

Biology By Canoe

How a scientific paddling trip through the Arctic wilderness opened the door to connections with the land, people, and culture.

BY JONATHAN FEAKINS

Danielle Nowosad cut her backcountry teeth on the edge of the Arctic. Hired in 2017 as a research technician at the Churchill Northern Studies Centre in the far north of her home province of Manitoba, Nowosad would conduct studies on nutrient dynamics one day, and serve as a bear guard for school groups and visiting researchers the next.

In 2021, however, Nowosad had the chance to go even farther north—to the Arctic hamlet of Cambridge Bay, in Canada’s northernmost (and Indigenously self-governed) territory of Nunavut. But this time—as part of an effort known as Arctic BIOS-CAN—Nowosad’s sights were set on more miniscule fauna: aquatic insects, and the DNA within their tiny thoraxes.

The genes that Nowosad planned to collect would contribute to what biologists hope will become a comprehensive compendium of life on Earth. Identified by unique snippets of genes called “DNA barcodes,”

efforts to date have catalogued over 1 million species, and are expected to surpass the total number of named species within five years. This endeavor is more than a planetary game of Pokémon: The Arctic samples, in particular, may also establish a crucial biodiversity baseline from one of the front lines of climate change—especially among insects, which make up as much as 80% of all species on earth and literally half of the planet’s biomass.

In pursuit of this most modern of projects, however, Nowosad opted to set out into the wilderness in one of the most traditional ways: by paddling a canoe.

A SELF-PROFESSED recreational canoer (“I still can’t steer,” she laughed), Nowosad didn’t venture into the wilderness alone. She enlisted a duo of backcountry professionals to join her: Gabriel Ferland and Elise Imbeau, who jointly operate Viventem, a science support agency that provides logistical know-how and tent-pitching grit to visitors who may

▼ *A musk ox crossing a river near the community of Cambridge Bay (Ekaluktutiak), Nunavut, where Nowosad spent time as a researcher working with local Indigenous communities.*





▲ The team camped near Ovayok (Mount Pelly), the largest glacial esker in the region, on the first night of their canoe expedition.

be more comfortable in a lab than a bivouac. Along with research assistant Carter Lear—an Inuit youth from Cambridge Bay, whom Nowosad met two years earlier when Lear was still a fresh-faced 17-year-old student—the team made up a mighty quadrumvirate who aimed to traverse a landscape wreathed in purple saxifrage, meandering muskox, and the occasional looming grizzly bear.

With an abundance of species yet to be sampled, the team could be forgiven for feeling rushed. And historically, researchers in this Arctic region haven't always taken their time: Often arriving by helicopter or snow machine, the demands of Western science encourage the extraction of data as fast as possible, and a departure that's just as quick. But when studying a landscape that has evolved over countless millennia, taking one's time might actually be as essential as any lab equipment.

The Arctic can be an ephemeral place. Rivers and waterways that exist one week may dry up by the next, and up-to-date satellite imagery can be prohibitively expensive. Before departing, Ferland poured over maps of the region's water systems using CalTopo. While not guaranteed to be accurate, these digital maps allowed Ferland to plot potential back-up routes, in case their two canoes floated into unexpected dead ends.

At each portage, they would have to schlep more than just hefty canoes and finicky cooking stoves. All together, Nowosad's team set off into the tundra with as much as 400 pounds of gear. Some of this equipment had hardly been designed with Arctic field operations

in mind: Glass beakers don't lend themselves well to use in the backcountry. But the adaptable nature of remote field science has a way of forcing researchers to make do.

Rough road map in hand, in the summer of 2021, Nowosad, Ferland, Imbeau, and Lear arose at 6 a.m. and piled into a pick-up truck that, in short order, plopped them out into the shadows of Uvayuq, a glacial ridge of stratified sand and gravel 15 kilometers northeast of Cambridge Bay. Their itinerary: 40 kilometers over three days on the winding, welcoming waterways of the north.

The team set forth from Kingmitquq (First Lake), under the unyielding rays of Arctic summer. Drifting through the gentle waters—mostly thanks to the veteran canoeing chops of Ferland and Imbeau, steering diligently in back—Nowosad and Lear dipped sampling nets into the passing streams and took studious notes on water quality. Each sample only added to the weight of the two-hour portage required to reach their first night's campsite.

"The first time we were processing lab samples, Carter and I were just laying on the tundra, as close to the ground as possible," Nowosad said. With no trees breaking up the lichen-strewn landscape, the crew's precious samples were at risk of getting whisked away by the wind while being carefully transferred into secure jars. Nowosad recalls shivering in below-freezing temps, working to use her forceps while she still had the fine motor skills to do so. The next day, she and Lear set up a makeshift lab in their small tent.



▲ The team's second night of camp came after a long day of paddling through cold Arctic rain.

Between Nowosad (the PhD), Ferland and Imbeau (the backcountry power couple), and Lear (who has since graduated with a degree in social work), the team also featured an additional member who dutifully provided their invaluable expertise.

"Shila's not a cuddly dog," Nowosad said.

A 90-pound Malamute-Lab, Shila joined Ferland and Imbeau's adventuring party as an industrious rescue pup, and took to bear guarding like a fish to water. She could also, as it turned out, swim like one. As the two canoes set off (Ferland in one, Imbeau in the other), Shila insisted on keeping a watchful eye on both parents—by leaping off one canoe and swimming to the other. Every time she'd climb back into Nowosad's canoe, she would send a fresh wave of Arctic-chilled river water coursing down the back of Nowosad's jacket. Nonetheless, Shila remained a very good dog, sleeping under the canoe windbreak each night, forever vigilant.

In the final kilometers of their trip, the team dragged the canoes through shallow streams—like "enormous, reluctant dogs on a leash," Nowosad said—although only after Lear and Imbeau trium-

phantly captured three *iguttaq* (an Arctic bumble bee, *Bombus polaris*). Over the course of three intense days, this marathon of data collection had netted 28 freshwater invertebrate species.

"I knew that the canoe would be an effective way to do it," Ferland said. "It's good for the researcher, because usually they go by helicopter; they don't have time to really be in the field." Even Ferland didn't necessarily anticipate, however, that canoeing would provide such a bounty of specimens. "It opens up the door to so much potential to sample in remote places," he said.

AT THE SAME TIME, Nowosad had been reckoning with the riddle of how to ethically conduct her scientific work on Indigenous lands. Although herself a citizen of the Manitoba Métis Nation, Nowosad's explorations still existed among a scientific tradition that has historically extracted data from marginalized communities while offering little benefit in return. Canoeing, in part, provided Nowosad and her team a deeper, gentler, and more respectful connection to Indigenous lands that running roughshod over the permafrost in an ATV could never provide.

Scientists are, increasingly, learning to partner with local communities and Indigenous peoples, so that these generational experts can weave their traditional knowledge into Western scientific research methods. In the context of the Canadian Arctic, this particular knowledge often takes the form of what is now called *Inuit Qaujimajatuqangit*, or IQ, which is an Inuit-specific term for Indigenous knowledge. IQ encompasses a comprehensive set of cultural values, specific to Inuit culture. Examples of these core principles include *aajiiqatigiinni* (decision-making through discussion and consensus), *qanuqtuurniq* (being innovative and resourceful), and *avatittinnik kamatsiarniq* (respect and care for the land, animals, and environment).

"Every single nation—and there are over 300 distinct Indigenous groups in Canada—have different knowledges that were developed in very contextual ways. The land is IQ, and IQ is the land," Nowosad said. But she is quick to clarify that, as someone with no ancestral ties to the north, she cannot responsibly claim any IQ-specific expertise. "Just like how for Red River Métis, which is my nation, our knowledge is the land

in Manitoba.” The vast, Arctic landscape, in essence, serves as more than just a physical territory, but as the foundation for thousands of years of cultural, social, and spiritual existence.

In the wake of her canoe sampling extravaganza, Nowosad has deepened her ties with Inuit communities, hoping to further interweave Western scientific research methods and traditional Indigenous knowledge. In 2020, an Inuit youth organization, Ikaarvik, proposed a detailed framework with which researchers could better engage with Inuit communities. In an act of inspiration, they coined this weave of science and local IQ, as “SciQ.” Though this method of consultation was tough to implement at the time of Nowosad’s canoe journey (which took place in the thick of the COVID-19 pandemic, limiting opportunities for in-person meetings and face-to-face interactions with the community), she embraces this framework for her current research in Nunavut (on biting insects, like black flies), in partnership with the local Inuit community.

Nowosad has since developed another passion—beadwork—as both an expression of her Métis ancestry, and as a form of “wearable science communication,” as she calls it. Formulating beaded portraits of northern bog violets or winter wrens, Nowosad often gifts her creations—especially to other Indigenous groups—as a form of gratitude for their partnership and trust.

For an art and science showcase at an annual gathering of marine scientists, Nowosad put together a particularly special beady-eyed crustacean: *Mysis relicta*, a species of opossum shrimp that she collected while paddling down Long Lake on her canoe expedition. Along the border of the artistic arthropod, Nowosad threaded a combination of red, black, green, and blue beads, with each color representing a distinct DNA base. Together, her beads spell out the four-note symphony that gives this creature life.

Of the over one and a half million species that scientists have named, tens of thousands of them call the Arctic home—including some whose time, in the face of climate change, may be running short. And tens of thousands more may be just over the horizon, still unnamed, one paddle away. ■



▲ Top to bottom: The team encountered multiple portages and sections of shallow water, forcing them to haul their heavy canoes on foot; Traveling by canoe turned out to be a very effective way for Nowosad to collect samples for the Arctic BIOSCAN project.