

## Canada's lakes suffer 'osteoporosis'

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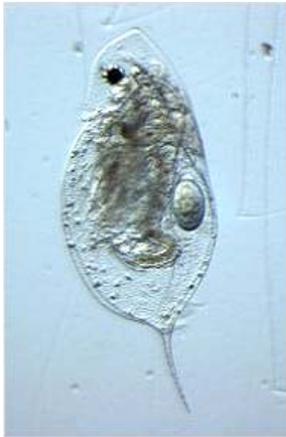
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The drop in calcium levels is being attributed to the effects of acid rain and logging, which together have depleted the element in the soil around lakes, reducing the amount that is in run off and available for aquatic life.

The finding of a new threat to the lakes has potentially far-reaching consequences. Many species depend on abundant levels of calcium, a key nutrient used in nature to build the structure of living things, everything from the shells of birds' eggs to the skeletons of animals.

A paper outlining the discovery, made by a team of scientists from Queen's and York universities and the federal and Ontario governments, appeared in the current issue of Science on Thursday. The research was based on sampling conducted at 770 lakes, of which 60 per cent had calcium levels low enough to concern scientists.



A water flea, Daphnia, is known to be a key component of many aquatic food webs. (*Shelley Arnott*)



The lakes studied were primarily in Ontario's Canadian Shield region, suggesting that there may be tens of thousands of others across the country that are similarly affected, along with many in the Northeastern United States and Scandinavia, areas also sensitive to the affects of acid rain.

"We call it aquatic osteoporosis," said Prof. John Smol, one of the researchers on the project and a biology professor at Queen's University in Kingston.

Prof. Smol said he is worried about the health of ecosystems around lakes because "everything requires calcium."

Returning concentrations in lakes to a healthy level will likely require further reductions in emissions that cause acid rain – primarily sulphur dioxide and nitrogen oxides from coal fired power plants, metal smelters and cars – along with changes in logging practices, he said.

Under previously implemented pollution control plans, emissions of sulphur dioxide in Eastern Canada fell by 63 per cent from 1980 to 2001, according to Environment Canada figures. As a consequence, acidity in many lakes has dropped to more normal readings, but the new findings suggests that even this massive emission cut has not been enough to offset the damage from acid rain.

The researchers believe the drop in calcium – perceived now as sharp – has been occurring for decades, in some areas since as early as the 1970s.

When acid rain falls on soil, it quickly leaches out the calcium, eventually exhausting the earth's stores of the element, leaving little available to be washed into takes as runoff. In the initial period of acid-rain deposition, this effect temporarily increased the amount of calcium entering the lakes, but once the stores of the element were depleted, levels plunged.

Logging is also a problem, because trees contain calcium drawn from the soil. When trees are cut and removed, their calcium is taken from the ecosystem. The calcium in uncut forests is returned to the soil when trees fall over and decay.

The scientists were able to determine that calcium levels have fallen sharply by studying populations of a water flea, called daphnia.

These water fleas are highly sensitive to calcium, and cannot reproduce if amounts fall too low. The key level is a water concentration at or below 1.5 parts per million – less causes populations to crash.

Loss of the water fleas is a huge blow to the life in the lakes, because they are a critical component of the aquatic food web. They eat algae and in turn become food for fish, which means that a drop in numbers has a wide-ranging effect.

"Once calcium declines below a certain threshold, some keystone species can no longer reproduce," said Adam Jeziorski, lead author of the study and a Queen's Phd candidate. "These species and other organisms that feed on them are endangered."

Fish, crayfish, and mollusks also have relatively high calcium needs.

The scientists were able to surmise the levels of calcium in the lakes over the past 200 years by looking at the remains of the fossils of water fleas in the mud at the bottom of lakes. By studying the abundance of the fleas, they determined that a big drop in their numbers happened over the past few decades, because of falling calcium levels.

One way to correct the calcium deficiency would be to add the element back to forests, much as farmers fertilize their fields. But it is not considered practical to do so over a large area like the Canadian Shield.

The weathering of rocks naturally replenishes calcium in soil, but this process takes time and acid rain emissions would likely have to be cut further to make sure this material was not leached away as quickly as it was being replenished.

Tree bark contains a lot of calcium, so loggers could be encouraged to leave it in the woods after they cut trees. Another approach being followed in some areas of Canada is to curb logging in areas with low calcium.

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