

# A mysterious disease in Antarctic fish

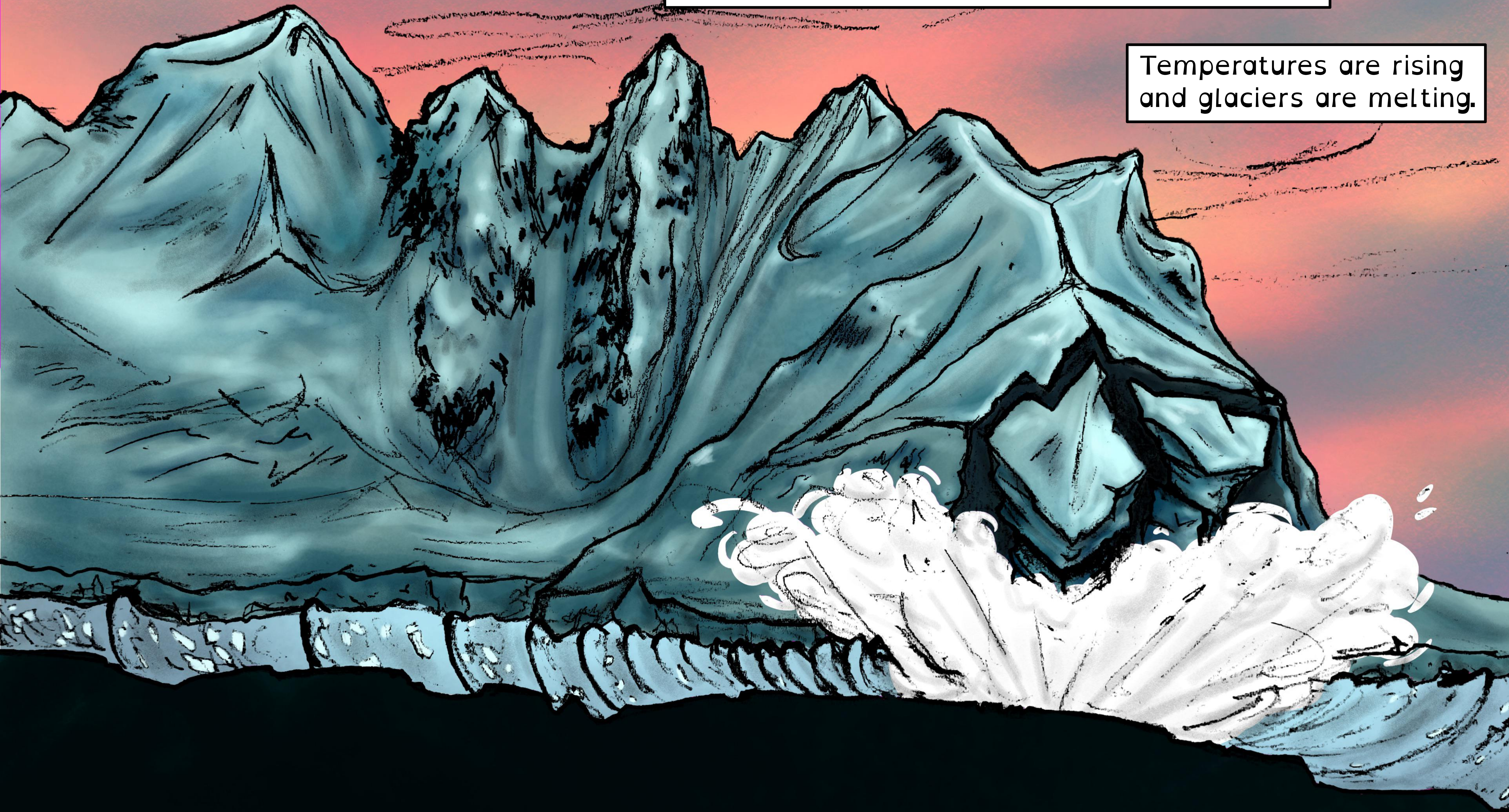
By Chloe DaMommio,  
John H. Postlethwait,  
and Thomas Desvignes



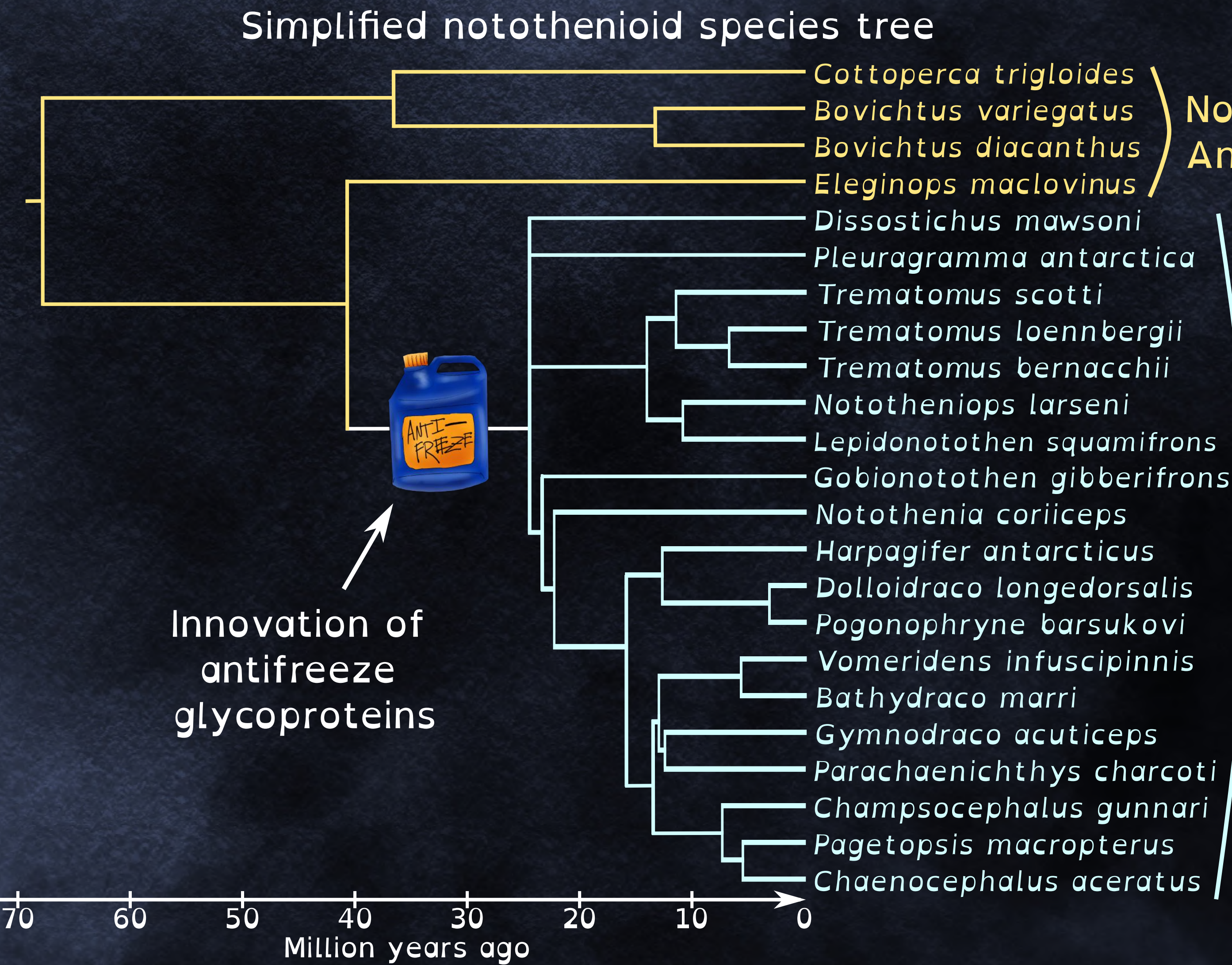
Antarctica has been chronically cold and covered with ice for millions of years.

This stable environment is now changing. Fast.

Temperatures are rising  
and glaciers are melting.

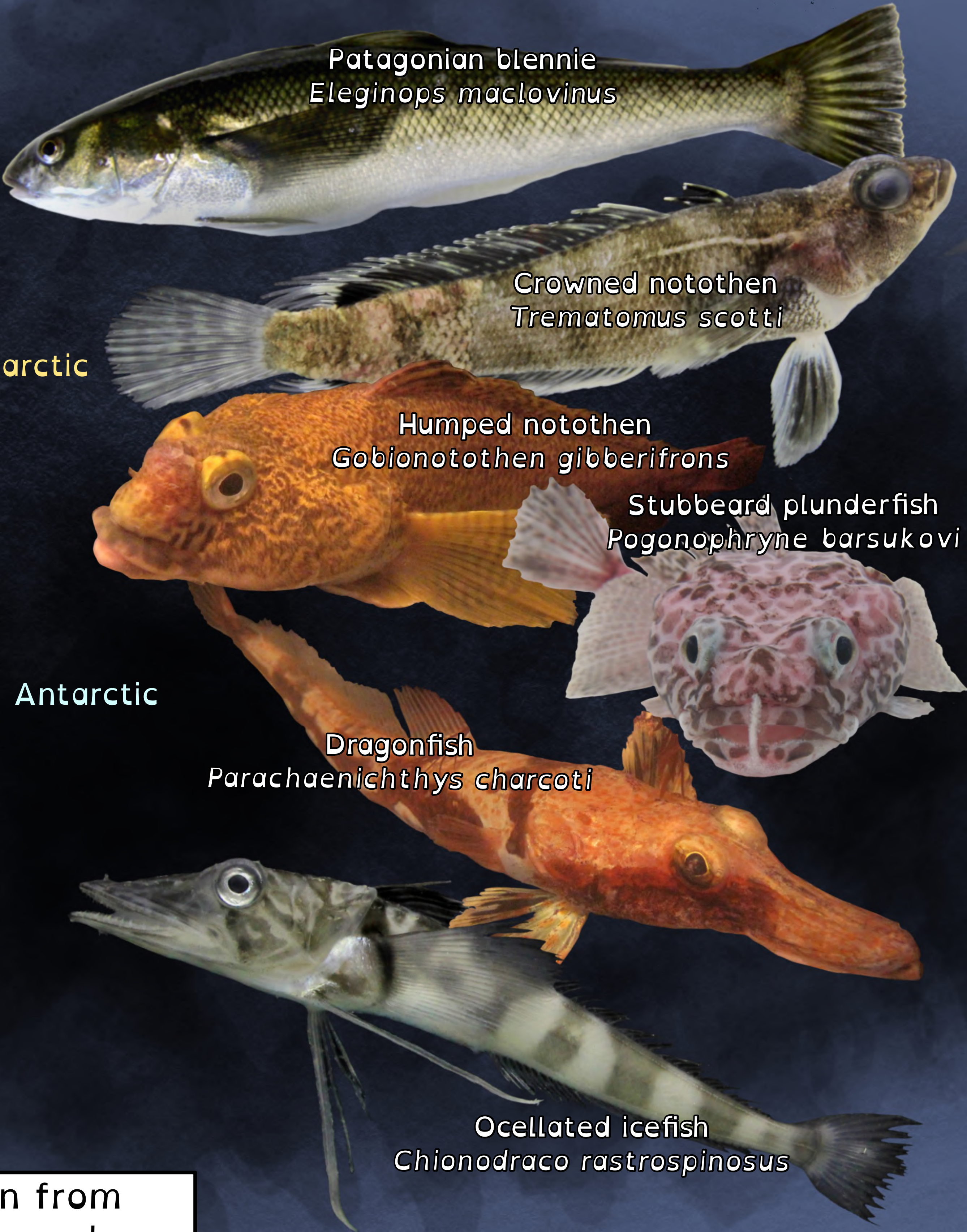


The blood and body of nearly all animals would freeze in Antarctica's ocean. But as waters cooled, an ancestor to most Antarctic fishes, which are called notothenioids, evolved an antifreeze protein that allowed them to thrive in this frigid environment.



Around Antarctica, notothenioids diversified with little competition and predators.

Notothenioids colonized the Southern Ocean from just below the sea ice to thousands of meters deep.



Some notothenioids are called icefishes.  
They are really special fish!

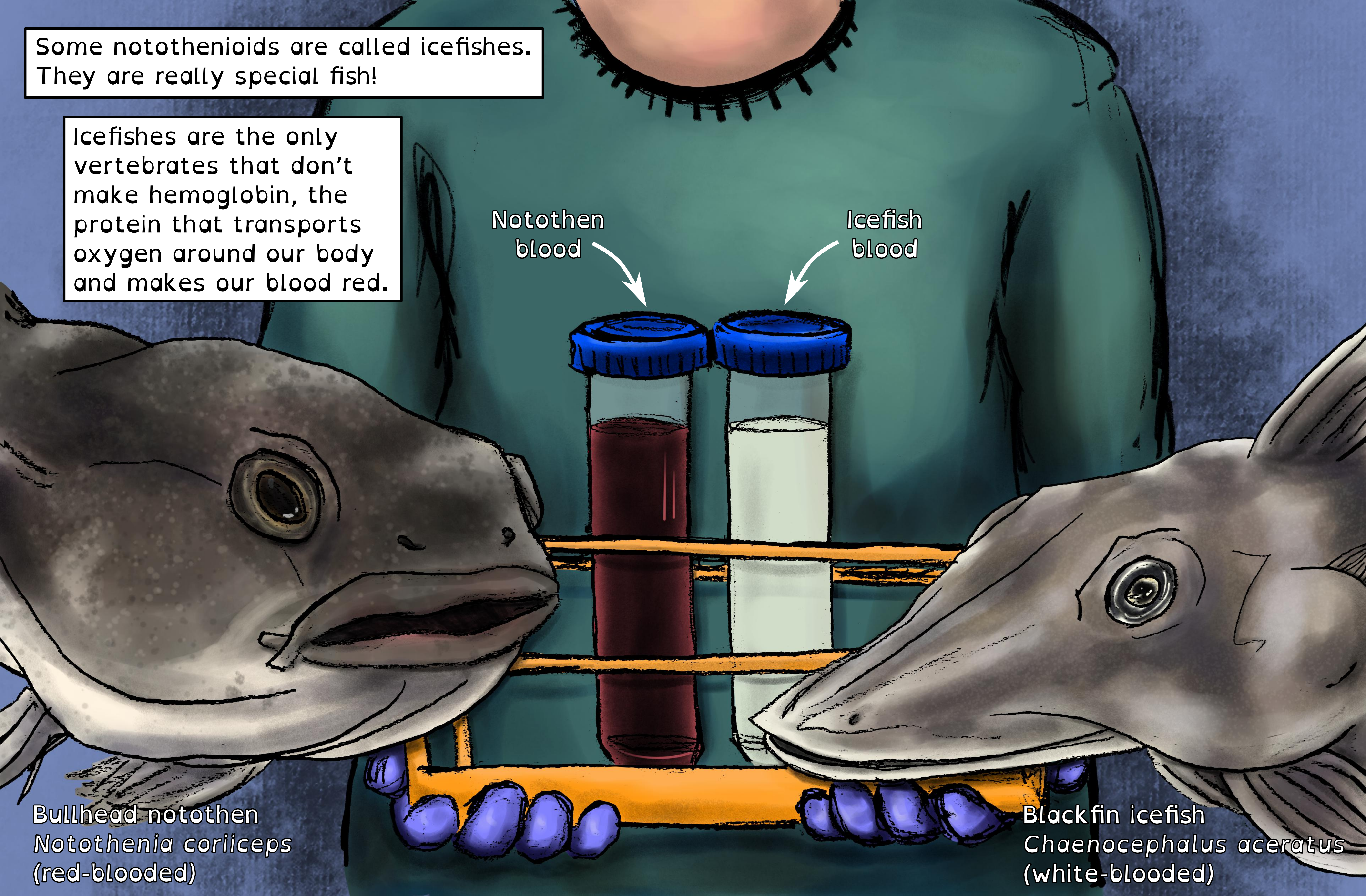
Icefishes are the only  
vertebrates that don't  
make hemoglobin, the  
protein that transports  
oxygen around our body  
and makes our blood red.

Notothen  
blood

Icefish  
blood

Bullhead notothen  
*Notothenia coriiceps*  
(red-blooded)

Blackfin icefish  
*Chaenocephalus aceratus*  
(white-blooded)



Aboard the Antarctic Research and Supply Vessel Laurence M. Gould (the "Gould"), scientists conduct research operations in this harsh environment.

Today, the Gould explores Andvord Bay, a small fjord and hotspot of biodiversity on the West Antarctic Peninsula.

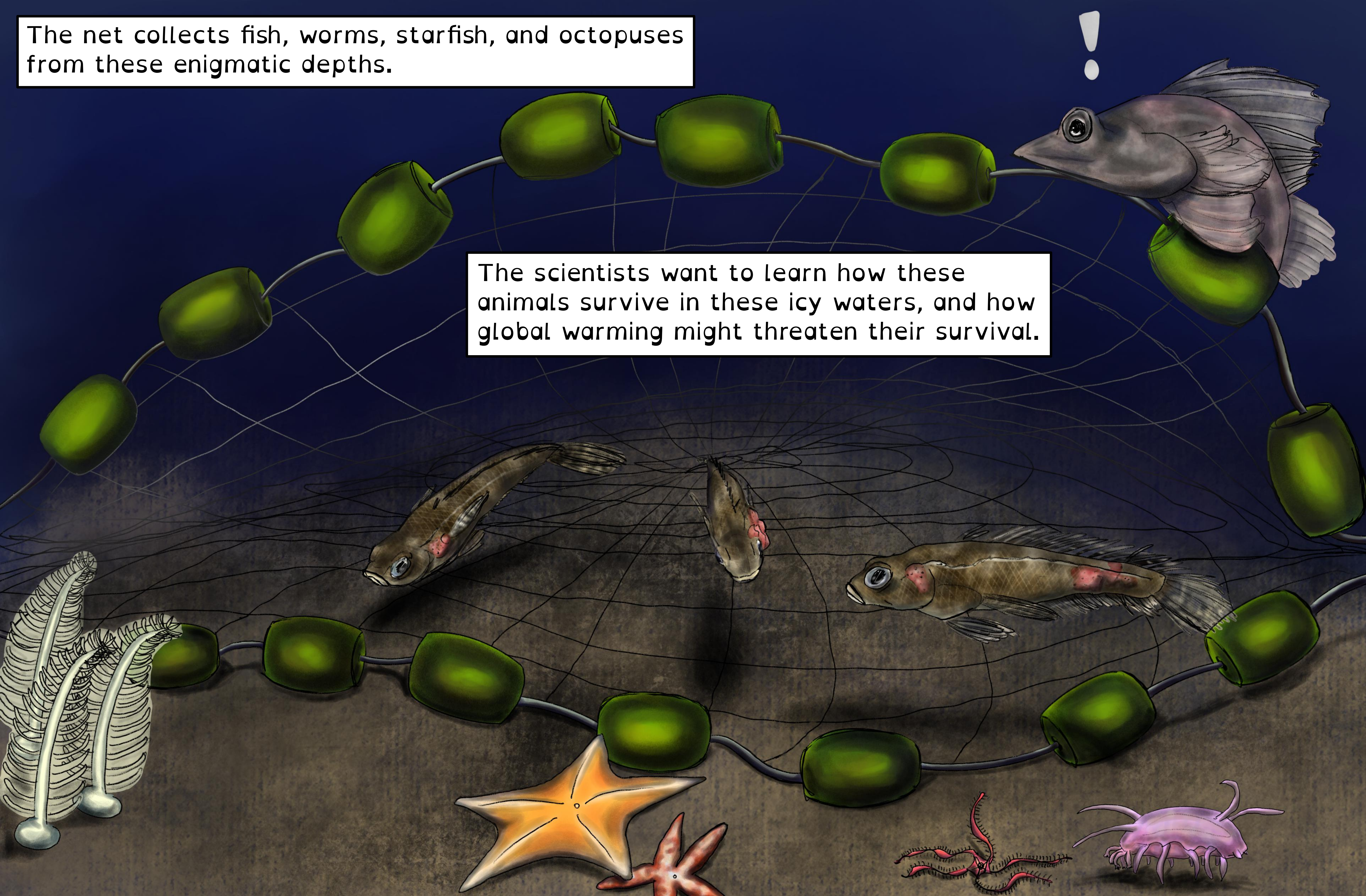


Tonight, scientists  
deploy a small  
trawl net to the  
ocean bottom.



The net collects fish, worms, starfish, and octopuses from these enigmatic depths.

The scientists want to learn how these animals survive in these icy waters, and how global warming might threaten their survival.



But while sorting the catch...

Wait!

There's something wrong  
with this crowned notothen!



Many of these fish have  
strange skin tumors!

We should bring some back  
to Palmer and study them.



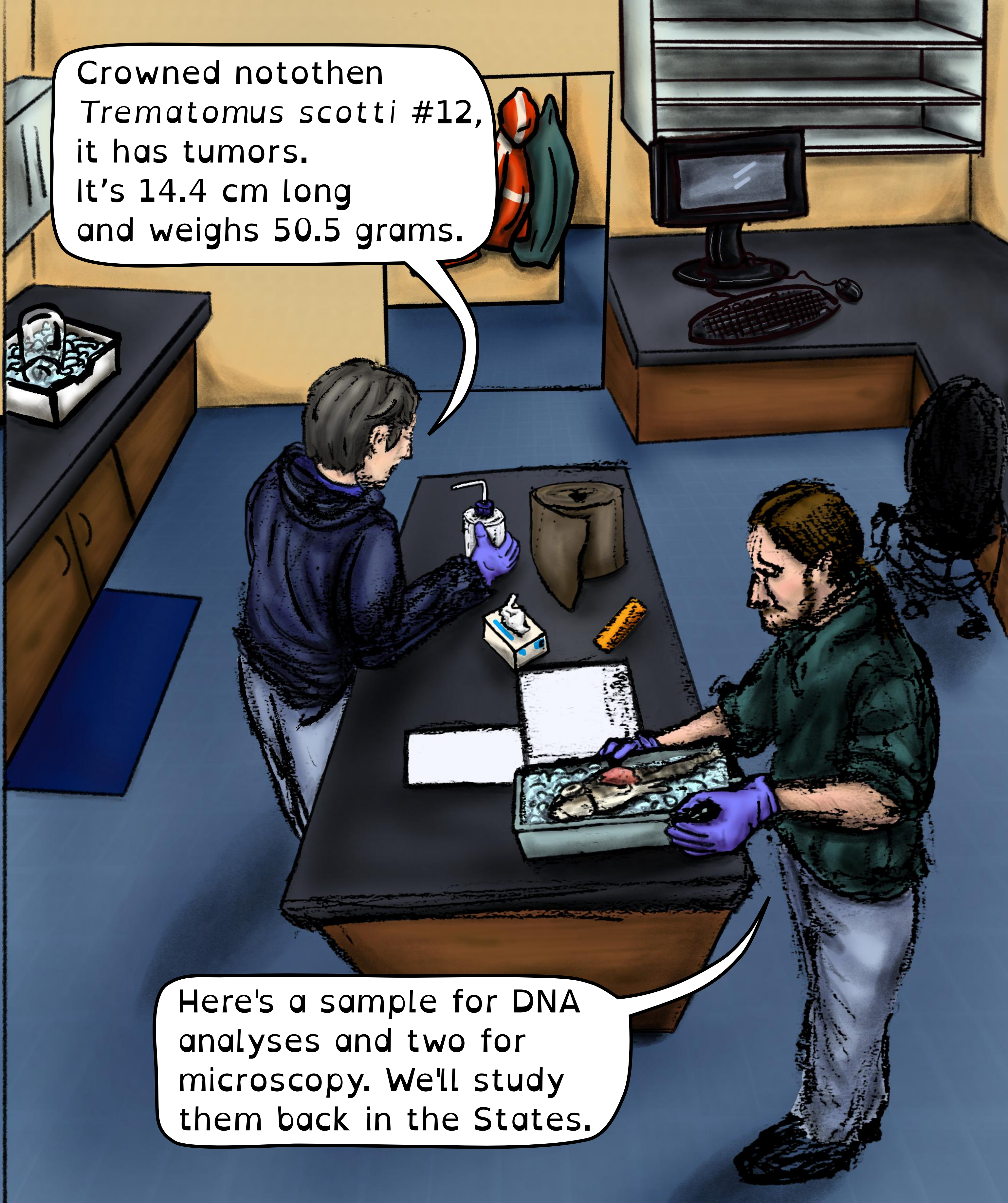
Palmer Station is the smallest of America's three permanent stations in Antarctica, housing only about 40 people.

Researchers and student scientists rotate through Palmer to study this unique environment: its fish, penguins, whales, krill and other organisms, but also its atmosphere, glaciers, and climate. How have these changed over the years?





At Palmer, scientists take measurements and samples of many diseased and healthy fish for genetic and microscopic studies to learn what causes the tumors and how they affect the fish.



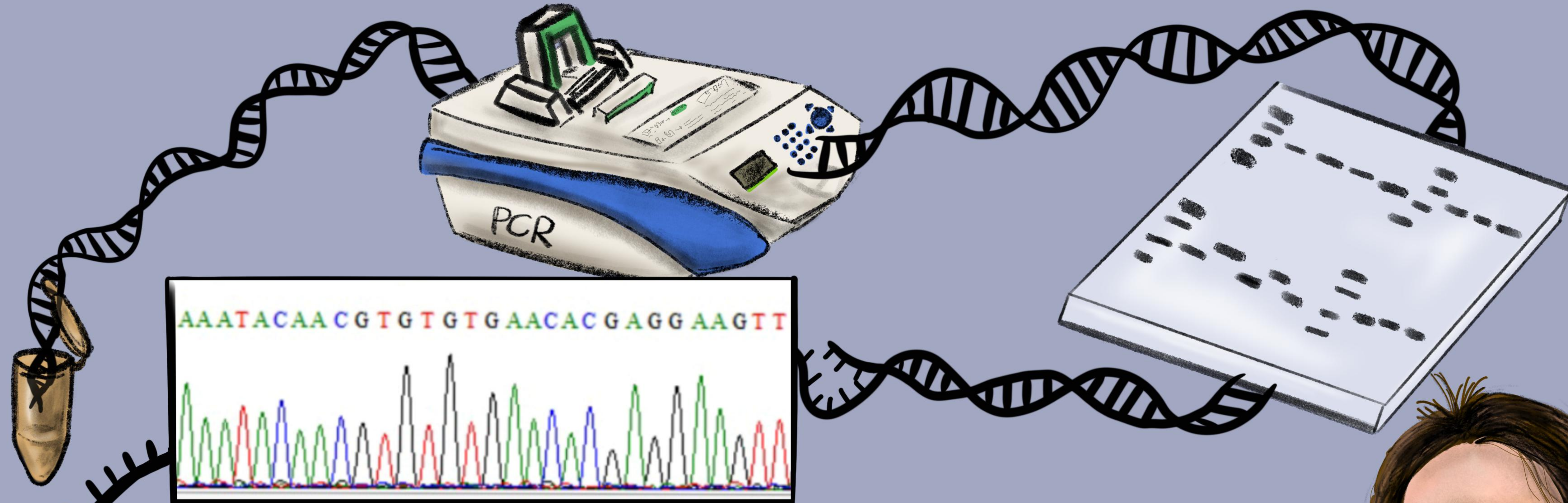
Crowned notothen  
*Trematomus scotti* #12,  
it has tumors.  
It's 14.4 cm long  
and weighs 50.5 grams.

Here's a sample for DNA  
analyses and two for  
microscopy. We'll study  
them back in the States.



Let's figure out what caused these tumors!



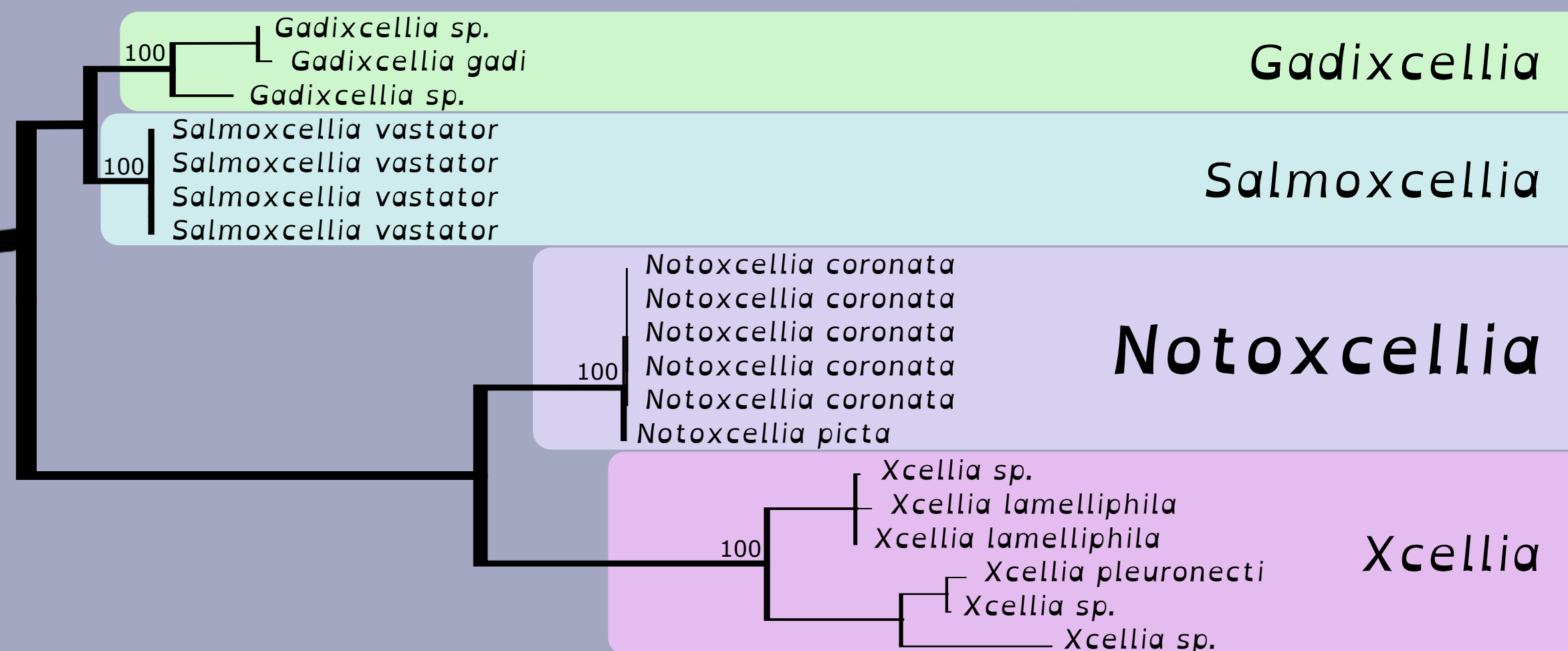


Genetic analyses using PCR tests revealed that a type of single-cell parasites caused these tumors. Scientists have seen similar parasites in cod, salmon, halibut, and a few other fishes, but rarely.

These parasites are called 'X-cells'.

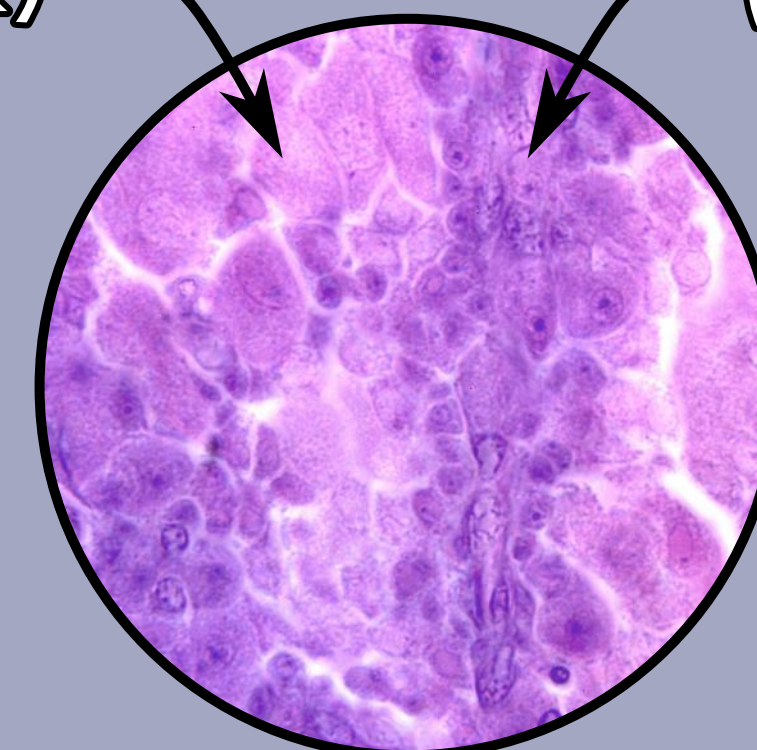
But X-cells parasitizing Antarctic fishes are different from those previously described.

### X-cell species tree



X-cells  
(pink)

Fish cells  
(purple)

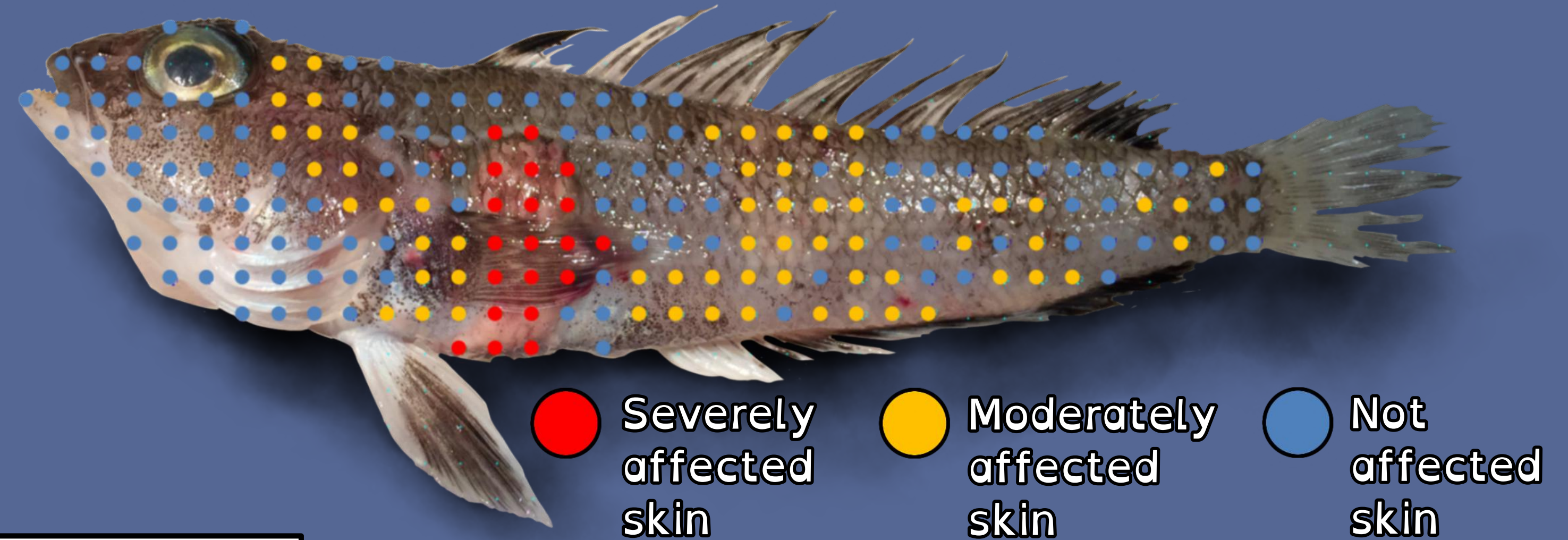


We called these new  
X-cell parasites  
*Notoxcellia*



Analysis of fish pictures showed that fish have tumors more frequently behind the head and close to the anus.

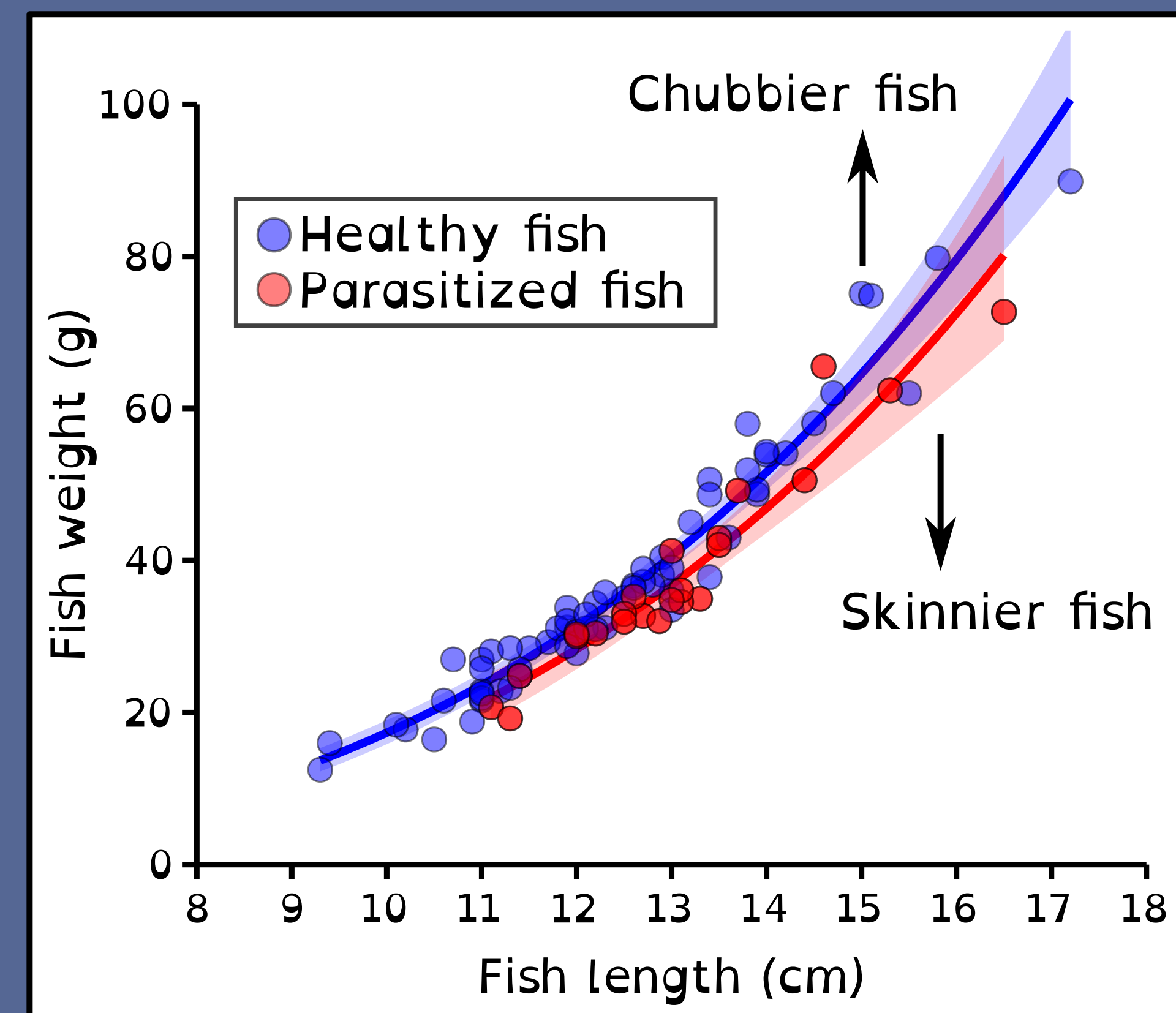
This result suggests infections may be linked to feeding.



Molecular microscopic techniques that stain blue either fish cells or X-cells revealed that the parasites proliferate within the fish skin and fill large compartments between thin partitions of fish cells.

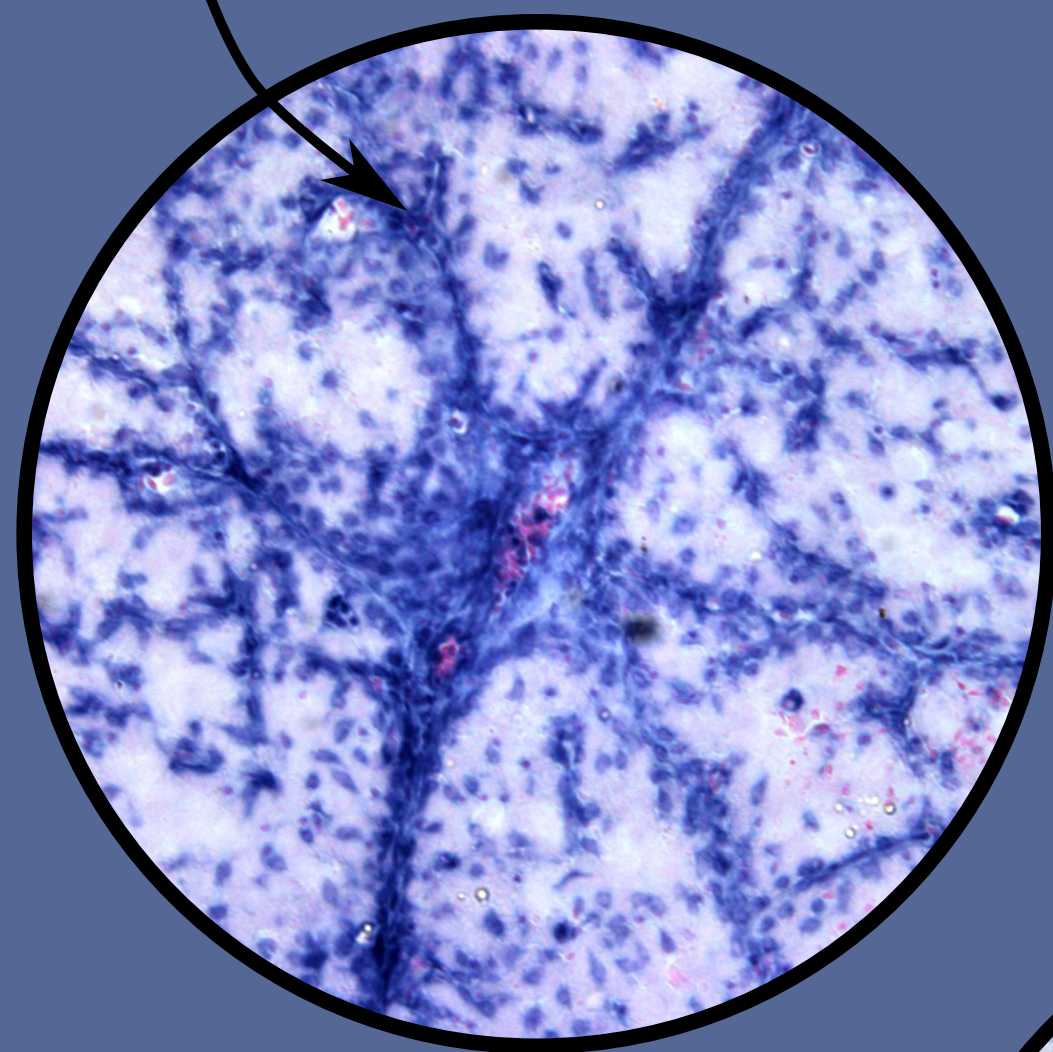
Results were inverse images of one another!

Measurements of fish weight and length showed that parasitized fish are skinnier than healthy fish.

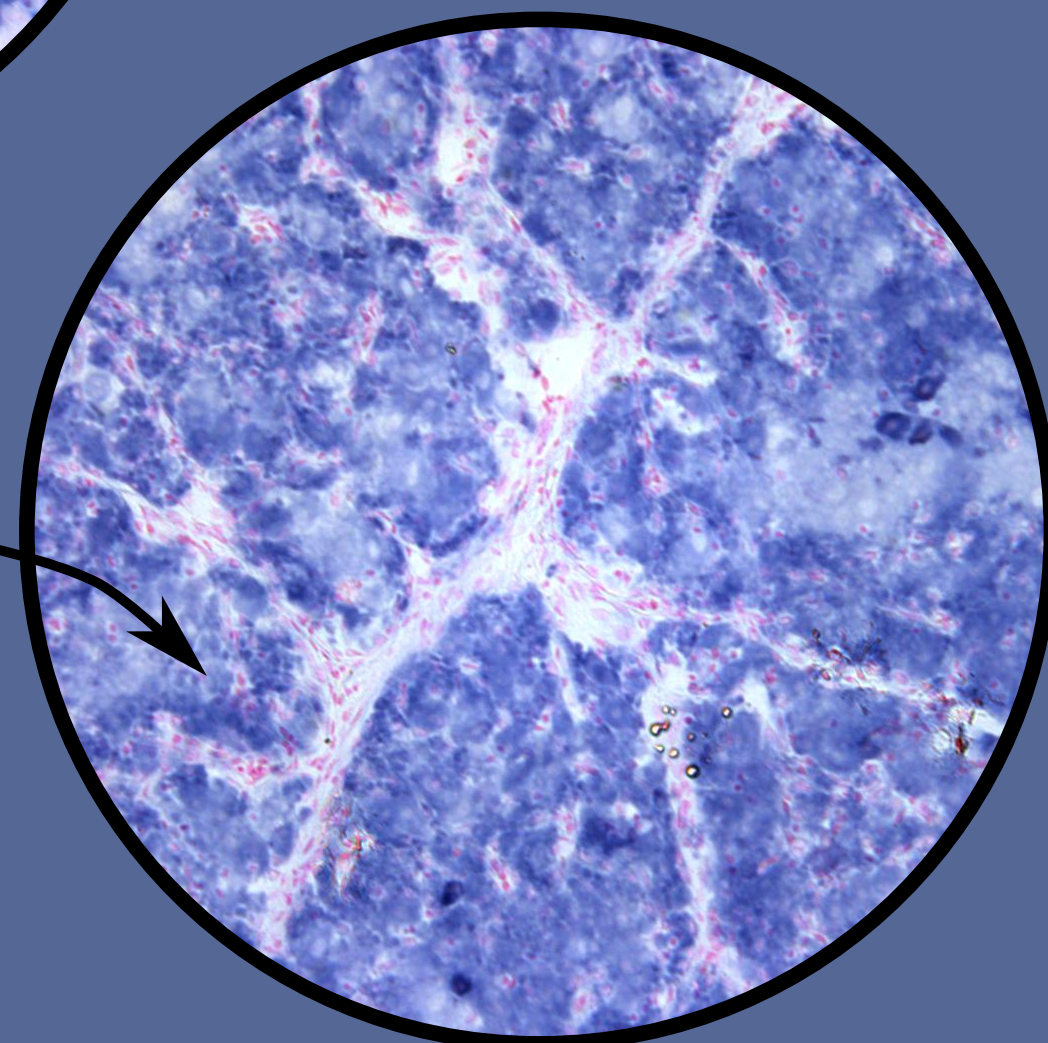


These parasites must really harm the fish!

Fish cells are stained in blue here



And here, X-cells are stained in blue



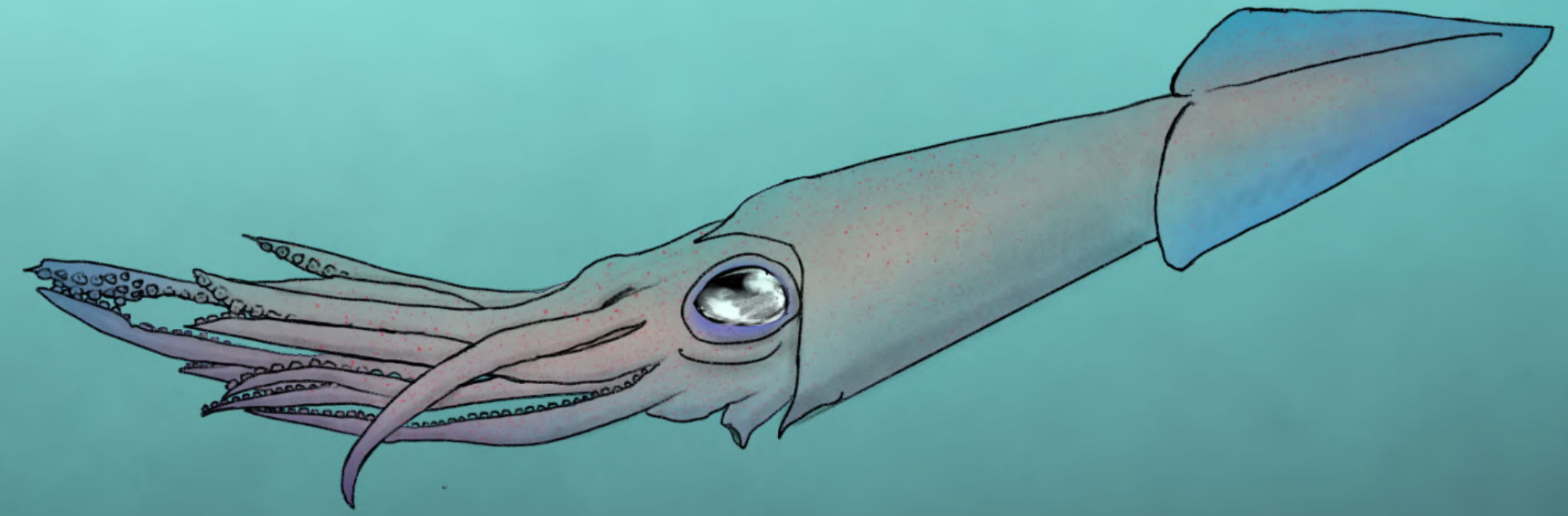
So why are X-cells now affecting these fish while no one has seen such an epidemic in Antarctica before?

Are X-cells waking up from a cold sleep and becoming more infectious?

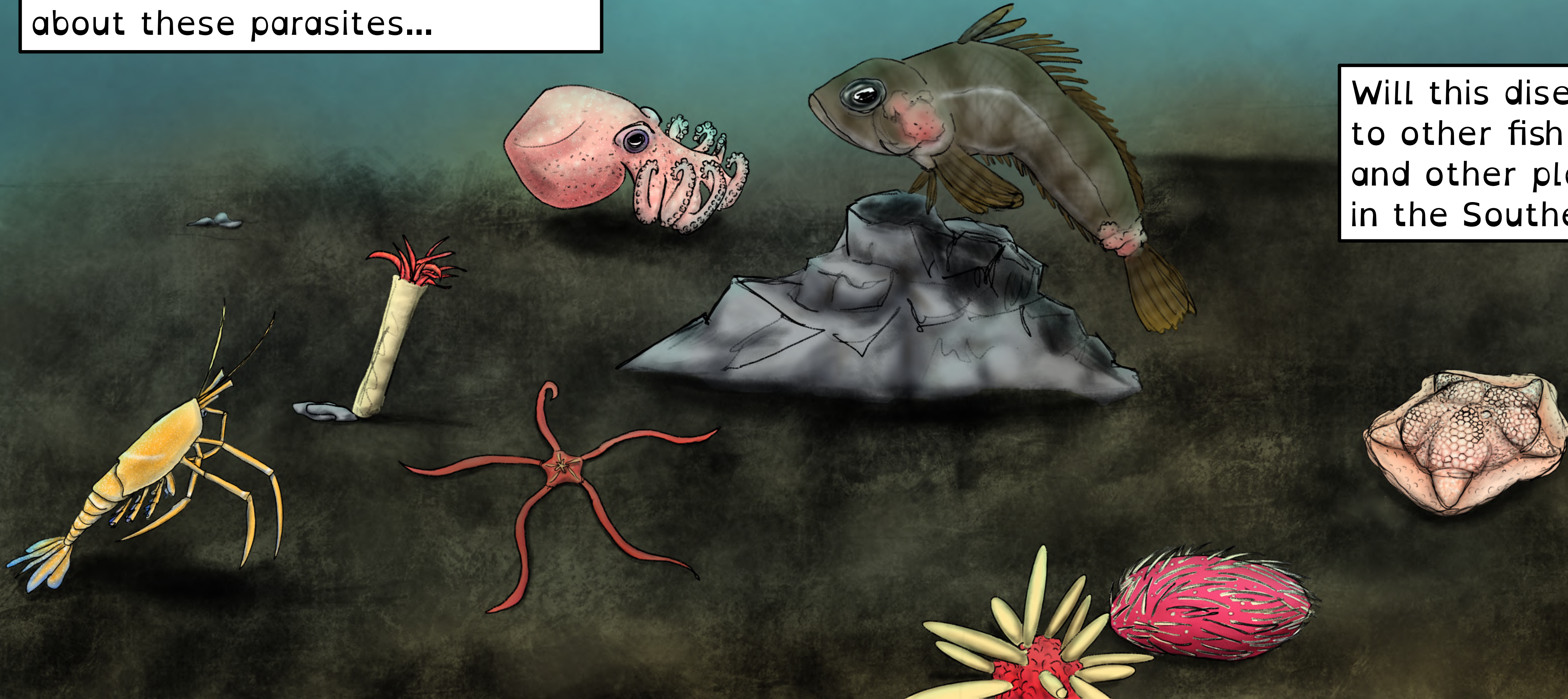
Or are fish getting weaker because of climate change, making them more likely to get infected?

Maybe both?

Or maybe something else?  
There is so much we don't know about these parasites...



Will this disease spread to other fish and other places in the Southern Ocean?



The scientists are planning to go back and explore additional areas to answer these questions.



We thank the captain and crew of the ARSV Laurence M. Gould,  
the personnel of the U.S. Antarctic Program for assistance  
in Chile, at sea, and at Palmer Station, as well as the logistics in  
Denver, CO for their support related to the Antarctic fieldwork  
required for this work.

### Translation credits

Danish: Henrik Lauridsen

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Spanish: Alejandro Valdivieso & Manuel Novillo

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

Based on the true events and findings associated with the scientific article  
**"A parasite outbreak in notothenioid fish in an Antarctic fjord"** (2022) in *iScience*  
by T. Desvignes, H. Lauridsen, A. Valdivieso, R.S. Fontenele, S Kraberger, K.N. Murray,  
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This material is based upon work supported by the Office of Polar Programs  
at the National Science Foundation under NSF grant number OPP-1947040.  
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