability. We will be having a plant workshop at the annual Indiana Lakes Management Society Conference so if you are interested please consider coming. If you would only like to attend the workshop on Thursday and not the technical sessions of Friday there is no charge, but you must register in advance.

Volunteer	Lake(s)	Start Year
Donna Moran	Olin, Oliver and Martin	2009
Michael Squint	Tawny	2002
Jeff Thornburgh	Tippecanoe, James, and Oswego	2008
Howard Pratt	Big Long	2000
Joy Kamradt	Clear	1996
Robert Ginger	Holiday	1998
Dave Byers	Shriner	2003
Jerry Caylor	Nyona	2002
Tom Mackin	Lake of the Woods	2004
Gordon Huston	Westler	1997
Michael West	Waubee	2009
John Winters	Ole Swimming Hole	1999

Our volunteers are a very important part of the work we do. Without the help and support of volunteer monitors we would not be able to collect the amount of data we do. We appreciate every individual who has helped grow and shape the program to what it is today. We have had several volunteers retire from the program in the past two years. We want to take the opportunity to recognize and thank these volunteers for their support over the years.

There are several lakes in the state that do not currently have monitors on them. We are always seeking new volunteers so if you are interested in becoming a Volunteer Lake Monitor or would like more information about our program, please check out our website or contact me at **indianaclp@gmail.com**.

and August. The July decline coincided with when green algae, blue-green algae, and diatom numbers were at their highest.

Waterfowl were observed around Stone Lake by the IDNR District Wildlife Biologist. Although there is some waterfowl habitat available, Stone Lake hosts few waterfowl. Human disturbance is likely the limiting factor to greater waterfowl populations at Stone Lake.

Stone Lake is an exceptional lake by Indiana standards and the public should be aware of the impacts that high-speed boating can have on the ecosystem and water quality of this small lake. Every effort should be utilized to maintain the high quality habitat and ecosystem at Stone Lake.

If future races are held, the following are recommended to aid in protection of this quality lake:

- High-speed boating should not occur on more than one weekend per year.
- Preventing high-speed boating within 200 feet from shore must continue to be a requirement in future permits.
- The race course should not pass over the shallow bench that crosses the lake.
- Enforcement should be increased for boats operating with propellers engaged when boats are at more than idle throttle at the boat ramp, beach staging area, and other areas within 200 feet of shore.
- Eurasian watermilfoil control should be performed three weeks or more before the racing weekend so that this invasive species is controlled to the greatest extent possible to prevent fragmentation by the high speed boats and additional spread within the lake.

It does not appear as though the single weekend of high-speed boating in 2013 had irreversible effects on the lake. An annual weekend of high-speed boating may or may not accelerate the eutrophication process at Stone Lake. Frequent or unregulated high-speed boating would likely prove more detrimental to the water quality and quality plant community of Stone Lake.

Aquatic Weed Watchers Plant Highlight

This will be the seventh plant in the plant highlight series. We will be featuring one aquatic plant in each *Water Column* issue. We will feature both native and invasive plants to improve our plant identification skills.

Illinois Pondweed (*Potamogeton illinoensis*), NATIVE

Illinois pondweed is a common submerged plant that grows all over the state of Indiana in lakes and shallow ponds. The plant has primarily submerged leaves, but can have floating leaves and greenish flower spikes that stick out above the water surface. It blooms from spring to fall.

I have heard this plant referred to as a nuisance by some lake users and while it sometimes can grow very densely, it provides valuable habitat for the lake. The submerged portion of the plant provides habitat for aquatic insects that are used as food for fish, amphibians, reptiles, and ducks. This is a naturally occurring plant in many lakes and can also help absorb nutrients from the lake keeping algal populations down.

You can find more information about our Invasive Species Monitoring Program, this plant and many others on the Clean Lakes Program website **www.indiana.edu/~clp**. We have updated the Invasive Species Monitoring page to include links to several resources and tips on identification guides.

Identification tips

- floating leaves are elliptic in shape and are longer than they are wide
- leaves are on long leaf stems
- leaves can be up to 8 inches long
- submersed leaves are the same size, but are more lance-shaped and pointed on both ends
- greenish flowers grow on spikes that stick out from the water surface up to 3 inches

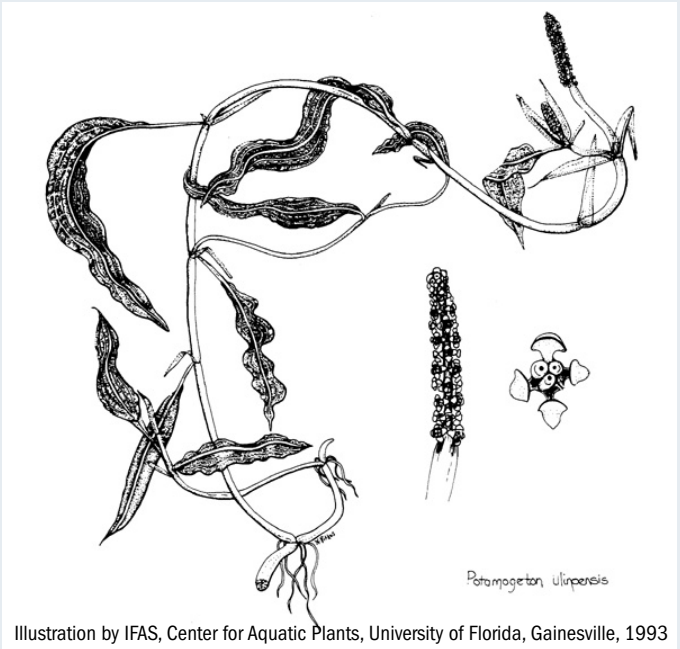
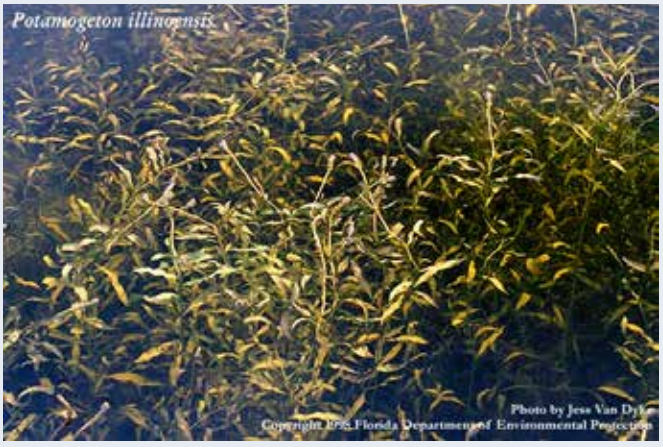


Illustration by IFAS, Center for Aquatic Plants, University of Florida, Gainesville, 1993



MIDWEST AQUATIC PLANT MANAGEMENT SOCIETY

2014 Midwest Aquatic Plant Management Society Annual Conference
Westin Lombard Yorktown Center
Lombard, IL
March 2- March 5, 2014

The 26th Annual

"Dedicated to our Lakes"

Indiana Lakes Management Conference

Thursday and Friday,
March 20th and 21st, 2014
Bloomington Convention Center
Bloomington, Indiana

Please take a look at the draft agenda
for those two days!
We are excited about our conference line up.
Registration is now open!
Please register for the annual conference at
http://www.indianalakesmanagementsociety.wildapricot.org

A Winter's Lake

I saw a man who could walk on water
(without asking a favor from his holy father)

He smile and slid and spun 'round
Twenty yards from solid ground
His tap dance routine was supreme
A dazzle, without a doubt
(but you try telling that
to the sleeping trout)

Beneath his clatter and commotion,
Life is slow - but not frozen

A *Daphnia pulex* does a twirl and dive
Searching for something green and alive
With luck, she'll survive to the thaw
But down below waits an open jaw

~ Tim Clark
MPA/MSES Candidate '14
School of Public and Environmental Affairs
Indiana University

Perspectives

"What good is the warmth of summer, without the cold of winter to give it sweetness."

~ John Steinbeck

WATER COLUMN

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Have you checked out the Indiana Clean Lakes Program Web page lately? Take a look at www.indiana.edu/~clp/ and see what's new and happening with the program and with Indiana lakes!