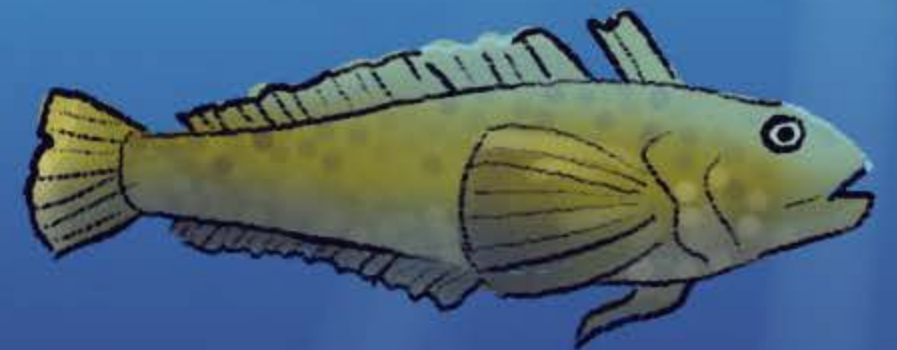


What cool fish live in icy Antarctica?

Isabel Lopez,
John H. Postlethwait,
and Thomas Desvignes



Ancestors of the largest group of Antarctic fishes, called notothenioids, likely originated about 60 million years ago (MYA) in the ocean where South America and Antarctica were connected.

They lived on the ocean floor – they were benthic fish.

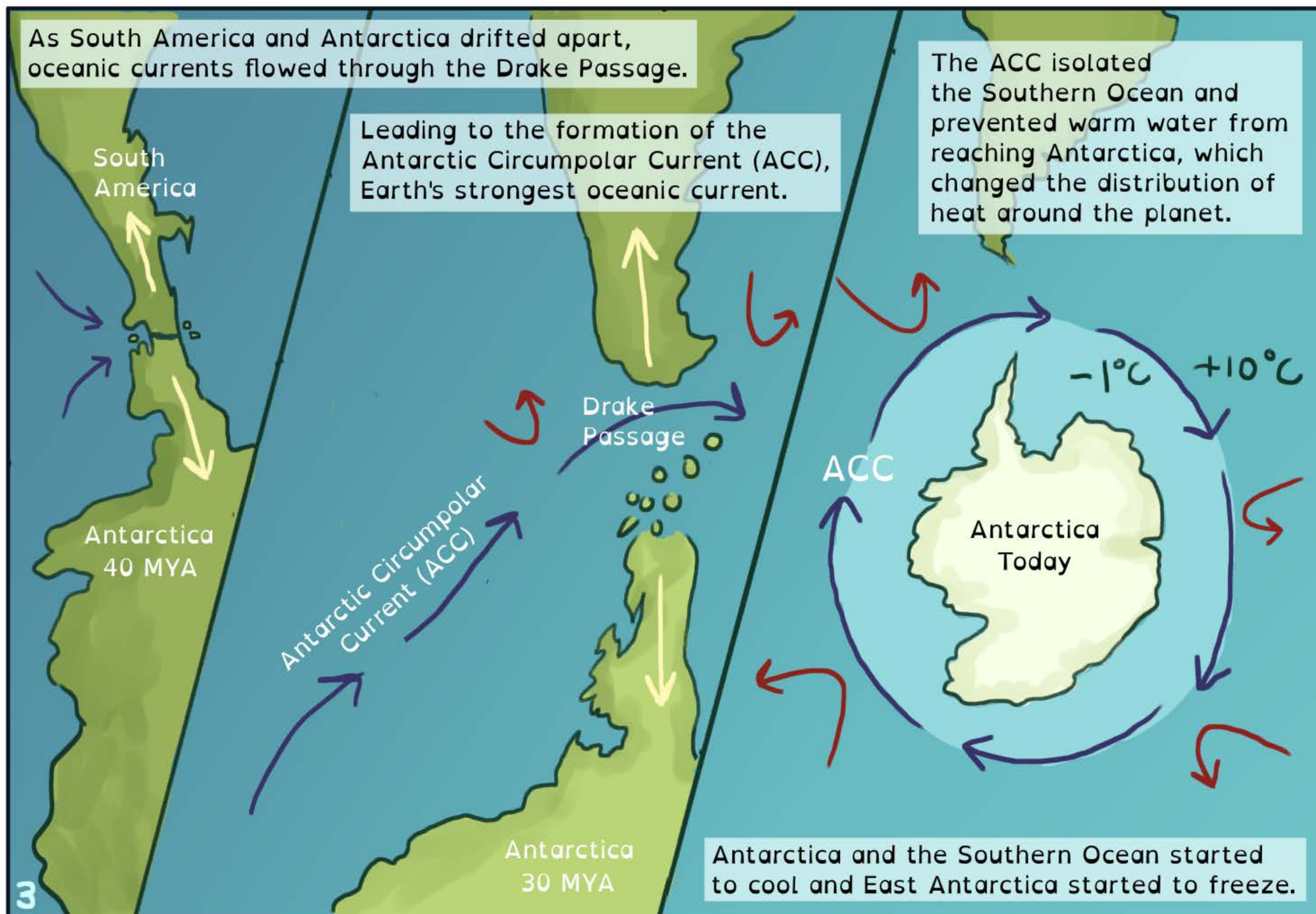


Few non-Antarctic lineages from those early ancestors still exist. They can be found in Chile, Argentina, Australia, New Zealand, and a few islands close to Antarctica.

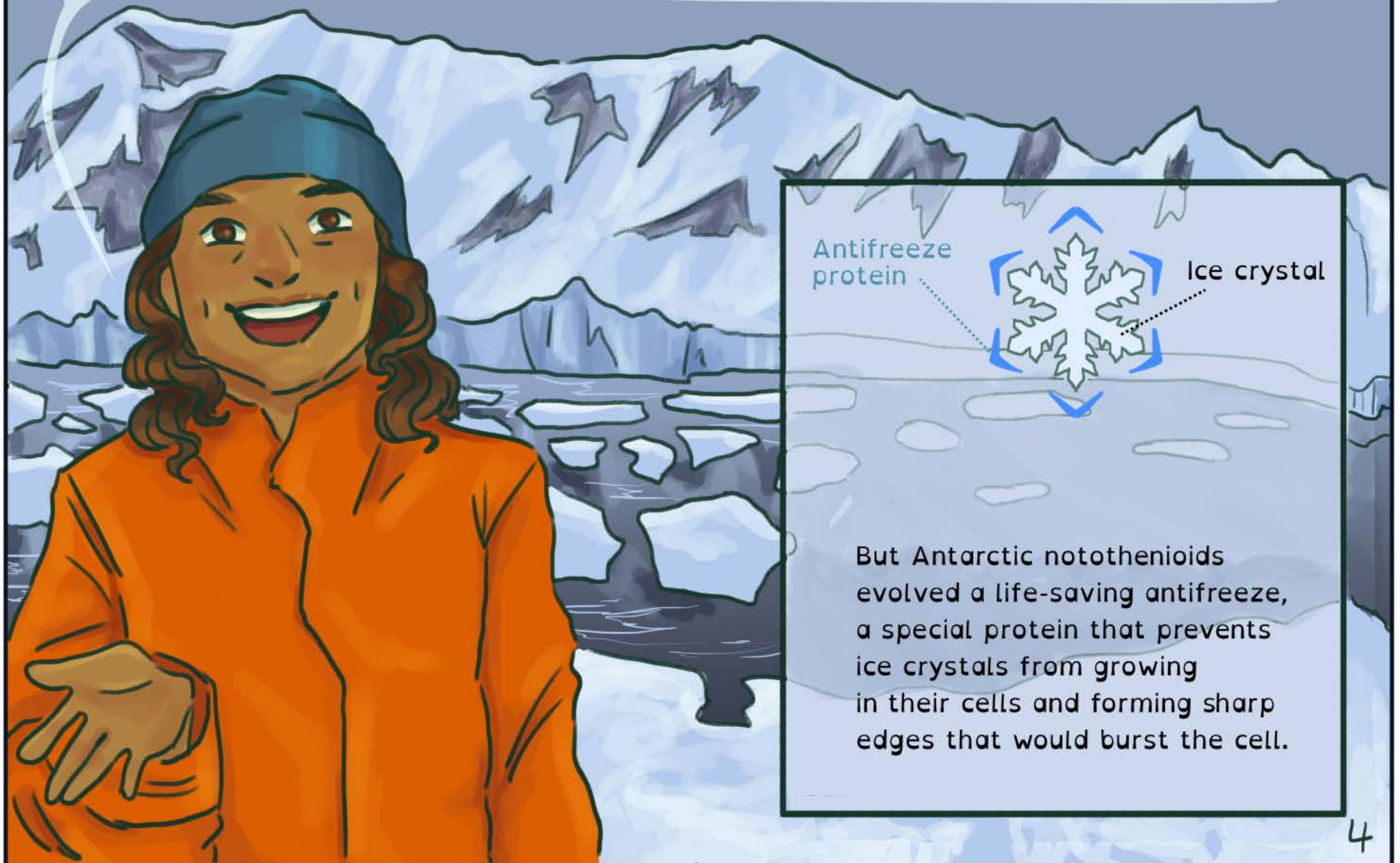
As South America and Antarctica drifted apart, oceanic currents flowed through the Drake Passage.

Leading to the formation of the Antarctic Circumpolar Current (ACC), Earth's strongest oceanic current.

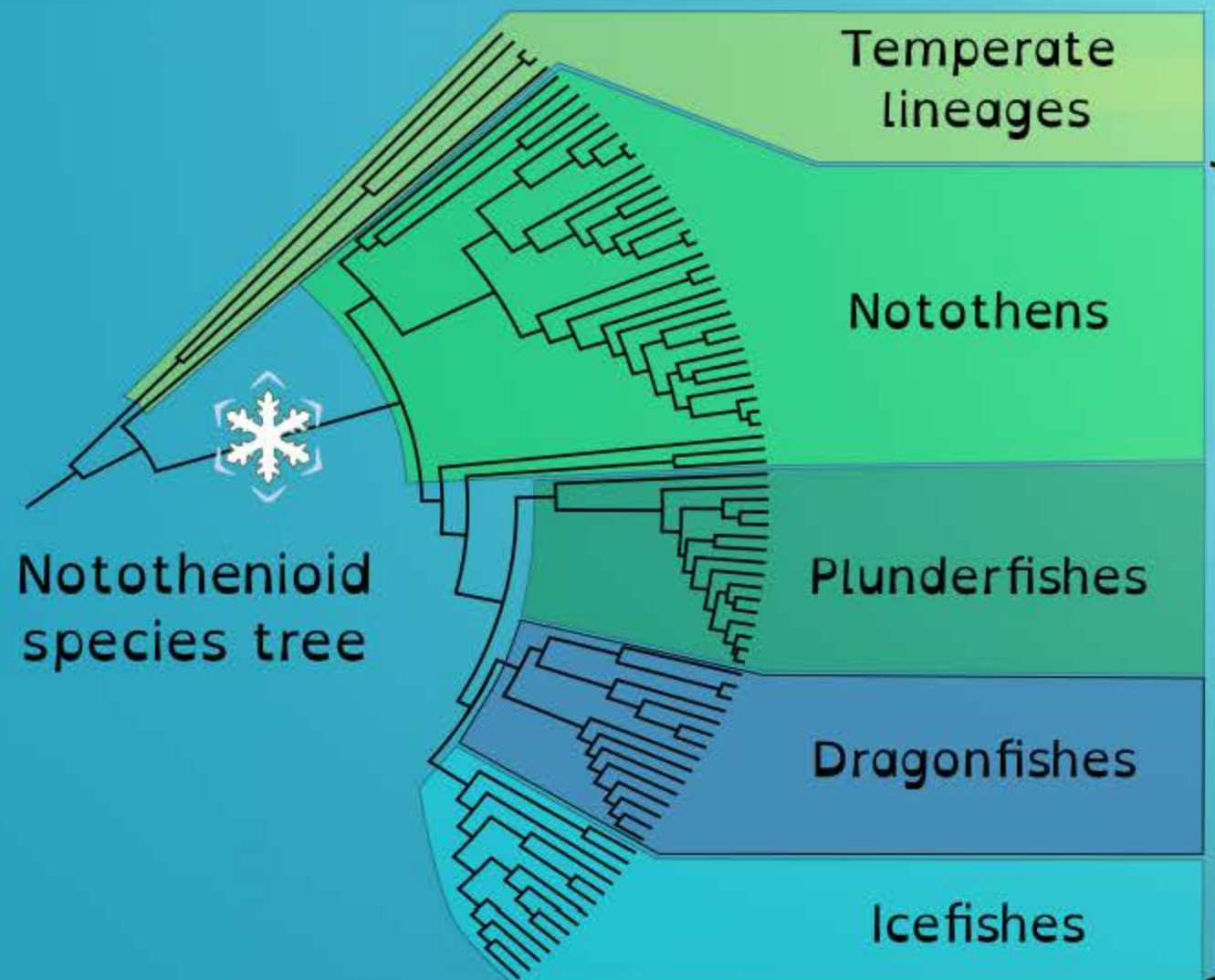
The ACC isolated the Southern Ocean and prevented warm water from reaching Antarctica, which changed the distribution of heat around the planet.



Ice shelves extended all around Antarctica about 14 million years ago.
Most fish couldn't survive the ocean's new icy conditions and vacated the Southern Ocean.



But Antarctic notothenioids evolved a life-saving antifreeze, a special protein that prevents ice crystals from growing in their cells and forming sharp edges that would burst the cell.



Antarctic lineages

Some continued to live on the floor of the continental shelf, up to a few hundred meters deep.

Humped notothen

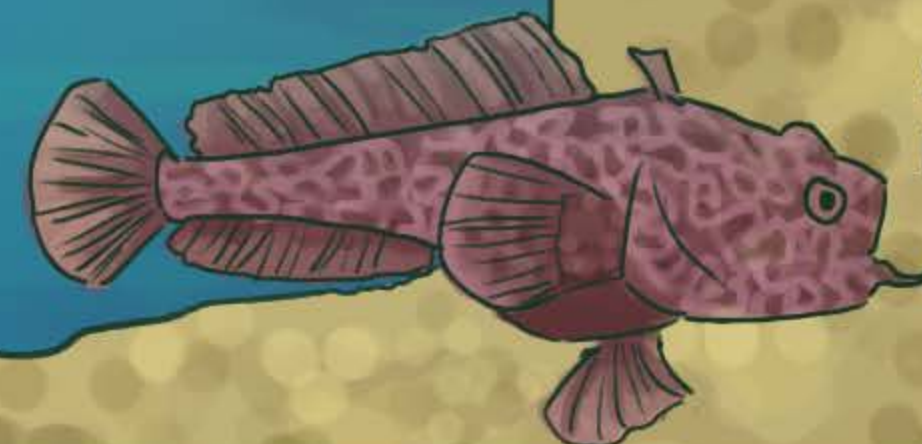


Others developed adaptations enabling them to get off the ocean floor and live in the open water.



Antarctic silverfish

And some adapted to extreme depth, well over 1000m deep.



Stubbeard plunderfish

In this new environment with new habitats, abundant food resources and few predators and competitors, Antarctic notothenioids rapidly diverged into several main lineages.

They form an adaptive radiation.

Other ways notothenioids diversified

Size

Toothfishes can be longer than 2m



Reproduction

Marbled notothen release their eggs in the open water



Life expectancy

Longfin icedevils can live over 60 years



Jonah's icefish make nests and guard their eggs until hatching



Spiny plunderfishes grow less than 10cm long

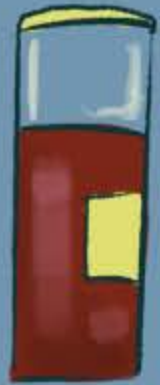


But most notothenioids like Charcot's dragonfish live about 10-20 years



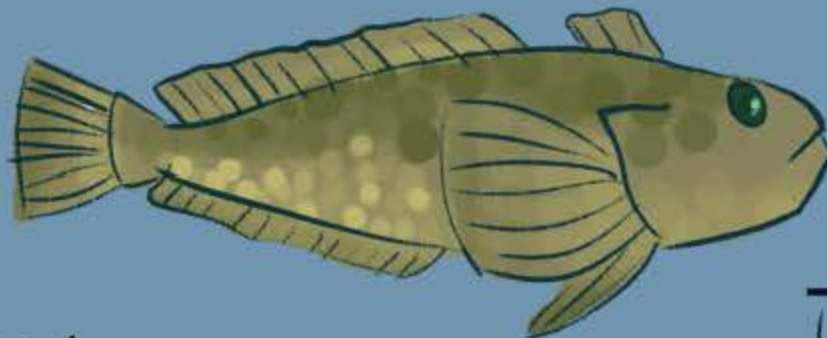
Icefishes are among the strangest of fishes:
their blood is translucent white instead of deep red!

That's because they live without hemoglobin,
the red protein that carries oxygen
in the blood in all other vertebrates.



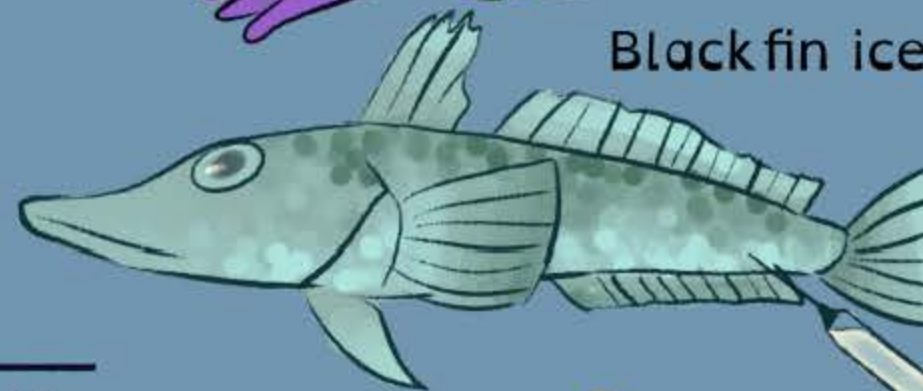
Notothen blood

Bullhead notothen



10 cm

Black fin icefish



Icefish blood

And to make up for lower ability to
distribute oxygen, icefish have a large
volume of blood and proportionally
enormous hearts to circulate it.

Notothen heart



1 cm

Icefish heart

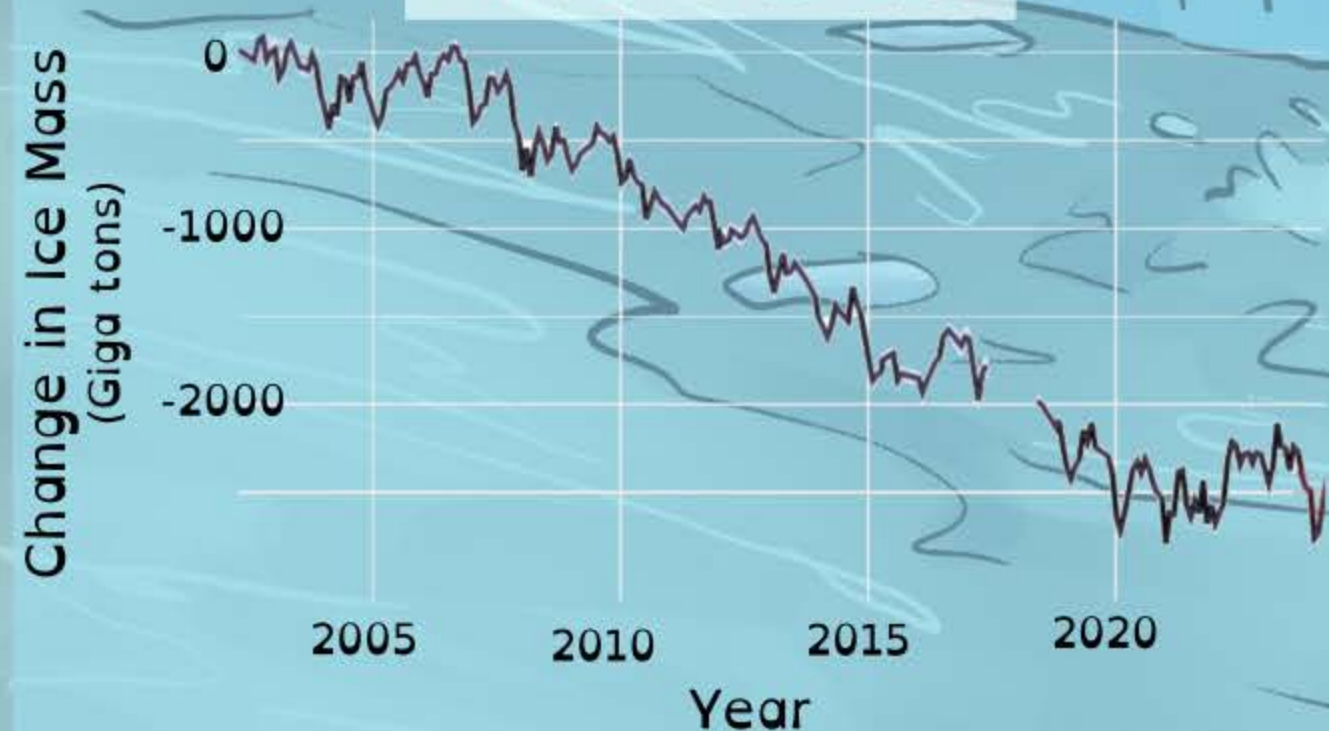


How that happened is still
an unanswered scientific question.

But Antarctica and the Southern Ocean are changing fast.

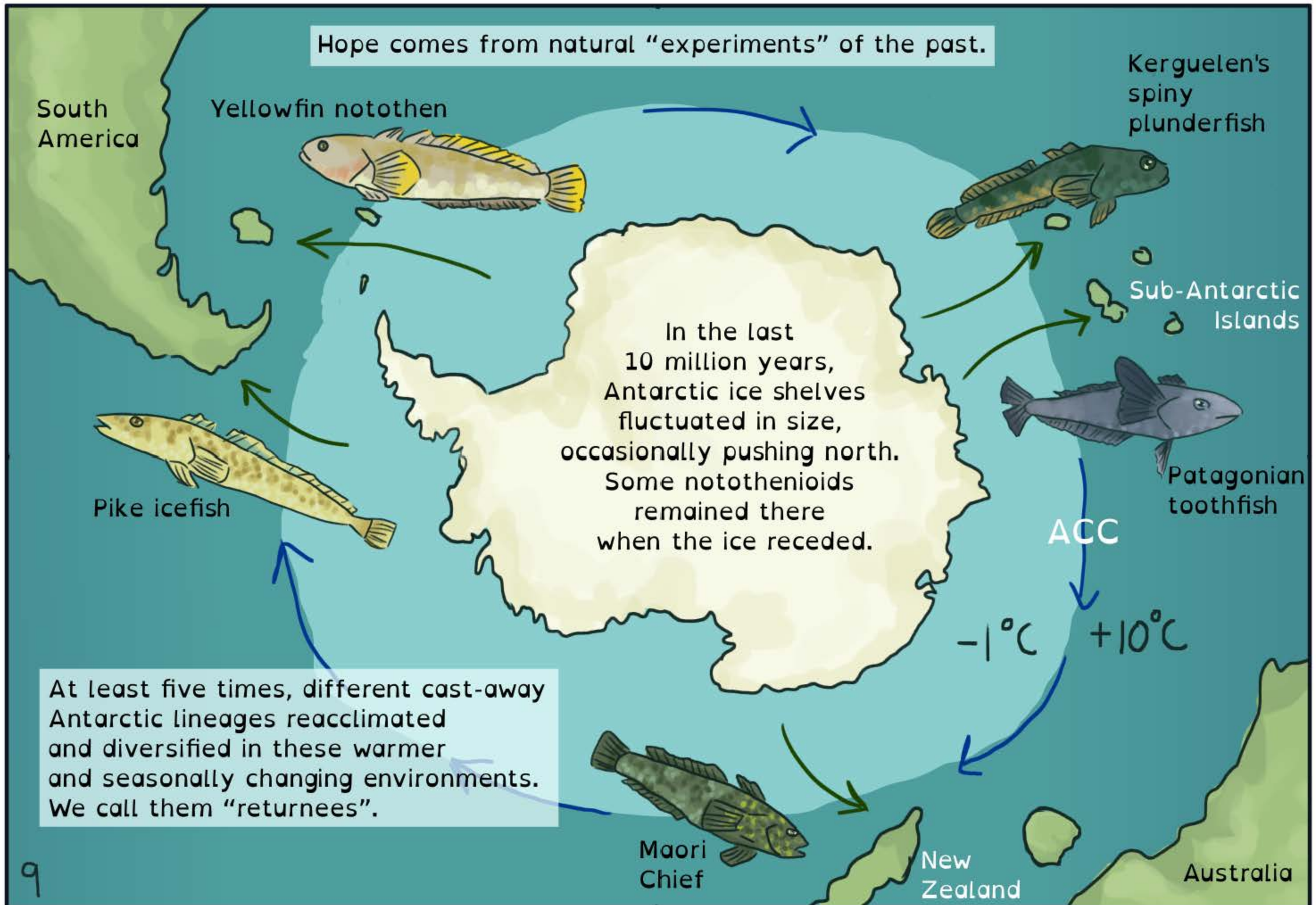
Glaciers are melting at an incredible pace, ice shelves are calving city-size icebergs, and the amount of sea ice is shrinking.

Antarctic Ice Loss



Will the highly specialized Antarctic fishes, which have adapted to stable freezing conditions for millions of years, be able to adapt to forecasted changes to their environment?

Hope comes from natural “experiments” of the past.



So maybe some of today's notothenioids will be able to also acclimate to a changing Antarctic environment?

But will they evolve fast enough?

No one knows.



Translation credits

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Font is OpenDislexic-Alta,
a typeface designed for some common symptoms of dyslexia.

This comic was created as part of the
University of Oregon Science and Comics Initiative.

This material is based upon work supported by the Office of Polar Programs
at the National Science Foundation under NSF grant number OPP-2232891.

Any opinions, findings, and conclusions or recommendations expressed in this material are
those of the authors and do not necessarily reflect the views of the National Science Foundation.

