Not so crowded house? New findings on global species richness

June 1 2015

Professor Nigel Stork. Credit: Griffith University

Planet Earth may contain millions fewer species than previously thought and estimates are converging, according to research led by Griffith University (Queensland, Australia).

In a paper published by the US-based journal *Proceedings of the National*

Academy of Sciences (*PNAS*), Professor Nigel Stork of Griffith's Environmental Futures Research Institute reveals findings that narrow global species estimates for beetles, insects and terrestrial arthropods.

The research features an entirely new method of species calculation derived from samples of beetles from the comprehensive collection at London's Natural History Museum.

"It has been said we don't know to the nearest order of magnitude just how many species with which we share the planet. Some say it could be as low as two million; others suggest up to 100 million," says Professor Stork.

"By narrowing down how many species exist within the largest group - the insects and other arthropods—we are now in a position to try to improve estimates for all species, including plants, fungi and vertebrates.

"Understanding how many species there are and how many there might have been is critical to understanding how much humans have impacted biodiversity and whether we are at the start of, or even in the middle of, an extinction crisis."

About 25 per cent of all species that have been described are beetles. However, when combined with other insects the figure climbs to more than half of all described and named species on Earth.

For this reason, Professor Stork and his colleagues focused on asking how many species of beetles and insects there actually are, in the process applying a new method of estimation arising from a tendency for larger species of British beetles to be described before smaller species.

"Because of the global spread of major beetle lineages, we made the assumption that the size distribution of the very well known British beetles might be similar to that of beetles worldwide," says Professor Stork.

"So, if we could get a measurement of the body sizes of the beetles from around the world, we might be able to plot where these fitted in time against the British beetles."

After measuring a sample from the Natural History Museum's worldwide collection of beetles, Professor Stork compared the mean body size with the changing body sizes of British beetles to reveal that roughly 10 per cent of the world's beetles have been named and described.

This figure sheds intriguing light on previous estimates of global species richness.

In the 1980s, there were just two methods of estimating species. In the case of beetles, these gave a mean of 17.5 million species and a range of 4.9-40.7 million. For all terrestrial arthropods, the mean was 36.8 million and a range of 7-80 million.

However, the new research shows that four current methods of estimation - dating from 2001 onwards—suggest much lower figures, namely a mean of 1.5 million for beetles (range 0.9-2.1 million) and 6.8 million for terrestrial arthropods (range 5.9-7.8 million).

"While all methods of estimating global species richness make assumptions, what is important here is that four largely unrelated methods, including the new body size method, produce similar estimates," says Professor Stork.

"With estimates converging in this way, this suggests we are closer to finding the real numbers than before.

"It also means we can improve regional species richness. For Australian fauna and flora, for example, we should be able to make better estimates of just how many species there are and which groups need more taxonomic attention."

Professor Ian Owens, Director of Science at the Natural History Museum, says this research is a great example of how natural history collections support high-impact scientific research that addresses challenging questions such as the diversity of life.

"The Natural History Museum's beetle collection is one of the most important and extensive in the world, so I'm delighted that it has played such a fundamental part in this study that uses a novel approach to estimating how many species of beetle exist," says Professor Owens.

"The results are very exciting and are a big step forward to establishing a baseline for biodiversity."

Meanwhile, co-author of the *PNAS* paper—the University of Melbourne's Associate Professor Andrew Hamilton - says efforts to come up with new or modified ways of resolving how many species exist are beginning to prove fruitful.

Professor Stork says the research has important conservation ramifications.

"Success in planning for conservation and adopting remedial management actions can only be achieved if we know what species there are, how many need protection and where," he says. "Otherwise, we have no baseline against which to measure our successes.

"Furthermore, it is arguably not only the final number of species that is important, but what we discover about biodiversity in the process.

"The degree to which we can or cannot accurately estimate the number of species or the scale of organismal diversity on Earth is a measure of our ignorance in understanding the ecological and evolutionary forces that create and maintain the biodiversity on our planet.

"Attacking this question also drives scientific enquiry and is of public interest. Society expects science to know what species exist on Earth, as it expects science to discover nuclear particles and molecules.

"These discoveries open doors to more utilitarian interests."

More information: New approaches narrow global species estimates for beetles, insects, and terrestrial arthropods, *PNAS*, www.pnas.org/cgi/doi/10.1073/pnas.1502408112

Provided by Griffith University