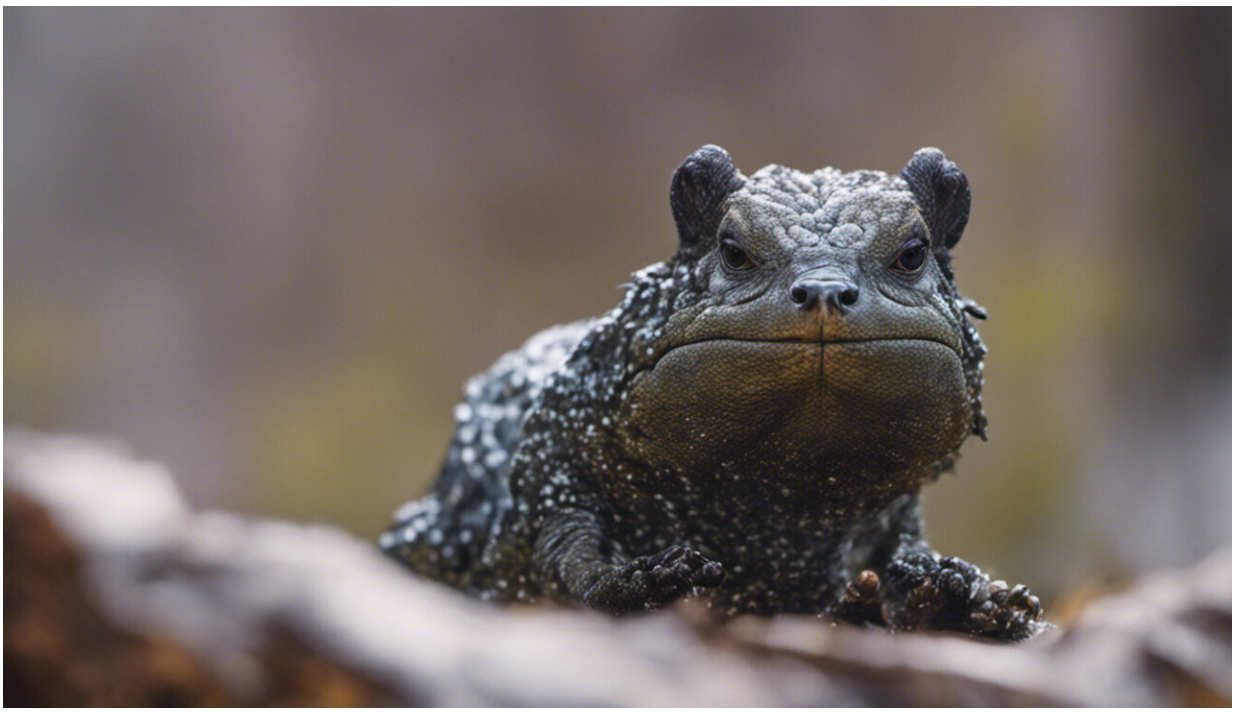
How climate change is causing a communication breakdown in the animal world

July 5 2023, by Mahasweta Saha



Credit: AI-generated image (disclaimer)

What do the following changes have in common?

Some ant species are struggling to follow trails, as warming temperatures cause a certain pheromone they use to communicate to decay. The water

fleas *Daphnia* are finding it harder to evade predators as CO_2 levels rise in the water. And in coral reefs, the colorful and pretty damselfish are losing their ability to learn who their predators are.

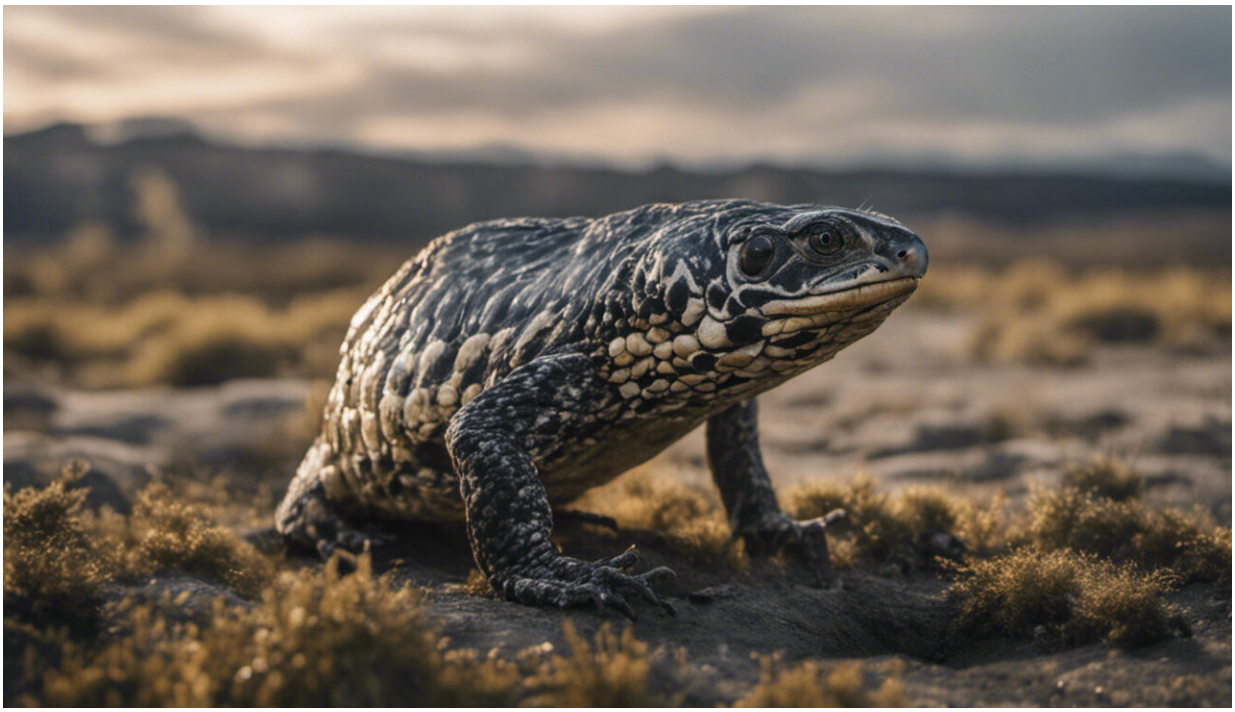
All have been caused in some way by arguably the biggest change of all: climate change.

My colleagues and I have led research which has shown that climate change is also changing chemical communication in marine, freshwater and land-based species, with far-reaching implications for our planet's future and human well-being.

Chemical communication plays an essential role in well-functioning ecosystems. This "language of life" regulates interactions between organisms and is essential to the environment, and ultimately, all life on Earth.

Interactions through so-called "infochemicals" are perhaps the oldest and most widespread form of communication on the planet. Infochemicals provide the basis for the vast majority of ecological processes across the tree of life, in both land and water, by serving as cues or signals that are present on the surface of organisms themselves or released into the surrounding environment.

They also help shape natural ecosystems by maintaining their equilibrium and, in doing so, support the provision of many things that are of great importance to humans, including food and clean water.



Credit: AI-generated image (disclaimer)

Infochemicals influence a broad range of functions and behavior such as the relationship between predator and prey. For example, sharks use these chemicals to "sniff" out their prey over mindboggling distances. Bear in mind that any chemical you can smell is probably an infochemical, often intended for a different species. For instance the smell of a pine forest—that is, the presence of certain chemicals—signals something different to a human, a bear or an ant.

These chemicals can affect foraging and feeding too. For example, infochemicals are released by some plant species to attract pollinators but repel those that may cause harm. In some cases, a plant under attack may even tell its neighbors of impending doom so they can respond accordingly.

Infochemicals can influence habitat selection. They're how barnacle larvae select a suitable surface on which to attach, for example. And infochemicals are also used by species to recognize potential mates and boost their chances of reproducing. For example, some bat species can "sniff" out a mate with the greatest genetic diversity.

Changing infochemicals

But climate change is altering the production of these info-carrying chemicals such as pheromones. This is having a major impact on a wide variety of species. Scientific research has shown that alterations in temperature, carbon dioxide and pH levels—all part of climate change—can affect every single aspect of the fundamental processes that organisms use to communicate with each other.

An example of this is a laboratory experiment that showed how climate change caused a reduction in anti-predator behavior in some fish species by decreasing their anxiety towards potential predators. Many fish release certain chemicals when they are harmed by a predator or are otherwise in danger. And their fellow fish use the presence of these chemicals, detected through smell, as a warning. But scientists found that when more CO_2 is absorbed in the water and the pH level is reduced, the most commonly researched alarm cue (hypoxanthine-3-N-oxide) is irreversibly changed and fish find it harder to detect.

Climate change is not just affecting individual species. A growing number of studies suggest that climate change-associated stressors which modify these chemical interactions are causing info-disruption across whole ecosystems.

However, our understanding of the underlying mechanisms remains scarce. As a next step, colleagues and I are working on how climate change may affect the chemically mediated relationship (or

communication) between disease-causing pathogens and the animals that host them. If global warming causes a communication breakdown, we ultimately want to know how that will impact us humans.

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