Why are there so many species of bugs, but so few species of human?

September 16 2016, by Darren Curnoe

Our past was like a scene from a Star Trek Episode: Ferengi (left) and Bajoran (right) character costumes from Star Trek, at the QTXP Destination Star Trek London MG. Credit: Wikimedia Commons, CC BY

Looking around at the natural world, have you ever wondered why some groups of organisms contain huge numbers of species while others are seemingly barren?

Take insects as an example, animals which evolved around 480 million years ago. There are perhaps 6 million species living in all manner of environments, and occupying an incredible diversity of niches. Surprisingly though, they have never truly adapted to the marine environment.

Contrast this with Methanopyri, in the Kingdom Archaea, for which there is only a single species (*Methanopyrus kandleri*) which evolved close to 4 billion years ago.

This remarkable bacterium was found living on the edge of a 'smoker' under extreme conditions: 81-110 degrees Celsius, high carbon dioxide concentration and at a depth of 2,000 metres in the Gulf of California.

Just why some groups contain large numbers of species while others don't has long puzzled biologists. One of the main explanations has been geological age - older groups of organisms are more diverse because they have simply had more time to accumulate greater numbers of species.

Yet, the fact remains that some comparatively young groups of species are remarkably diverse; and conversely, some like the Methanopyri are very ancient but species poor.

A new study by Joshua Scholl and John Wiens published in the *Proceedings of the Royal Society B* has taken a fresh look at this age old problem.

They looked for the first time ever at the rates at which new species were formed across the entire Tree of Life, rather than just a subset of organisms as has been the focus until now.

They found some remarkable and fascinating patterns that shed new light on the question of diversity and its possible causes.

Over the course of life's history, plants have had a species production rate more than twice that of animals, while complex organisms (multicellular eukaryotes) have produced new species at a rate almost 10 times that of simpler one (protists and prokaryotes).

The work could also help explain another long held mystery: why did sexual reproduction evolve? Sex seems to have been a major catalyst for increasing the rate at which new species formed, perhaps explaining its success as an evolutionary strategy.

Among the vertebrates, a terrestrial lifestyle seems to explain greater species diversity. While simply living in a marine versus non-marine habitat might be the major reason for high species number in some major invertebrate groups, like molluscs.

Back to insects, adopting herbivory was probably the key to explaining high rates of new species forming in the past and their remarkably diversity today.

All of this made me pause and reflect on our own group of species, the two-footed apes, or hominins, and our incongruous existence today.

It's striking that we find ourselves alone, especially when we contrast this with the remarkable diversity of hominins seen in the past. Might this tell us something about humans today, and perhaps even where we might be headed as a species?

Our broader biological group, the Order Primates, contains the lemurs, lorises, tarsiers, monkeys and apes. There are around 350 species of living primates in a group that evolved perhaps 80 million years ago. Today, we're quite a diverse lot, with primates representing somewhere around 5 per cent of the total number of mammal species.

In total, there must have been many thousands of primate species over the course of that time, nearly all of which have gone extinct. Extinction is the norm in evolution, with estimates of around 99 per cent of all life having disappeared. Same probably also for primates.

Tragically, half of all living primate species are threatened with extinction, and all of our close Great Ape cousins - the orangutans, gorillas and chimpanzees - are regarded as endangered or critically endangered by the IUCN.

By far the most diverse primates are the monkeys, particularly the Old World monkeys, naturally inhabiting Africa and Asia. They essentially evolved as a group about the same times as we hominins did, in Africa after 10 million years ago.

And some monkey species evolved over just the last couple of hundred thousand years, like *Homo sapiens* did, while others evolved several million years ago, just like some of our extinct relatives such as *Homo erectus* which existed from around 2 million to perhaps 50 thousand years ago.

But unlike the monkeys though, today we're alone. The sole surviving

bipedal ape. Yet, there are probably many more species of Old World monkeys now than at any time in the past.

Why have we gone the opposite way of the monkeys? Species poor, not species rich?

Just 40 thousand years ago we humans shared the planet with several closely related hominins: like the Neanderthals, Denisovans, perhaps the Red Deer Cave people, and even archaic species in Africa.

It was kind of like an episode of Star Trek, with humans, Klingons, Vulcans, Cardassians, Ferengi and Bajorans all coexisting. Keeping each other in check ecologically, competing for resources, occasionally even mating with each other.

So, why are there still so many monkeys, but only one bipedal ape? Um, no idea, actually.

It's no exaggeration to say this is the greatest mystery of human origins, and one of the most important conundrums of science today.

What we do know though is that we humans belong to a highly extinction prone group of primates. We've gone from a total of at least 30 species - with, I predict, many more yet to be discovered - to one. And in just 10 or 20 thousand years.

From a world in which there must have been half a dozen or more bipedal apes coexisting at any one time - across the 8 million years of our evolution - to just us; solo.

The question we need to ask ourselves today is, which kind of species are we? Are we in it for the long haul, or will be disappear in the blink of an eye of evolutionary time as well?

I must confess that I'm an optimist; in the face of some incredible global scale environmental threats, mostly of our own doing, I'm not on the side of the extinction of *Homo sapiens*.

But I do think future generations are in for a pretty rough ride, and will look back on today and ask the question, why didn't you (we) act sooner to lessen our impact on the planet?

The answer might be difficult to face, especially if we eventually find out that the real reason we're alone today, the sole bipedal ape, is of our own making; that *Homo sapiens* was as *Homo sapiens* is.

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