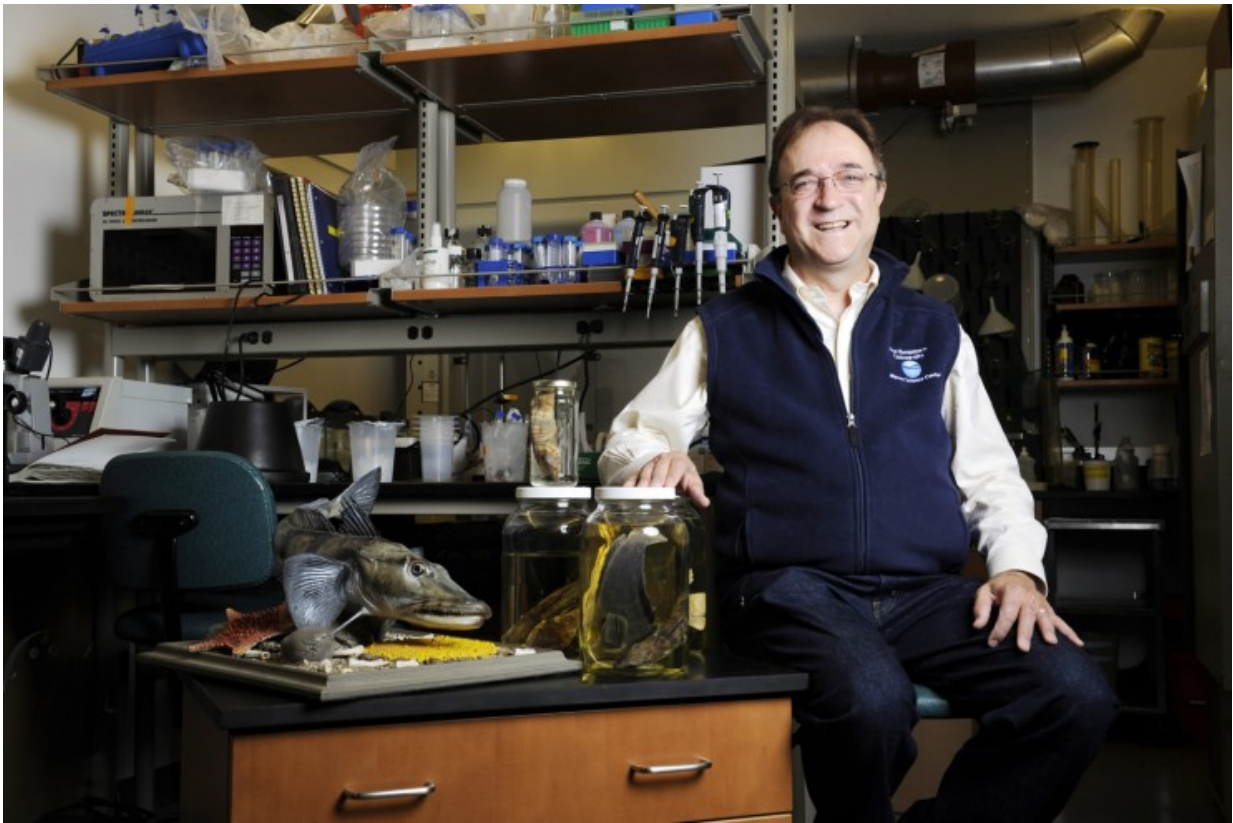


# How will cold-loving Antarctic fish respond to warming ocean waters?

June 23 2015, by Greg St. Martin

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Northeastern professor William Detrich in his lab at the Marine Science Center in Nahant, Massachusetts. Credit: Matthew Modoono/Northeastern University

Antarctic fish are a vital component to the food web that sustains life in the cold Southern Ocean that surrounds Antarctica. They feed on smaller

organisms, and serve as meals for the bigger ones. But little is known about how the rapid rate at which these waters are warming will affect the development of fish embryos and their growth after hatching, according to Northeastern professor William Detrich.

Answers to these questions, he said, are needed to understand how the ecology of the Southern Ocean may be perturbed by [climate change](#).

Detrich, who is an expert in marine molecular biology and biochemistry, has received a four-year, \$1.25 million award from the National Science Foundation for a project that will support his continued research to address what he calls a critical research gap.

"The Antarctic Peninsula is the hot zone right now for warming oceanic waters," Detrich said. "Along the peninsula, the Southern Ocean is warming faster than any other ocean on the planet. That's a big driver for this research. We're working in an area that is really demonstrating climate change."

## **Temperature readings**

Detrich pointed to the Intergovernmental Panel on Climate Change's estimates that the Southern Ocean around the peninsula could rise between two and five degrees Celsius over the next one to two centuries. At the present time, the body temperatures of Antarctic fishes fall in a very narrow range determined by their cold habitat—between minus 1.9 degrees and plus 2 degree Celsius—and the long-term objective of Detrich's project is to understand whether these fish are equipped to respond and adapt to higher temperatures as the Southern Ocean warms.



Professor Bill Detrich, right, and his colleague John Postlethwait of the University of Oregon, at Palmer Station, Antarctica. The Antarctic Research Vessel Laurence M. Gould is in the background. Credit: Thomas Desvignes

"For organisms like fish that have adapted to very cold habitat temperatures over a long period of time, 50 million years, the challenge of a rapid temperature increase will be a real shock to their physiological systems," he said. "The question is: are they capable of dealing with that?"

## More co-ops coming to Antarctica

Detrich is in the College of Science and is based at Northeastern's

Marine Science Center in Nahant, Massachusetts. Over the past three decades he's made many treks to Palmer Station in Antarctica to study icefish and other species native to those waters, and since 2010 students have joined him there for co-op experiences. He said this new project will lead to even more co-ops in the winters of 2016 and 2018.

"I'm proud that my research has provided the opportunity for many undergraduate and graduate students to gain invaluable experience in expeditionary biological science, a unique example of experiential learning set in the last place on Earth," he said.

## **What the research will involve**

In this project Detrich will assess the effects of elevated temperatures on embryo viability, on the rate of embryo development, and on the gene "toolkits" that respond to temperature stress. He and his team will focus on two related species, one a red-blooded rockcod, the other a white-blooded icefish. For each species, there will be one group raised at current water temperatures (0 degrees Celsius) and another at the predicted elevated water temperature (plus 4 degrees Celsius).

As part of his project, Detrich will evaluate how and why the white-blooded fishes evolved to no longer produce red blood cells, a defect that may make its embryos particularly vulnerable to heat, he said.

This research, he hopes, will help provide the public and policymakers more data to inform decision making around strategies to address climate change, particularly protecting life in the Southern Ocean.

Detrich noted that there are two extreme outcomes that could result from rising temperatures. One is that higher temperatures will be very disruptive to development and the fish embryos will die. The second is that the fish would live, but they'd develop much more rapidly. In the

latter case, he explained, the fish would hatch earlier than normal, in the dark wintertime when their food source—phytoplankton, which requires light—hasn't bloomed yet.

"Under the rapid development scenario, what you'd have is a larval [fish](#) looking for food and perhaps not finding it," he said.

Provided by Northeastern University

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