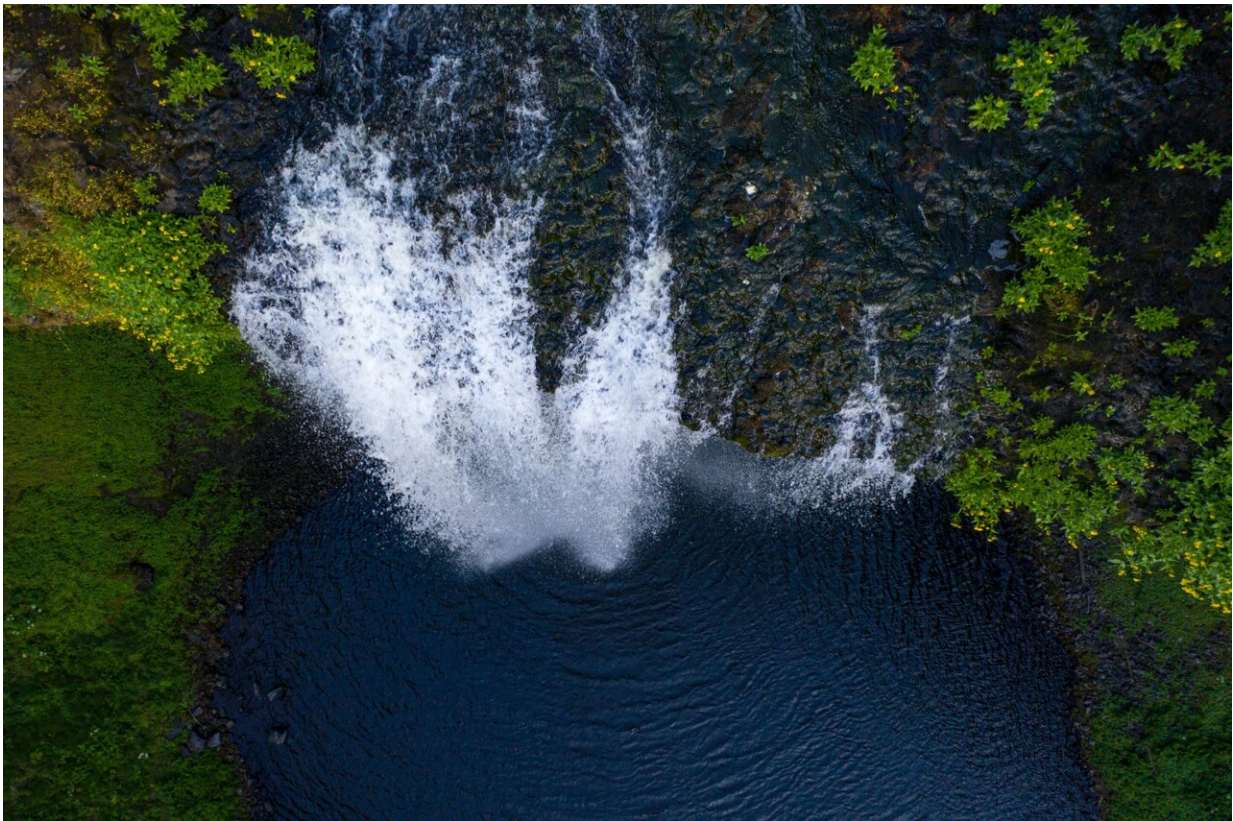


Government guidelines insufficient to protect freshwater ecosystem from salt pollution

February 21 2022



Credit: Unsplash/CC0 Public Domain

Current water quality guidelines aren't protecting freshwater ecosystems from increasing salt pollution due to road de-icing salts, agriculture fertilizers, and mining operations, according to an international study

that included researchers at Rensselaer Polytechnic Institute. Published today in the *Proceedings of the National Academy of Sciences (PNAS)*, the research shows that freshwater salinization triggers a massive loss of zooplankton and an increase in algae—even when levels are within the lowest thresholds established in Canada, the U.S., and throughout Europe.

"It's clear that salt pollution in [freshwater lakes](#), streams, and wetlands, even when constrained to levels specifically chosen to protect the environment, threatens the biodiversity and overall function of [freshwater ecosystems](#). This is a global problem that has the potential to impact ecosystems and human health," said study co-author Rick Relyea, an expert in the impacts of road salt on freshwater ecosystems, and director of Rensselaer's Darrin Fresh Water Institute. "The good news, as we've seen in our own region, is that communities are learning how to apply road salts in smarter ways while still providing safe roads and saving considerable money in snow and ice removal."

Dr. Relyea, a member of the Rensselaer Center for Biotechnology and Interdisciplinary Studies and director of the Jefferson Project at Lake George, has conducted extensive research on the impacts of road salt on aquatic environments. His work has helped to establish that [road salt masculinizes developing frogs](#) and [obliterates circadian rhythm in zooplankton](#). In recent work, Dr. Relyea has collaborated with an experimental network of 16 sites in four countries across North America and Europe. Earlier this year, Dr. Relyea and that network produced experimental findings led by Canadian scientist Marie-Pier Hébert, which show that [lake salinization reduces zooplankton abundance and diversity](#).

The *PNAS* research, led by The University of Toledo and Queen's University in Kingston, shows that even at [salt concentrations](#) below ranges government regulators have deemed safe and protective of

freshwater organisms, significant damage is being done to freshwater lakes.

In particular, increasing salt levels threaten zooplankton, a critical food resource for many young fish, and changes caused by rising salinity could alter nutrient cycling, water quality and clarity, and instigate growth and population declines in economically important fish species.

Researchers say the results indicate a major threat to the biodiversity and functioning of freshwater ecosystems and the urgency for governments to reassess current threshold concentrations to protect lakes from salinization sparked by [sodium chloride](#), one of the most common salt types leading to the salinization of freshwater lakes.

"Salt pollution occurring from human activities such as the use of road de-icing salts is increasing the salinity of freshwater ecosystems to the point that the guidelines designed to protect fresh waters aren't doing their job," said Bill Hintz, assistant professor of ecology at The University of Toledo, author, and co-leader of the project. "Our study shows the ecological costs of salinization and illustrates the immediate need to reassess and reduce existing chloride thresholds and to set sound guidelines in countries where they do not exist to protect lakes from salt pollution."

The lowest threshold for chloride concentration in the U.S. established by the Environmental Protection Agency is 230 milligrams of chloride per liter. In Canada, it's 120 milligrams of chloride per liter. Throughout Europe, thresholds are generally higher.

It can take less than a teaspoon of salt to pollute five gallons of water to the point that is harmful for many aquatic organisms.

In other countries such as Germany, chloride concentrations between 50

and 200 milligrams per liter are classified as "slightly polluted by salts," and concentrations between 200 and 400 milligrams per liter are classified as "moderately polluted by salts." The drinking water guideline is 250 milligrams per liter across much of Europe.

But as the study shows, negative impacts occur well below those limits. At nearly three quarters of the study sites, chloride concentration thresholds that caused a more than 50% reduction in zooplankton were at or below the governments' established chloride thresholds.

The loss of zooplankton triggered a cascading effect causing an increase in phytoplankton biomass, or microscopic freshwater algae, at almost half of the study sites.

"More algae in the water could lead to a reduction in water clarity, which could affect organisms living on the bottom of lakes as well," said Shelley Arnott, professor of aquatic ecology at Queen's University and co-leader of the project and paper. "The loss of zooplankton leading to more algae has the potential to alter [lake](#) ecosystems in ways that might change the services lakes provide, namely recreational opportunities, drinking water quality, and fisheries."

The scientists chose to study zooplankton communities from natural habitats instead of short-duration, single-species laboratory studies because such an approach encompasses a greater diversity of species and naturally occurring predator-prey and competitive interactions over a six-to-seven-week timespan within the zooplankton community.

The study was designed to better understand how the chloride thresholds would hold up in a more natural ecological setting.

They focused on determining if current chloride-based water-quality guidelines protect lake organisms in regions with different geology,

water chemistry, land-use, and species pools.

"Many salt-contaminated lakes with chloride concentrations near or above thresholds established throughout North America and Europe might have already experienced food web shifts," Dr. Hintz said. "This applies to lakes across the globe, not only among the study sites. And the variability in our experimental results demonstrate how new thresholds should integrate the susceptibility of ecological communities at the local and regional scale. While the government guidelines may protect freshwater organisms in some regions, that's not the case for many regions in the U.S., Canada, and Europe."

Solutions also include finding ways to strike a careful balance between human use of salt responsible for freshwater salinization with ecological impacts, such as reducing the amount of road [salt](#) used to melt winter snow and ice to keep people safe and traffic moving. A previous study led by Dr. Hintz suggests [best management practices](#).

Scientists across the globe contributed to the research "Current [water quality](#) guidelines across North America and Europe do not protect lakes from salinization."

More information: Current water quality guidelines across North America and Europe do not protect lakes from salinization, *Proceedings of the National Academy of Sciences* (2022). [DOI: 10.1073/pnas.2115033119](#).

Provided by Rensselaer Polytechnic Institute

Citation: Government guidelines insufficient to protect freshwater ecosystem from salt pollution (2022, February 21) retrieved 20 June 2024 from <https://phys.org/news/2022-02-guidelines->

[insufficient-freshwater-ecosystem-salt.html](https://phys.org/news/2019/05/insufficient-freshwater-ecosystem-salt.html)

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.