

# These fish live in sub-freezing waters. Why are so many getting sick?

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Credit: Matthew Modoono/Northeastern University

Antarctic fish have evolved to survive—and thrive—under unbearable conditions. They make their living at the sub-zero Centigrade, freezing temperatures of the ice-filled Southern Ocean, and they keep their

bodies from freezing solid by producing an antifreeze protein in their blood.

But now, Antarctic fish face a new threat: A novel disease involving large skin tumors.

Northeastern's H. William Detrich, professor emeritus of biochemistry and [marine biology](#), and his 2018 Antarctic field research team, discovered a new disease that afflicted a substantial number of fish belonging to two different species, reported in a paper published in the journal *iScience*. The pathogen at fault was previously unknown to science.

"This may be an early warning signal of the impact of oceanic warming," says Detrich, an author on the paper. Because [polar regions](#), both marine and terrestrial, are warming more rapidly than [temperate zones](#), they serve as bellwethers for [climate change effects](#), he says.

If, as the scientists suspect, the stress of climate change is what caused this new disease outbreak, "This is a potential example of what we might expect to see in more temperate latitudes," Detrich says. "This discovery makes it all the more important that people be aware of the potential for climate-stress-mediated disease" in the Antarctic and beyond.

The scientists discovered the disease outbreak in 2018 during a research cruise along the West Antarctic Peninsula, led by Dr. Thomas Desvignes of the University of Oregon, lead author of the study and a member of Detrich's field research team. (Detrich asked Desvignes to take over as leader of the field research team after Detrich was rendered out of action due to an earlier accident at sea.) As Desvignes, accompanied by John Postlethwait, also from the University of Oregon and senior author of the study, and the team caught hundreds of fish one night in Andvord Bay, they quickly noticed that many of them had tumors.

"Occasionally you will see a fish that appears to be abnormal, appears to have a cancer or another disease, but it's very, very rare," says Detrich, who has been doing fieldwork in the Western Antarctic Peninsula since 1983 and has led many research expeditions in the area.

The team collected both healthy fish and fish with tumors to analyze later. Using samples returned to the U.S., with the help of virologist Arvind Varsani from Arizona State University, Desvignes first performed a metagenomic study to determine whether a virus was causing the tumors. None were detected. Instead, they found that a microbial parasite was the culprit.

The parasite in question is called an "X-cell," which is known to infect other fish and cause tumors like the ones the scientists found on the skin of the two Antarctic fish species, Detrich says. But the DNA of this specific X-cell parasite, a unicellular eukaryote, revealed that it is a previously-undiscovered species.

"It's the first example that we've ever seen of a major disease outbreak among [Antarctic] fishes," Detrich says. "Basically, nobody's ever seen this. Now the question, of course is, why?"

The team's working hypothesis is that the warming occurring in the Southern Ocean is putting physiological stress on the animals, and this could be reducing the fish's resistance to infection by the parasites, he says. It is also possible that the changing environmental conditions in the Southern Ocean act on the parasites to improve its dispersion or infectivity.

"You can come up with other hypotheses," Detrich says. Perhaps someone dumped a carcinogen or other toxin in the bay where these tumor-riddled fish were found, although this is extremely unlikely given the isolation of the site. It could also be that the parasites have long life

cycles and manifest into disease outbreaks many years apart. Rather, climate change seems to be the most likely trigger, Detrich says.

The next step to establish or debunk the link between warmer waters and disease would be to conduct laboratory experiments on the [fish](#) involving infection with X-cells at various temperatures, according to Detrich.

Should a [causal relationship](#) be established, he says, "This is a taste of what's to come from an area that is greatly understudied and points to the potential harm throughout the planet from diseases promoted by climate change."

Provided by Northeastern University

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