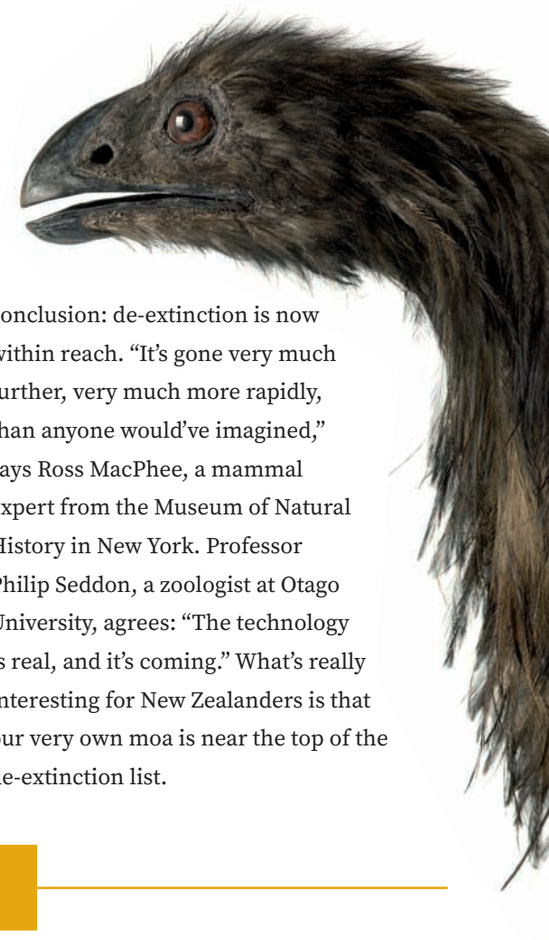
RETURN OF THE MOA?

by Quinn Berentson

IMAGINE THIS: You're walking through the bush, native birds all around. It's very peaceful, but then you hear crashing footsteps. Another tramper? No, whatever's making that noise … it's huge. The footsteps get closer, and something totally unexpected steps onto the track. The creature is taller than any person, despite its short stubby legs. A comically small head sits at the end of a very long neck. You see feathers but no wings, although it's clearly a bird – and another native one at that. It's the moa, New Zealand's legendary giant, back from the dead!



Back from the Dead

No one has seen a live moa for more than five hundred years. We can be sure there are none left, even in the most remote parts of the country. But recent scientific breakthroughs have created a startling possibility – bringing the moa back from the dead! It sounds like science fiction, but de-extinction is closer to reality than you might think.

In 2013, a historic meeting took place in Washington, DC. For the first time, world experts in fields such as **genetics**, animal biology, and **bioethics** met to talk about de-extinction. They reached an amazing conclusion: de-extinction is now within reach. "It's gone very much further, very much more rapidly, than anyone would've imagined," says Ross MacPhee, a mammal expert from the Museum of Natural History in New York. Professor Philip Seddon, a zoologist at Otago University, agrees: "The technology is real, and it's coming." What's really interesting for New Zealanders is that our very own moa is near the top of the de-extinction list.

Plenty to Think About

De-extinction is a form of cloning. But while cloning usually takes the **DNA** from a living animal to make an exact replica, de-extinction begins with the DNA from an extinct animal. Not surprisingly, ancient DNA from long-gone animals is never complete. Essential information is missing. These gaps are filled using DNA sequences from a closely related species.

Of course de-extinction is very complicated, but here's the thing: a lot of progress has already been made. So, if putting giant birds back in the bush is no longer a fantasy, the question isn't can we bring certain species back … but should we? In its short history, de-extinction has created much debate. The arguments are strong on both sides. So, what are they? Let's take the moa as a case study.

bioethics: the study of controversial issues arising from breakthroughs in biology and medicine
DNA (deoxyribonucleic acid): the genetic information inside cells
genetics: the study of DNA (see above)

De-extinction: The Arguments Against

Although the technology is almost here, bringing the moa back would be a huge venture. It would take a large team of scientists and cost a lot of money. There would also be no guarantee of success – and many embryos and even live chicks would die during the process. Plus, of course, one moa is only the beginning. For the species to survive, you would need lots of them, both males and females, so they could breed and become established. And you would need a safe habitat for them to live in.

Many people believe that de-extinction is a waste of money and effort, especially when our list of threatened species is so long. Shouldn't we just focus on saving the kiwi or kākāpō? What about the 2,786 other threatened species in New Zealand that most people don't even know about, such as the black stilt, the *Powelliphanta* snails, the southern elephant seal, the lesser short-tailed bat?

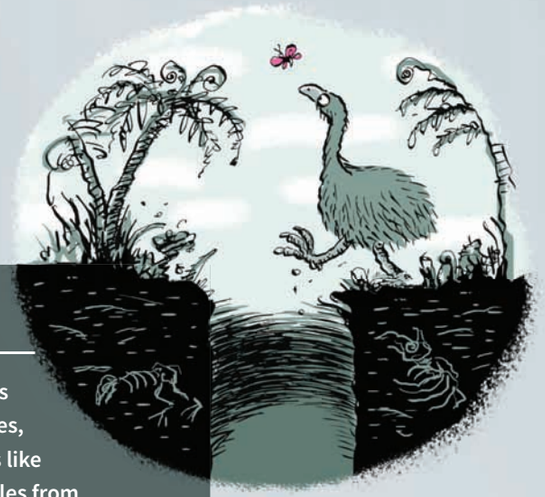
What about the 2,786 other THREATENED SPECIES in New Zealand ...?

And if de-extinction were to become cheaper and easier, would it change our attitude to conservation? If we can bring a species back, would that make us care less about protecting it in the first place? People might say, "Let's just mine all the coal we can. Don't worry about that native snail's habitat. We can bring it back later." This attitude could be more dangerous than we ever imagined.

Other people find tinkering with the building blocks of life – and making what they consider to be artificial animals – deeply disturbing. If scientists "made" a moa, we'd have no idea how it would behave. Would it even know how to be a moa? If not, who would teach it? And where would it live? At the moment, releasing a genetically modified organism into the wild is illegal. Many species have also become extinct precisely because the habitat in which they lived was destroyed.

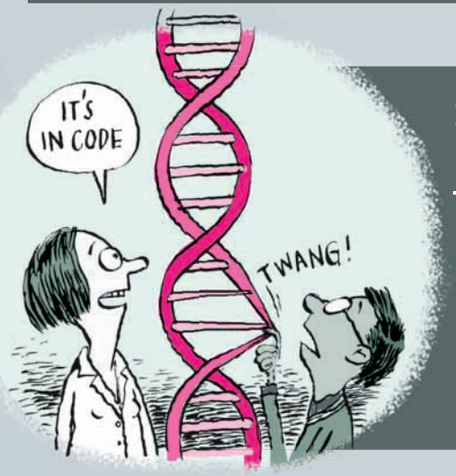
Then there's the tricky question of who would own (and make money from) the giant birds. What if a private company brought the moa back? Could it do whatever it wanted? What role would the government play? And scientists? And what about the opinions of iwi? Who would make decisions about the de-extinct bird?

A MOA IN FIVE EASY STEPS!



1. Get some moa DNA.

Because moa died out "only" five hundred years ago, this bit is easy. Many moa also fell into caves, which are excellent places for preserving things like DNA. Scientists have recovered good DNA samples from each of the nine species of moa. You'll need to borrow some of it.

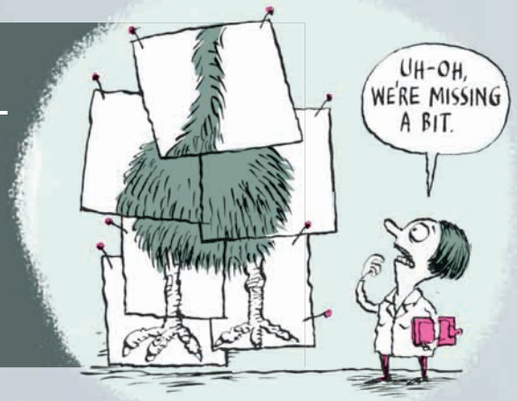


2. Figure out the genetic code of the moa.

Imagine billions and billions of building blocks, all joined together to make strands of DNA. This is a genetic code (or "recipe") for a living thing. Sweet-talk a geneticist into analysing your moa DNA sample to figure out its genetic code.

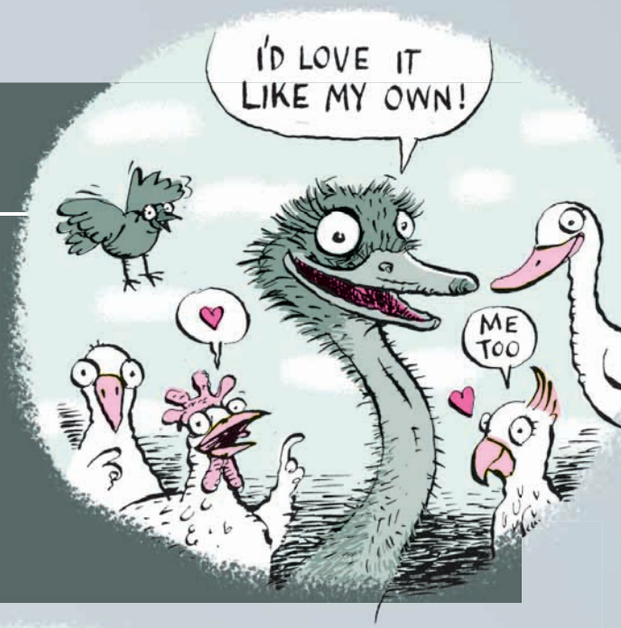
3. Fill in the gaps.

Ancient DNA samples are never 100 percent complete – but if you want to make a moa, all the genetic information needs to be there. To fill in the gaps in the moa's genetic code, you now need bits of DNA from a close living relative. Try the ostrich or emu.



4. Create an embryo and find a mother.

Now that you have a complete code, you can get started on the **embryo**. Remove the DNA from an ostrich or emu **egg cell** and replace it with your moa DNA. Chemically stimulate the egg cell so it starts dividing to form an embryo, then find a **surrogate** mother. Because this bird has to lay a moa egg, she needs to be very large. Again, an ostrich or emu would be a good option.



5. Wait for the egg to hatch.

If everything goes according to plan, the surrogate mother lays the moa egg and eventually a healthy baby moa will hatch. Congratulations!

egg cell: the female reproductive cell that combines with the male sperm cell to form an embryo
embryo: an unborn (or unhatched) offspring
surrogate: a mother that carries an embryo that isn't her own

De-extinction: The Arguments For

Professor Michael Archer is a big supporter of de-extinction. He's leading a team of Australian scientists that's trying to revive a strange amphibian called the mouth-brooded frog – last seen in the 1980s. When people argue that de-extinction is "playing God", he replies something along the lines of "Didn't we play God by making them extinct in the first place?"

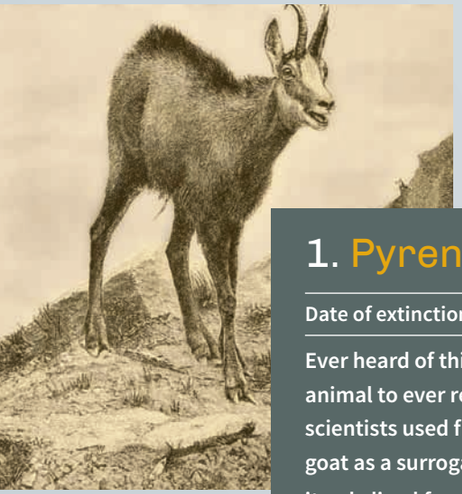
There's no doubt that humans wiped moa from the Earth (in just two centuries). So isn't it our duty to bring them back if we can? We've had a devastating impact on countless species. The World Wildlife Fund estimates that half of all the planet's wildlife has been wiped out in the last forty years. Many of our most iconic animals are on the verge of extinction. Tigers, orangutans, elephants, rhinoceroses, and many species of whales and dolphins may not survive another decade. Imagine your children or grandchildren never seeing one of these creatures. Wouldn't bringing the moa back fix a mistake from the past – and open the door to doing the same with other important species?

Another thing: **ecologists** are just starting to understand how important the nine species of moa were. Moa were around for over 60 million years. In that time, they became a valuable part of the forest ecosystem. Moa did things like spread seeds and keep the growth of some plants under control as they ate. They were the most important large **browsers** in our forests for a very long time. If we're serious about restoring our forests to their original state, then moa should be in them.

> Wouldn't bringing the MOA back FIX a MISTAKE from the past ...?

And the final reason for bringing the moa back ... well, it would be truly awesome! Everyone in the world would want to see these amazing birds. And people everywhere would learn to appreciate other endangered species and try harder to save what we've got. Just imagine: you're walking through the bush, nothing but birds all around, then you hear crashing footsteps ...

browser: an animal that eats vegetation from trees or shrubs
ecologist: a person who studies where plants and animals live and how they live together



OTHER CONTENDERS

There are other animals that could be brought back from the dead. Here are five for starters:

1. Pyrenean Ibex (also known as the bucardo)

Date of extinction: 2000

Ever heard of this Spanish relative of the goat? Technically, it became the first animal to ever return from extinction when a team of Spanish and French scientists used frozen DNA from the last surviving bucardo with a common goat as a surrogate mother. The baby bucardo was born on 30 July 2004, but it only lived for nine minutes because it had major genetic deformities.

2. Tasmanian Tiger

Date of extinction: 1930s

This was the largest meat-eating **marsupial** known in modern times – and it's the only marsupial that scientists suggest could be brought back. Although it vanished recently, the dog-sized Tasmanian tiger may be tricky to bring back because it has no close living relatives. Despite the challenges involved, some Australian scientists have already made a start.

3. Huia

Date of extinction: Last confirmed sighting in 1907 (although unconfirmed sightings continued into the 1960s)

When the tail feathers of these elegant birds became fashionable for hats, the huia was quickly wiped out (although deforestation and introduced pests also played a role). Tissue samples of the huia remain, and the species has several close living relatives (for example, the saddleback and kōkako). Because of these factors, some people think the huia is a better choice for de-extinction than the moa.

marsupial: an animal that carries its young in a pouch on the mother's belly

4. Dodo

Date of extinction: 1662

This unusual flightless member of the pigeon family lived on the island of Mauritius (off the coast of Africa). When hungry sailors learnt about the dodo, the species was wiped out in just a hundred years. Some preserved parts remain. Might we one day have to retire the phrase "dead as a dodo"?

5. Woolly Mammoth

Date of extinction: 3,000 to 10,000 years ago

These hairy, tusked giants once roamed the plains of Siberia and Alaska. The mammoth is a close genetic match to the African elephant, and because mammoths lived in the cold, there are plenty of well-preserved remains. Some of these remains contain blood that is still liquid! Scientists in Russia and South Korea recently starting working together on a mammoth de-extinction project.

Note: One species that can't be brought back is the dinosaur. It turns out that DNA has a use-by date of around 500,000 years. After that, no useful information can be extracted because the DNA is so decayed. Dinosaurs lived at least 65 million years ago. They've missed the de-extinction bus by around 64.5 million years.

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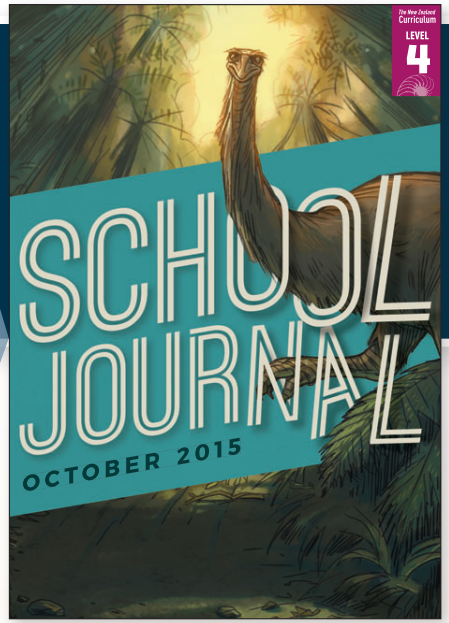

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