THIS WEEK

EDITORIALS

How lizards got their big feet

Creatures that survived wild weather in the Caribbean offer a rare and enlightening glimpse of natural selection in action.

When Charles Darwin first saw a Madagascar star orchid — sent to him by an enthusiast — he predicted the existence of a long-tongued pollinator that could reach for nectar inside the flowers' long tubes. The discovery of Morgan's sphinx moth, which had a tongue just long enough (and no longer), proved Darwin right — some two decades after his death.

It's one of the great demonstrations of evolution by natural selection. But what naturalists really want is to catch natural selection in the act, as it's doing the selecting. And opportunity knocked at the door of biologist Colin Donihue at Harvard University in Cambridge, Massachusetts, a year ago, just after he and his colleagues had returned from the Turks and Caicos Islands, where they had been studying anole lizards (*Anolis scriptus*).

On 8 September last year, Hurricane Irma struck the islands, battering them with sustained winds of up to 265 kilometres per hour. Two weeks later, Hurricane Maria arrived. Dozens of people in the region died. Reconstruction and rebuilding efforts continue.

Three weeks after the winds had died down, the researchers went back to assess the damage, and to see how (or even if) their lizards had survived. Their study, published this week in *Nature*, is the first to use an immediate before-and-after comparison to assess the impacts of hurricanes on evolutionary selection (C. M. Donihue *et al. Nature* http://doi.org/csgp; 2018). They saw clear trends of natural selection in action. In general, anoles found after the storms had bigger toepads, longer forelimbs and shorter hindlimbs than did lizards collected before the storm.

What have these traits to do with hurricanes? The lizards live in bushes and other low-growing vegetation. Toepads allow them purchase on the branches as they move, and it's a fair bet that limb proportions also play a part in helping a lizard to keep in contact with a branch, resisting moves by predators, other lizards — or, as it turned out, hurricanes — to knock them off.

The researchers took their idea further with a simple laboratory experiment in which they allowed lizards to get settled on a perch and then blew them off using a commercial leaf blower. (The lizards flew into comfy padding, and were not injured in the experiments.)

This experiment showed that when lizards are subjected to a stiff breeze, they hang on tightly with their forelimbs and let their hindlimbs hang loose. Longer hindlimbs, then, offer more purchase, explaining why lizards found after the storms tended to have shorter hindlimbs, but longer forelimbs.

These bigger toepads, shorter hindlimbs and longer forelimbs did not evolve as a direct response to the hurricanes. Natural selection interfered with the way in which these traits were spread across the population. Specifically, those lizards unable to hang on when the storms blew up — those with smaller toepads, longer hindlimbs and shorter forelimbs — were (presumably) blown away and perished. Those lizards better able to hang on tightly would have survived to weather another day. In technical terms, the mean values of the crucial traits measured before the storms had shifted.

These changes are phenotypic — merely observable characteristics. They say nothing about the genetic assimilation of such changes, which will presumably happen when the surviving lizards breed and new lizards are recruited to the population. Such changes are unlikely to be the last, given the extreme weather expected in the future. ■

Hot topic

Pinning extreme weather on climate change is now routine and reliable science.

Extreme weather is grabbing public attention. And a familiar question is being asked: is climate change to blame?

For years, the standard response was that climate change makes such events more likely, but it is hard to pin down the causes of a particular event. That is now changing.

As we highlight in a News Feature this week (see page 20), extreme-event attribution — the science of calculating how global warming has changed the likelihood and magnitude of extreme heat, cold, drought, rain or flooding — is ready to leave the lab. The research has advanced to the point at which public agencies can take over the task. That's down to progress in modelling, and more-accurate observations.

Rapid-attribution services are already being set up in Germany and elsewhere in Europe. Officials on other continents should follow suit.

Climate-change attribution statements are not yet ready for prime-time weather reports. But attribution is not just for the media or public curiosity. Policymakers, risk managers and courts will have a new decision-making tool on hand for issues related to climate change — to help plan infrastructure and, ultimately, assess liability.

Scientists should continue to improve the usefulness of attribution statements. There is no universal threshold beyond which climate change becomes dangerous, so research must establish resilience limits for different regions and sectors of the economy. To do this, and to help prepare a large city's health system or a region's agriculture for more turbulent weather, climate researchers must join forces with economists, social scientists and local specialists.

As attribution proceeds from science to service, the researchers who developed it can return to climate physics, such as exploring how clouds and climate interact, and how large-scale atmospheric circulation will change in a warming world. This is needed to continue checking the output of the models and to make attribution more precise. That can only help to highlight that our world is changing and we need to respond. ■