Uncovering the lost world of New Zealand from fossil bone DNA

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Curtin University researchers have used DNA from fossil bones to reconstruct the past biodiversity of New Zealand, revealing a history of extinctions and biodiversity decline since human arrival there about 750 years ago.

The research, which was published today in *Proceedings of the National*

Academy of Sciences, characterised DNA preserved in fragmented and unidentifiable bones from across New Zealand.

By comparing bones excavated from caves that predate human arrival with bones from ancient human kitchen waste (or middens), the researchers were able to characterise the biodiversity that had been lost in New Zealand.

Lead author Curtin Ph.D. candidate Mr Frederik Seersholm, from Curtin's School of Molecular and Life Sciences, said causes of extinctions were usually hard to identify due to the time that had passed since it happened.

"However, through this study, we were able to examine in more detail the first contact between people and fauna in New Zealand because it only happened 750 years ago," Mr Seersholm said.

"The research also identified a large faunal diversity with DNA from more than 100 different species uncovered, including 14 species that are extinct today.

"Our results demonstrate that certain species tend to be missed by traditional research methods. For example, we identified species of eel and whale in Maori middens previously unknown in the prehistoric Maori diet."

The research was undertaken by an international study team led by Distinguished Research Fellow Professor Michael Bunce, also from Curtin's School of Molecular and Life Sciences, including academics from University of Otago, Canterbury Museum and Museum of New Zealand Te Papa Tongarewa.

The research team analysed DNA from more than 5000 bone fragments

collected from 21 archaeological middens and 15 paleontological caves in New Zealand.

Professor Bunce said the researchers sequenced genetic signatures to identify different species and characterise different genetic lineages within one species.

"For the ground dwelling parrot, the kakapo, surprisingly high amounts of genetic diversity was detected in the bone fragments, which demonstrates that the kakapo population has been declining since human arrival in New Zealand 750 years ago," Professor Bunce said.

"Of the ten kakapo lineages we identified, only one is still around today and this is an indication of the amount of biodiversity lost from one of New Zealand's iconic flightless birds."

Mr Seersholm said the findings demonstrate how much information is stored in seemingly insignificant bone fragments.

"There is without doubt a great deal of information to be retrieved from fragmented bones, and it is likely that important future discoveries on extinct species and past biodiversity are hidden in neglected excavation bags in the basements of museums and universities around the globe," Mr Seersholm said.

With support from the Australian Research Council and The Forrest Research Foundation, the researchers aim to expand the study to other parts of the world.

More information: Frederik V. Seersholm et al. Subsistence practices, past biodiversity, and anthropogenic impacts revealed by New Zealand-wide ancient DNA survey, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1803573115

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