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## Animals

# Amphibian apocalypse is twice as bad as scientists thought

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More than 500 frog and salamander species are suffering from a deadly fungal disease.

By Jason Bittel

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There is a plague ripping through the amphibian species of the world. It's caused by fungus that's invisible to the naked eye and spreads easily by many means. It kills by disrupting the way these creatures breathe through their skin, essentially suffocating frogs and salamanders.

The disease is called chytridiomycosis, and according to a landmark study published Thursday in the journal *Science*, it's even worse than we thought.

Scientists once estimated that about 200 species of frogs and salamanders have been harmed by the disease, but the study concludes that chytrid fungus has contributed to declines in at least 501 amphibian species. Ninety of the species are thought to have gone extinct because of it. Populations in tropical Australia, Central and South America seem to be hardest hit, though populations in Africa, Europe and North America are also affected. According to this accounting, the epidemic has caused the worst loss of biodiversity of any disease ever recorded.

"It's a staggering thing to consider," said [Jonathan Kolby](#), one of

the study's authors and a herpetologist specializing in conservation and wildlife diseases at James Cook University in Australia. "We've never before had a single disease that had the power to make multiple species extinct, on multiple continents, all at the same time."

[Carly Muletz Wolz](#), a molecular pathogen scientist at the Smithsonian National Zoo's Center for Conservation Genomics, said she was not surprised by the findings and that it was important to finally see the scale of the problem quantified.

"This is the newest, best estimate on where things stand," said Muletz Wolz, who was not involved in the study. "And it's probably even worse than this, because you only know what you know."

The scope of the chytrid fungus's onslaught on the amphibian world is unprecedented. West Nile virus, now a relatively well-known pathogen, affects just 23 bird species. The fungus laying waste to bat populations across North America, white nose syndrome, is attacking about a dozen species.

"You've got hundreds if not thousands of frog species that could go extinct, and they're getting much less attention from a global health perspective," said Kolby, who helped establish the [Honduras Amphibian Rescue and Conservation Center](#).

Scientists suspect the lineage of the chytrid fungus that has been ravaging frog populations became more virulent in the 1980s, after it hybridized with another lineage. As more people transport infected amphibians in the global pet trade, the more opportunity there is for the fungus to spread and further hybridize.

"There's nothing preventing hybridization from happening again,

and if it happens again, who knows what that hybrid offspring will act like,” Kolby said. “We could have another global wave of disease, which could be similar, different or even worse than the one we’re facing now.”

In 2013, scientists discovered a species of chytrid that goes after salamanders, called *Batrachochytrium salamandrivorans*.

Fortunately, this species has not yet made its way into the United States. In 2016, the U.S. Fish and Wildlife Service made it illegal to import 201 high-risk species of salamander as a safeguard against outbreaks.

There are no such restrictions in the frog trade.

Kolby said the United States and other countries need to enact stricter biosecurity measures for several reasons. [It’s already been shown](#) that frogs and toads can harbor the fungus that afflicts salamanders, so only banning certain salamander species may not be enough to protect native species.

In many ways, the United States already does a good job of preventing the spread of diseases that affect crops and livestock, Kolby said, thanks to agencies such as the Agriculture Department and the Centers for Disease Control and Prevention. Chytrid fungus may have slipped through the cracks, however, because it does not immediately affect humans.

“What concerns me is there’s going to be a next time. By not using this as a learning experience about what happens when we aren’t being careful, it almost undoubtedly ensures that the wildlife trade is moving other pathogens right now, be it for mammals, birds, fish. You name it,” he said.

It is unclear how a global amphibian decline will disrupt the various ecosystems they inhabit. Many species improve water quality by clearing waterways of vegetation when they are in the tadpole stage of development. Other frog species play a crucial role in keeping mosquito numbers in check by feasting on their larvae. And countless other species rely on frogs as a food source.

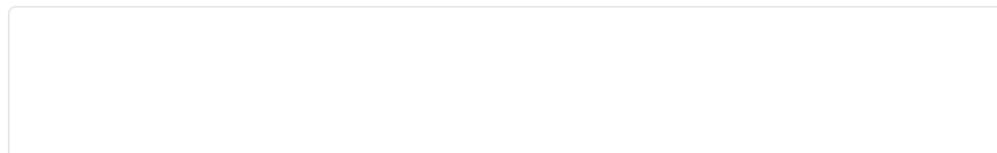
Even though the outlook is darker than it's ever been, glimmers of hope exist. Kolby and his co-authors were able to find documented population trends for 292 frog species that have seen declines because of chytrid. Of those, 60 species have shown some evidence of recovery, possibly because they evolve to resist the fungus. The scientists note, however, that these recoveries are mostly of individual populations, rather than rebounds for the species at large.

"It at least gives us something to look at in terms of why some species are recovering and why others are not," said Muletz Wolz.

Kolby said he can understand how the news fuels a sense of hopelessness.

"But I think that's the worst thing that could come out of this," he said. "I still look at this as just one huge opportunity to learn how to not let this happen again."

*Correction: An earlier version of this story quoted a scientist who said that Canada has banned imports of all amphibians. Canada has banned imports of all salamanders. The quote has been removed.*



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