NZASE scientist profile

Simon Hills

Affiliations

Born Gisborne, 1978. “My grandmother spoke te reo fluently, but not my dad’s generation.” Maunga: Hikuranga; awa: Waiopehu Stream; iwi: Ngāti Porou; marae: Karuai.

Schools and subjects

Horohoro School near Rotorua, and Lytton Street School, Feilding; Huntly College and Palmerston North Boys’ High School.
Simon studied Chemistry, Biology and Physics.

How he got into science

“I was a bit of a science geek, into dinosaurs long before it was cool. I wanted to be a palaeontologist from age five, then a marine biologist at 12. I was always going to be some kind of scientist - it just took a while to nail down exactly what. At uni, I discovered I was pretty good at genetics and kept it up for my Masters. Evolutionary biology really got me going, understanding the evolution of life.”

Training and jobs

Science degree, 2000. **Masters degree**, 2004; **PhD**, 2010, all at Massey University (MU).
Research lab assistant, Allen Wilson Centre for Molecular Biology and Evolution
Post-doctoral Fellow, studying the population genetics of pūpū on the East Cape.
Research Development Advisor, Māori, MU.
Senior lecturer, MU.

Fields of science

Genomics, ecology, and evolutionary biology.

Topics he studied

Simon sampling snails at Waiopehu River, Tararua Ranges.

Biodiversity of coastal molluscs

Simon’s PhD was one of the first to provide a broad analysis of the evolution of a single genus of ngata (marine snails) using DNA and fossil data. “We have very rich paleontological data for our snails; 85 percent of our molluscs are endemic, so have mostly evolved here.”

“We can get a much better understanding of the evolutionary history of a species when we consider multiple strands of evidence, than if we look at DNA or fossils alone.”

“If we understand how species have changed through time in response to environmental shifts, we can project that understanding into the future, and model evolution in response to climate change.”

“My uncle called me a Ngata studying ngata” (Simon is a great-great-nephew of Sir Apirana Ngata).

Evolutionary history of viruses

Simon applied those evolutionary biology skills with others to build an evolutionary whakapapa of two virus populations.

“*Papillomavirus* is a huge group, which can

Simon with some of the marine snails he has studied. Photo: Massey University.

cause warts and sometimes cancer in humans, dogs, cats and farm animals. Dogs here are vaccinated for canine *Parvovirus*, which is widespread and causes bad diarrhoea in puppies. There are three major strains around the world."

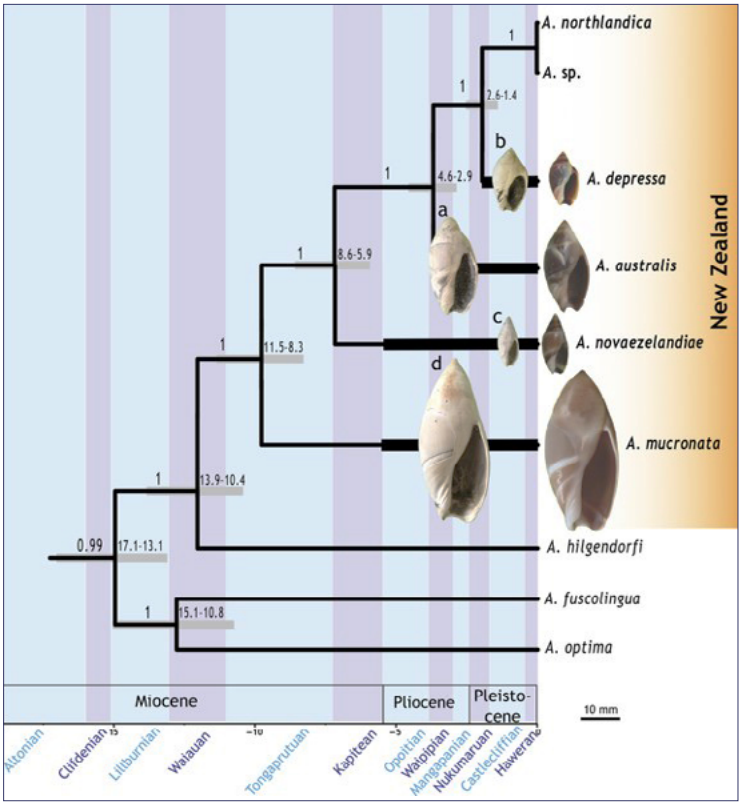
Simon helped a MSc student analyse the DNA structure of that viral population; they found that dogs here have only one of the strains, and that our quarantine is effective at keeping out the more recent and worse strains.

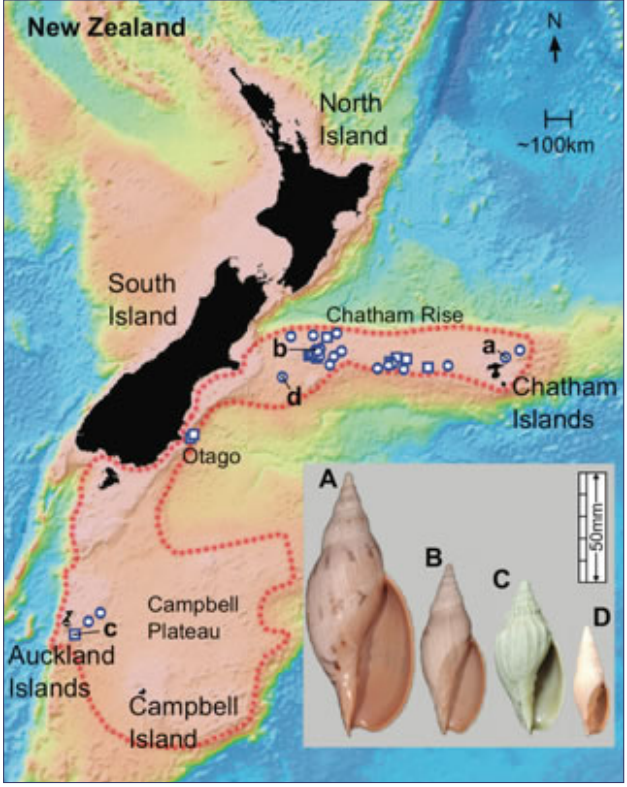
Genomics of taonga species

Simon contributed to the first review of 41 genetic studies of kiwi, which are now in isolated populations. There is little gene flow between them so the groups become interbred, which limits their genetic variation and over time can make them less able to respond to disease.

Simon also worked with PhD students who were examining the whakapapa of those different populations across Te Tai Tokerau. This analysis can help hapū decide on whether particular kiwi should be moved from a group in an area to another population, to increase the genetic variability and survival of the second group.

Simon's estimated times for speciation in Amalda sea snail lineages.





The distribution of four sea snails around Te Waipounamu. Simon's genetic analysis showed that these snails are a single species that is 10 million years old.

Impacts of 1080 on insects and predators

Simon worked with Ngāti Rangi about 1080 drops by the Department of Conservation to reduce predators in forest on Mt Ruapehu.

"Māori wanted to monitor its impact on native species like beetles, as well as pests. The research lasted only four years. Beetle results were unclear due to fluctuation related to other environmental conditions, which highlights the need for very long-term monitoring."

"The first 1080 drop was *far* more effective after a hard winter, than the second during a milder winter. Possum and rat populations dived after the first drop – we found none in tracking tunnels, although that doesn't mean all the rats were gone. Weta numbers increased once rats and mice were killed, but rats and mice returned to previous numbers within a year."

"Dropping 1080 once is not enough – when existing predators in an area have been killed, we have to trap incoming predators."

Maori landscape perspectives in GIS

Simon is a member of the Māori-led project He Tātai Whenua, which has created the first geographical information system (GIS) dataset of mātauranga Māori knowledge about landscapes. It aims to provide the same standing for Māori connections to land as other datasets used in decisions about managing the environment, such as geology, ecology and weather, which don't include or

recognise Mātauranga Māori.

"We used the Manawatu catchment to develop the algorithms to extend the Māori Landscape Classification GIS to the whole of the country, which is a massive job." Simon will analyse the biology and ecology of the Māori dataset - for example, shag roosting sites in an area - to help environmental restoration and reforesting projects.

Research methods

Environmental monitoring

They select sampling sites and times; place tracking tunnels, or pitfall traps for small bugs; compare animals at different times and places; and analyse what has changed.

Genetic sequencing and analysis

Simon collects different types of snails from different places, extracts DNA, sequences it, compares that with known sequences in the region, and determines how sequences vary across that landscape.

Whakapapa tree

Simon aligns DNA sequences across different samples, runs them through computer programmes that create phylogenetic trees, where branches represent the amount of genetic difference. If there is a good fossil record, he uses that calibrate the timing of branches in whakapapa trees.

Most valuable result

"I've helped provide a better understanding of New Zealand's biodiversity, in areas where we don't know a lot, and with unique species. We say we value biodiversity, but we don't know how rich it is - it's not just birds or trees."

What he likes about science

"I like asking the basic questions - why does that do that? Why are there so many species of micro-snails (up to 2mm long)? I get a kick out of identifying something that no one else has seen or paid attention to, making a contribution to human knowledge."

Link

- Massey University, 2020, *Rangahau*.

Mātauranga Māori

"All my research is part of te taiao, understanding the environment, asking the why questions. I'm interested in results that help with kaitiakitanga decisions. Science has tended to get done *to* Māori rather than *with* Māori; increasingly the interesting research is happening by and with Māori. It's better science when the answers are relevant to local people and communities."

Professor Murray Potter, Massey University group leader for Wildlife and Ecology, left, with Simon monitoring impacts of 1080 in Rangataua Forest.

Ngā Kupu

Huaketo - Virus
Huinga ira - Genome
Kaitiakitanga - Guardianship
Konihi - Predator
Mātātoka - Fossil
Te taiao - The environment
Pītau ira - DNA
Rerenga rauropi - Biodiversity
Taketake - Endemic
Whakapapa - Lineage, genealogical table.

Te Aka Maori Dictionary and Paekupu