The liver cells showed signs of cellular aging. Fish in the polluted lakes had two to three times more lipofuscin, a mishmash of lipids and proteins that is a hallmark of older cells. In addition, their telomeres—the repetitive DNA sequences that safeguard ends of chromosomes—were shorter, a change associated with age-related diseases.

Liu and colleagues conclude that the chlorpyrifos was to blame for the truncated telomeres. Chlorpyrifos and other organophosphate pesticides are known to produce reactive oxygen molecules that harm DNA. And some epidemiological studies have linked exposure to chlorpyrifos and related insecticides to shorter telomeres in people. But the relationship between pesticides and fish telomeres that Liu's team found is surprisingly strong—much stronger than in human studies of pollutants, notes Brandon Pierce, an environmental epidemiologist at the University of Chicago.

The researchers also set up laboratory tanks and exposed captured lake skygazers to either clean water or 10 or 50 parts per trillion of chlorpyrifos, which they say are realistic concentrations for the polluted lakes. After 4 months, all the fish in clean water were alive. But at the higher chlorpyrifos level, about 20% of the 2-year-old fish and more than half of the 3-year-old fish had died. Fish in the higher exposure tanks also had telomeres roughly one-quarter to one-third shorter than did fish in the clean water.

Study co-author Jason Rohr, an environmental health scientist at the University of Notre Dame, says it's too soon for regulators to make changes based on the team's findings, but he hopes they will stimulate more research on chronic effects of chlorpyrifos and other pollutants.

Now that this study has linked shorter telomeres and increased lipofuscin in tissues to long-term changes to the population structure of these fish, the two measures could help researchers look for evidence of harm in other wildlife populations, says Rita Triebskorn, an ecotoxicologist at Tübingen.

Whether these findings have implications for risk to humans exposed to chlorpyrifos "remains to be seen," Köhler says, "but it cannot be ruled out." □

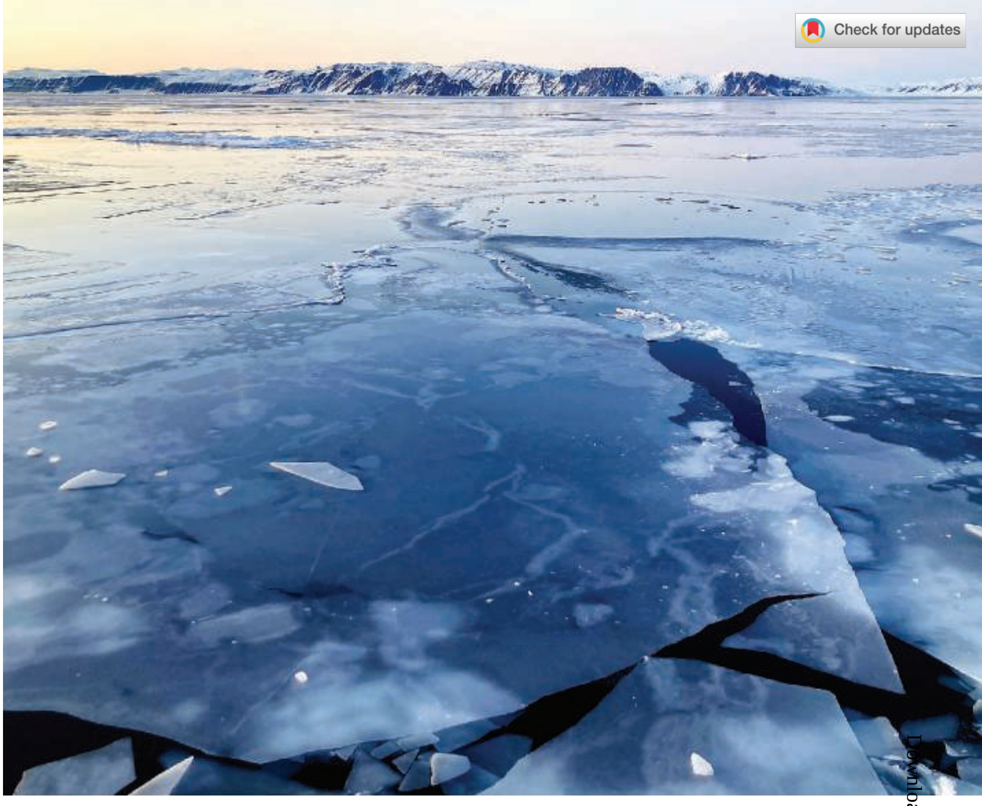

PHOTO: AUDREY LIMOGES/UNIVERSITY OF NEW BRUNSWICK

First-year sea ice drifts in the Tuvaijuittuq Marine Protected Area, north of the Queen Elizabeth Islands.

CLIMATE CHANGE

Arctic's 'last ice area' is on thin ice

Mission to Canada's Queen Elizabeth Islands reveals signs of weakness in a sea ice haven

RACHEL BERKOWITZ

Plugged with the world's oldest and thickest sea ice, the fjords of the Queen Elizabeth Islands (QEI), in the northernmost Canadian Arctic, have long been impenetrable to icebreaker ships. But even here, in a place where climate models predict ice will persist the longest, global warming is taking its toll. Last summer, when the Canadian Coast Guard ship *Amundsen* conducted the first comprehensive oceanographic research mission through the QEI archipelago, the ice "was much easier to go through than we expected," says *Amundsen* Capt. Pascal Pellerin. Floes once several meters thick were broken and soft.

"I really thought the multiyear ice would be thicker and more solid," says David Babb, an oceanographer at the University of Manitoba who spearheaded the cruise, which surveyed the ice, water, and sediments below for clues to the fate of the ice. At the ArcticNet annual science meeting last month in Calgary, researchers revealed some of the first results from the cruise, which offered a close look at the ailing ice.

Arctic sea ice forms in winter, in the waters north of Siberia. Ocean currents drive it across the North Pole into the Canadian Arctic, where it piles up against rugged coastlines. The famously cold fjords of the QEI host the thickest and oldest ice, which squeezes in during fleeting summer melt. It becomes trapped in narrow channels, sheltered from warm air and ocean currents.

In 2015, the World Wildlife Fund Canada, an environmental advocacy group, coined the term "last ice area" as part of lobbying efforts to preserve the region, which will be a last refuge for polar bears and other Arctic wildlife.

Overall, the loss of sea ice across the Arctic may actually be in a lull. An August 2025 study in *Geophysical Research Letters* found that Arctic sea ice coverage had stabilized since 2005. Natural variations in ocean heat and currents seem to be offsetting losses due to climate change, which is warming the Arctic four times faster than the rest of the planet. However, in the past decade, Babb says, "we see declining conditions in the QEI."

Ice in the region was hit especially hard in 2024. A warm winter in the Canadian Arctic meant ice was thinner when spring melt started. Less ice traveled into the region, and the autumn freezing started later than usual. "Ice simply didn't have time to survive the summer," says Mallik Mahmud, a remote sensing specialist at McGill University.

Conditions like 2024's are likely to repeat, and Mahmud's analysis of recent satellite data in the QEI, presented at ArcticNet, suggests the area may be in trouble. His analysis showed ice in the QEI has started to melt 5 days earlier per decade since 1997. If sea ice has more days to melt, he explains, even the thickest ice will suffer. "Multiyear ice used to have a haven in QEI," he says. "Now, it will come here to die."

The *Amundsen* cruise was a chance to groundtruth the decline. "Collecting samples and feeling the ice and touching it tells you much more," Babb says. Aboard the *Amundsen*, he noticed thin ice extending deep into sheltered fjords. Ice floes were broken apart, and cores drilled into ice some 6 to 7 meters thick hinted at interiors that were not frozen solid. "It's more susceptible to melt," Babb says.

Measurements from the *Amundsen* hint at other, deeper changes. The team found that waters tens of meters below the ice are warmer and less salty than they were in the 1960s. Dissolved organic matter suggests growing amounts of Pacific Ocean water entering the Arctic, where the nutrients they carry could influence food webs. However, the warm water is too deep and isolated to have an immediate effect on the ice.

The *Amundsen* crew also drilled into seafloor sediments to learn about nearby glaciers and past climate. "We didn't even know if we would find sediments," says Audrey Limoges, a climate scientist at the University of New Brunswick. The sediment grains in a few cores display shifts from fine to coarse that mark periods when glaciers that feed into the fjords retreated, releasing meltwater and icebergs that entrain larger sediments. By linking these shifts over the past 50 years to satellite records of glacial retreat, researchers can then use the sediment proxies to extrapolate further back in time.

The *Amundsen* crew is also off to a good start on another challenge for understanding the fate of the ice: pinning down its age and original thickness. The only way to ascertain these properties is to find first-year ice and track its growth over time, says Christian Haas, a geophysicist at the University of Bremen.

In what Babb describes as "a dream come true," he and his colleagues watched ice form around the ship—going from nothing to 10 centimeters thick overnight. Instrument-laden moorings the crew installed will capture how that ice evolves over the coming year, in addition to monitoring water and sediments entering and exiting the region. The mission provided a "snapshot in time," and a baseline to gauge future change, Haas says. "The last words of the last ice area haven't been spoken yet." □

Rachel Berkowitz is a journalist based in Eastsound, Washington, and Burnaby, Canada.

A weakening stronghold Last summer, the *CCGS Amundsen* undertook a first-ever oceanographic cruise through the Queen Elizabeth Islands, which are expected to be one of the last refuges for Arctic sea ice. Thin and softening floes point to surprising vulnerability.

ASTRONOMY

Ex-Google CEO funds private space telescope bigger than Hubble

Schmidt Sciences invests in orbiting observatory and three ground-based instruments

DANIEL CLERY

Last week, Schmidt Sciences, a foundation backed by billionaires Eric and Wendy Schmidt, announced one of the largest ever private investments in astronomy: funding for an orbiting observatory larger than NASA's Hubble Space Telescope, along with funds to build three novel ground-based observatories. The project aims to have all four components up and running by the end of the decade.

"We're providing a new set of windows into the universe," says Stuart Feldman, president of Schmidt Sciences, which will manage the observatory system. Time on the telescopes will be open to scientists worldwide, and data harvested by them will be available in linked databases. Schmidt Sciences declined to say how much it is investing, but Feldman says the space telescope, called Lazuli, alone will cost hundreds of millions of dollars.

Eric Schmidt, former CEO of Google, and his wife, Wendy Schmidt, are staunch supporters of science: They founded the Schmidt Ocean Institute, and last month, they were among the donors in a $1 billion commitment toward building a gigantic new collider at the CERN particle physics laboratory in Switzerland. In addition to astrophysics, Schmidt Sciences also funds research on artificial intelligence, biology, and climate science.

Philanthropists have long played important roles in the history of astronomy. Industrialist James Lick's money enabled the 1888 construction of a telescope in California with a 91-centimeter lens—world leading at the time. Donations from oilman William Keck led to his eponymous twin 10-meter telescopes in Hawaii that are still among the world's most powerful. Schmidt Sciences's new observatories follow that tradition, says Bruce Macintosh, director of the University of California Observatories. "It's also a new approach—building in modern ideas about open science and making national

CREDITS: (GRAPHIC) V. PENNEY/*SCIENCE*; (DATA) AMUNDSEN SCIENCE; WORLD WILDLIFE FUND CANADA'S *LAST ICE AREA TECHNICAL REPORT* (2013)