The Atlantic

How Dams Risk Poisoning Indigenous Diets

A new hydroelectric facility in Canada could push dangerous amounts of methylmercury into communities that rely on seafood.

Muskrat Falls in Central Labrador, Canada

Greg Locke / Reuters

JOSHUA SOKOL | NOV 9, 2016 | SCIENCE

On October 13, Billy Gauthier, an Inuk sculptor in Labrador, Canada, uploaded a picture of what he called his "last meal" to Facebook. It showed the split head and tail of a smoked salmon, dimly lit, against a white plate. "Not appetizing to some but delicious to me," he wrote. "Hope it keeps me going for a while."

So began Gauthier's hunger strike. His salmon was from Lake Melville, an enormous estuary that cuts over a hundred miles from the Atlantic to inland Labrador. Since the end of September, indigenous activists in the area have been furiously opposing a new 824-megawatt hydroelectric dam under construction upstream. They fear it will poison Lake Melville's creatures and, by extension, its people.

Bolstered by a series of studies released from the lab of Elsie Sunderland, an environmental scientist at Harvard, opponents argue that the dam, which is being built at a waterfall in the Churchill River called Muskrat Falls, will send high levels of the neurotoxin methylmercury downstream and into Lake Melville's food webs. Since the area's Inuit and Innu populations get much of their food from Lake Melville, that toxin would then percolate into their diets, threatening traditional ways of life.

Nalcor Energy, the provincial utility behind the dam, doesn't deny that methylmercury would spike. But levels would rise only modestly before falling back down to pre-dam levels, they contend, and that the neurotoxin wouldn't make it far into Lake Melville or people's diets. "We've been studying various aspects of the river system since the 1990s, including more than 2000 samples of fish collected to date, and over 100 samples of seal tissues, to understand the current levels of methylmercury in the local species," Karen O'Neill, a spokesperson for Nalcor, told me in an emailed statement.

On Wednesday, *Environmental Science & Technology* published a paper by Sunderland's lab at Harvard that argues differently. The new study predicts that

flooding for the dam will expose Inuit and Innu communities along Lake Melville to double the amount of methylmercury they currently ingest, placing the average person in the area near what the U.S. Environmental Protection Agency suggests as a safe reference dose for the substance. (The EPA says that ingesting up to one ten-millionth of a gram of methylmercury per kilogram of body weight every day may be safe; Canada's own recommendation is twice this.)

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According to the study, the town likely to be the most severely affected would be Rigolet, a remote Inuit community of about 300 people. There is a grocery store there, but residents still go out on the water or the ice, depending on the season, to harvest salmon, seals, trout, char, cod, smelt, sculpin, dolphin, whale, and seabirds and their eggs. "Eating whatever you get from the water, the seal or fish, is just part of the way of life," says Darryl Shiwak, a Rigolet native and environmental minister for the indigenous Nunatsiavut Government, which represents Labrador's Inuit and autonomously governs five coastal communities.

In Rigolet, the study finds, the average methylmercury exposure for women of childbearing age and children younger than 12 could rise to *double* the EPA reference dose, pushing Canada's limit. Residents with more traditional diets would be the worst off. "For some people who eat local seafood every day, it might push them into the zone of acute poisoning, where you start to see tremors and possible hair loss," says Ryan Calder, a Ph.D. student in Harvard's School of

Public Health, and the new paper's first author.

Calder's work was partly funded by the Nunatsiavut Government. Methylmercury spikes are a well-established consequence of hydroelectric-dam construction; the disruption caused by flooding converts elemental mercury in soil into the neurotoxin, which washes downstream. Unlike elemental mercury, methylmercury can waltz through living tissues, including the blood-brain barrier, and its concentration builds up in animals high on the food chain. Since the Muskrat Falls project gained momentum in the late 2000s, Nalcor Energy has conducted its own studies that have minimized the proposed dam's methylmercury impacts on fishing communities in Lake Melville. So, in 2012, the Nunatsiavut Government reached out to Sunderland's lab for a second opinion.

When Sunderland lab members arrived, their measurements began to diverge from Nalcor's. According to Amina Schartup, a post-doc on the team, they found less methylmercury already in the Churchill River than the energy company had reported, which meant that the relative increase expected from the dam would be more dramatic than previously thought. They also noticed that Nalcor's studies treated traditional Inuit diets, which Canadians call "country food," as outliers, instead of considering the region's indigenous population as its own unit with a higher risk of methylmercury exposure.

Nalcor predicted that the methylmercury-laden river water would dilute once the river emptied into Lake Melville. But as in other Artic and sub-Arctic estuaries, Lake Melville's fresh water stays trapped in a narrow top layer where animals spend most of their time, with salt water at different buoyancy underneath. And Sunderland's group believes the top layers actually have too much methylmercury to be explained by inputs from the rivers and deposition from the atmosphere alone. In a 2015 *PNAS* paper, Schartup argued that the estuary makes a surprising amount of methylmercury on its own. A floating film of

bacteria lives between the estuary's salt and fresh layers, metabolizing the scraps of organic matter and elemental mercury that fall from above and producing more of the neurotoxin.

That means Lake Melville is unexpectedly good at focusing the toxin back into the animals that live in and around it—and that other estuaries throughout the Arctic should have the same problem. Calder's paper forecasts methylmercury the rest of the way, extrapolating from measurements in the present day: from the flooded dam to the estuary, up the food chain into birds, fish and seals, and into the actual diets of the region's indigenous people, many of whom donated hair samples and filled out a questionnaire about the local species they ate.

This problem isn't unique to Muskrat Falls. Calder's paper tallies 22 hydroelectric facilities currently being planned across Canada, every one within 100 kilometers of indigenous lands. In 11 of the systems, water methylmercury levels may rise even more than Calder predicts for the Muskrat Falls project.

"I agree with their findings and share similar concern," says Laurie Chan, a toxicologist at the University of Ottawa. "Whenever there's such a system of hydro development being considered, this mercury issue and the health of indigenous populations really needs to be addressed publicly."

Nalcor's position remains unchanged. "The paper by Calder et al. does not provide evidence that would change Nalcor Energy's predictions," O'Neill says. "Nalcor has its own independent experts who are completing a Human Health Risk Assessment and completing ongoing Aquatic sampling and modeling to further support our initial predictions."

Nalcor's CEO has claimed that delays from protests have already cost the company hundreds of millions of dollars. As Calder sees it, the "whole point in doing this research is to show that it can be a screening tool. This whole imbroglio is costing [Nalcor] so much money. If they had been able to screen

health impacts ahead of time, they could have made much better decisions."

In a marathon meeting that went into the early morning of October 26, indigenous leaders and representatives of the province of Newfoundland and Labrador—including the Premier—struck a fragile compromise: In the spring, an independent committee with representatives of both sides will make measurements and recommendations to lower the project's methylmercury impact. According to Nalcor, this may involve clearing vegetation and carbon-rich soil away from the reservoir, where methylmercury-producing bacteria would thrive, but no specific commitments have been made yet.

The deal was enough for Billy Gauthier to break his fast. He shared a plate of smoked char with other hunger strikers who had travelled to Ottawa to lobby against the project.

Shiwak, the Nunatsiavut environmental minister, hopes that the compromise will prevent a future where his community in Rigolet has to be especially wary of their traditional food sources and the cultural practices surrounding them.

"It's handed down from generation to generation—where are the best places to fish, at what time of year do you fish here or there, where do you hunt the seal, how you skin the seal, and what parts of the seal to eat," he says. "If we have to tell stories about this, for the next generation, it's not going to be as meaningful as it is now."

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