Big-headed gecko shows human actions are messing with evolution

August 1 2017, by Jan Hoole

Credit: Pixabay

Evolution doesn't have to take millions of years. New research shows that a type of lizard living on man-made islands in Brazil has developed a larger head than its mainland cousins in a period of only 15 years.

The group of insect-eating geckos from the species *Gymnodactylus amarali* was isolated from the rest of the population when areas of the countryside were flooded to provide hydro-electric power. This caused

the extinction of some larger species of lizards on the new islands, leaving the geckos to eat insects that would normally have been mopped up by the bigger species. As a result, the geckos have evolved bigger mouths, and so bigger heads, that enable them to eat their larger prey more easily.

We've actually seen rapid evolution like this before, but usually in response to a natural disaster such as drought or climate change. What's different about the geckos is that they've evolved in direct response to an environmental change enacted by humans, demonstrating just how much impact we can have on the natural world.

The gecko study, published in PNAS, gives us an interesting demonstration of how evolution works, not just because the change has happened within our lifetimes. Those geckos among the original colony that had larger heads (and mouths) could eat a wider range of prey and so had more energy to put into survival and reproduction. As a result, they had more children and their genes for larger heads spread to a greater proportion of the next generation. This continued until larger heads had become a common feature of the group.

But why just those with bigger heads? Why didn't geckos whose whole bodies were bigger receive the same evolutionary advantage? Well larger bodies take more energy to maintain, so those individuals would lose the advantage that they gain by eating more food.

One of the most interesting things about this research is that the geckos on all five of the islands studied have evolved larger heads, even though they were isolated from each other. This suggests that increasing head size without increasing body size is the most efficient way to take advantage of the opportunity to eat a more varied diet than is normal for this species.

Gymnodactylus amarali. Credit: Carlos Eduardo Ribeiro Cândido, Universidade de Brasília

This kind of rapid evolution has been seen before, including among the finches of the Galapagos Islands that helped Charles Darwin formulate his theory of natural selection in the first place. One of these finches species reduced the average size of its bill in a period of just 22 years when a competitor with a larger bill colonised the island.

The larger species ate all the larger seeds with tough shells, a large bill that still couldn't compete became a disadvantage for the finches and so those birds with a smaller beak began to thrive. This is one of the fundamental principles of biology: if you don't need a particular structure you don't bother to grow it and save the energy instead.

A similar instance occurred in Florida when a lizard called the Cuban brown anole, which is much larger than the native green anole, colonised

areas of Florida. The green anole promptly retreated up into the treetops and within 20 generations had evolved bigger, stickier foot pads, a helpful characteristic for the high life.

Human impact

Another example of rapid evolutionary change was found in Soay sheep on the island of Hirta in St Kilda off the coast of Scotland. After the residents of the island were evacuated in 1930, the sheep were allowed to run wild and, within 25 years, began to get smaller. The explanation put forward for this is that milder winters caused by climate change are allowing smaller lambs to survive, bringing down the average size of the whole population.

This suggests that we should expect to see many more examples of rapid evolution as the climate continues to change in response to greenhouse gas emissions. But the new study on geckos shows that localised human action can also interfere with the processes of evolution. Although the change in head and mouth size in the gecko seems benign, we should remember it came about because of the extinction of four other species of lizard in the area linked to the flooding. It's a timely reminder that climate change is not the only issue facing biodiversity and evolutionary processes.

More information: Mariana Eloy de Amorim et al. Lizards on newly created islands independently and rapidly adapt in morphology and diet, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1709080114

Provided by The Conversation