

Too hot: Temperatures messing with sex of Australian lizards

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This handout photo provided by Arthur Georges, University of Canberra, Australia, taken in Oct. 2014, in Eulo, Queensland, Australia, shows a bearded dragon lizard. Hotter temperatures are messing with the gender of Australia's bearded dragon lizards, a new study finds. Dragons that are genetically male hatch as females and give birth to other lizards. And the way the lizards' gender is determined is getting changed so much that the female sex chromosome may eventually disappear entirely, the study authors say. (Arthur Georges/University of Canberra, Australia via AP)

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"This is the first time we have proved that sex reversal happens in the wild in any reptile at all," said Clare Holleley of the University of Canberra, lead author of the study in the journal *Nature* Wednesday. The study, she said, "is showing that climate extremes can very rapidly fundamentally alter the biology of an organism."

To understand what's happening, it helps to have a quick lesson in the birds and the bees - and the bearded dragons and other reptiles. Some reptiles, like alligators and some turtles, have their genders determined not by [sex chromosomes](#), like humans and other mammals, but by temperature during incubation.

Until now, bearded dragons had their gender based on chromosomes. Like birds, their sex chromosomes are Z and W instead of X and Y. Males are ZZ. Females are ZW. In humans, everyone has an X and the presence of Y makes a person genetically male. In bearded dragons, everyone has a Z and the presence of a W makes them a genetic female.

In the past, scientists have shown in the lab that hot temperatures can switch that natural chromosome-based gender.

Holleley and colleagues examined the genetic sex markers of 131 wild-caught bearded dragons in Queensland province and found that 11 of them were female outwardly - even having offspring - but had the ZZ chromosomes of a genetic male. Their sex determination was "switched into overdrive," Holleley said.

Holleley concedes 11 dragons is a small sample size, so she and colleagues will continue and expand their research.

The genetic-male-into-female dragons not only laid eggs, but in a way were better mothers than genetically determined females, laying more eggs, said study co-author Arthur Georges, chief scientist for the Institute for Applied Ecology at the University of Canberra.

The team also found that the offspring of these dragons no longer have their gender determined by [chromosomes](#), but by temperature.

"They're throwing away the equivalent of the Y, which we call the W, chromosome," Georges said. "If the climate warms not much more at all, the percentage of [sex reversal](#) will increase and the W chromosome will be lost from the population."

This is happening in an area that is one of the fastest warming places in Australia over the past 40 years, Holleley said. Lab tests show that the switch from genetic sex determination to temperature [sex determination](#) seems to start at about 90 degrees Fahrenheit (32 degrees Celsius) and occurs 100 percent of the time at about 97 degrees (36 degrees Celsius), Holleley said.

Outside scientist Frederic Janzen at Iowa State University praised the work as thorough and convincing. He said in an email that the study can help "to better understand these remarkable animals in a rapidly changing world."

Holleley said the heat could be transformative for more than these lizards: "It certainly can happen to other species, but it's not going to happen to humans, more than likely."

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