

How individual species form and maintain themselves has long captured the attention of humans with many cultures gravitating towards invoking deities that formed them as part of a master plan to make the modern world. Such creationist ideas dominated until the theory of natural selection—perhaps the greatest scientific discovery of all time—was developed and promoted by the English naturalist Charles Darwin (1809–1882) after voyaging across the world and noting differences between populations on the various islands that form the Galápagos Archipelago, an isolated chain of volcanic mountains in the Pacific Ocean. His revolutionary 1859 book ‘On the Origin of Species by Means of Natural Selection’ led critics to decry the outrageous nature of his claims, denouncing it as antithetical to a Creator with the assertion that humans were simply intelligent animals derived from apes. Numerous challenges to the nascent theory of natural selection were overcome, especially with the discovery that the genetic material of cells transferred mutations to the parent’s offspring.

A recent study by Australian scientists examined a group of native toadlets belonging to the genus *Uperoleia*. These small frogs occur over northern and eastern Australia, as well as southern New Guinea, and have bumpy, rough skin (hence the Australian name of ‘toadlet’, although they are not related to the cane toad). The 30 or so species are often hard to identify in the field, with some species having been discovered by their unique advertisement calls and molecular sequences rather than any distinctive characters. The study examined a complex of three closely-related species—*U. borealis*, *U. crassa* and *U. inundata*—that occur in the Kimberley and the Top End of the Northern Territory. Each was described in 1981 before the advent of molecular techniques and relied on differences between their advertisement calls, the webbing between their toes and subtle differences in body colouration. Using sophisticated genetic methods including single nucleotide polymorphisms (SNPs) and more standard



Naturally invading toadlets

DNA data, the authors of the new study found an interesting and perhaps unexpected story of invading toadlets.

Instead of three species, they found clear evidence for only two species, with *U. borealis* in the Kimberley, and a combined *U. crassa* + *U. inundata* taxon in the Kimberley and the Top End (they used the name *U. crassa*, and abandoned *U. inundata*). They surmised that *U. borealis* originated in the Kimberley and *U. crassa* in the Northern Territory about 1.8 million years ago when the climate replaced many woodlands with grasslands, thus forming an isolating barrier that ultimately led to speciation.

They had strong genetic evidence that a population of *U. crassa* had later moved into the Kimberley from the Northern Territory, and disrupted mating patterns within each species. Wherever both species occurred, the calls of invading *U. crassa* males developed fewer pulses so that *U. crassa* females could distinguish them from the more abundant *U. borealis* males. Occasional hybrids occur but their calls aren’t accepted by either species. This phenomenon of female mate choice is a relatively new discipline and has been

Above *Uperoleia borealis*.
Photo – Paul Doughty/Western Australian Museum

often overlooked by researchers. But it makes sense that males have to adapt—often quickly—to keep pace with whatever it takes to be accepted by a female.

Migration is a common phenomenon in all biological systems with ‘invaders’ trying to establish themselves to form viable populations in new areas and among the original inhabitants. The Galápagos islands that were made famous by Darwin are only 20 million years old and all terrestrial organisms living there today are the result of immigration from another landmass. Not all had to contend with a very recent relative as in the Australian toadlets, but many altered their lifestyles to fit in with their new neighbours and the local environment. The invading Australian toadlets also had to compete for acoustic space, and the males changed their calls accordingly. Biological immigrants don’t always survive in their new homes, but those that did contribute to the astounding diversity we see around us.