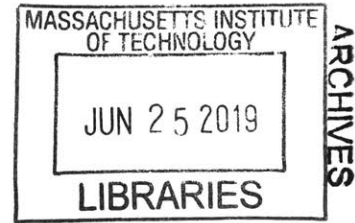


The Conservation Sacrifice:
How Far New Zealand Will Go to Save Its Birds

by

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ABSTRACT

In July of 2016, the New Zealand government announced plans for Predator Free 2050, the biggest predator control effort ever undertaken in the country—and perhaps the world. Predator Free 2050 is a government-sanctioned goal to eliminate rats, stoats, and possums from New Zealand. Since New Zealand has no native land mammals, its bird species are poorly adapted to withstand predation from the mammals that have been introduced since humans first arrived on the nation's shores. The country is now home to nearly 170 native bird species, most of which are declining and considered at risk or threatened after years of predation by invasive mammals. 93 of these species are endemic, found nowhere else on the planet. Predator Free 2050 builds on years of conservation efforts to reduce predator numbers and provide safe spaces for bird populations to recover, including the successful elimination of mammalian pests on islands and fenced-in sanctuaries around the country.

Birds are a critical component of the nation's cultural identity and the government hopes that Predator Free 2050 will protect New Zealand's rare birds. However, it's not yet clear whether this goal is feasible and some of the methods used to wipe out pests have been controversial. The difficult decisions being made in New Zealand right now reflect the challenges and conflicts that arise around the world when wildlife protection requires significant changes and sacrifices.

Thesis Supervisor: Marcia Bartusiak

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Hazel Speed for showing me "all the cool birds," the interns and volunteers at Motutapu Island for their stories, James Ross for showing me around Tawharanui Sanctuary, and all of my sources for generously sharing their time, knowledge, and perspectives.

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My dear friends, who are always willing to listen.

Her tough hands moving carefully, Hazel Speed removed the top of the ice cream container and tilted it toward me so I could see the dead chick inside. “Isn’t it beautiful?” she asked, looking down at the tiny, squished body. Without waiting for a response, Speed replaced the lid, slid the container into a plastic bag, and lowered it into a small cooler.

An intern had found the dead shore plover chick near its nest—the tenth loss of the summer on Motutapu Island in New Zealand. The island should be a safe haven for these birds, but chicks were disappearing without a trace. Finding one was a rare opportunity to figure out why. “Last year we also had a lot of young birds die,” Speed said. “There were seven chicks produced, and six died.”

Speed walked back to her truck with the cooler in tow. The little chick had quite a journey ahead: it would travel across two islands and traverse choppy waves on the harbor ferry before being transferred from Auckland to Massey University for a necropsy. Shore plovers are nationally critical, a designation given to the most vulnerable species in New Zealand. Long ago decimated by rats on the mainland, only about 200 are left in the wild. All of them live on tiny islands, where conservation rangers like Speed help keep their predators at bay. Dave Houston, director of the shore plover recovery group, said the entire species is so vulnerable, they could be lost forever at any moment.

As Houston said, “We are basically one rat away from catastrophe.”

Poison, traps, and shotguns. These are words not often spoken in the same breath as conservation. But in New Zealand, wildlife protection looks quite different than it does in most of the world—all because of a deep-seated connection to their feathered fauna. The country is home to nearly 170 native bird species, most of which are declining and considered at risk or threatened. Like the shore plover, 93 of these species are endemic, found nowhere else on the planet. The culprits behind these losses are clear: invasive rats, stoats, possums, and other mammalian predators have devastated avian numbers. The nation now finds itself in a difficult spot. To save New Zealand’s birds, the best option is to wipe out as many predators as possible.

“Conservation in New Zealand is about killing things,” Mick Clout, a conservation biologist at the University of Auckland, said. “Killing some things to save other things. Killing mammals to save birds.”

Over the past five decades, predator control has reduced or eliminated mammalian pests in patches across the country. Yet the bird losses continue; pests kill 25 million native birds each year (and that’s the conservative estimate). Nearly sixty bird species are already extinct and lost forever. It’s become clear that more drastic measures are needed to save New Zealand’s birds. In response, the nation is taking their pest elimination program to a globally unprecedented new level. Their goal? Eliminate all rats, stoats, and possums by the year 2050.

The country's predator problems date way back. The land that gave rise to New Zealand began to break away from the ancient supercontinent Gondwana roughly 85 million years ago. Separated from the rest of the world, life on New Zealand—sometimes called The Last Place on Earth—had a unique opportunity to adapt on its own. Soon home to many unique species, New Zealand had a notable absence in its ecosystem. Aside from a few bats and seals, the country remained a mammal-free bubble.

Without mammals, the birds of New Zealand thrived. Since their primary predators were fellow birds, many species evolved to be flightless. Why take to the risky skies when you can opt to trot? Others adapted to hunt, breed, and nest on the ground. For thousands of years, these conditions suited New Zealand's feathered forest rulers. Until the bubble burst.

Around 800 years ago, mammals arrived and found themselves at the top of a food chain that never saw them coming. After millennia without this type of threat, many bird species were defenseless against the predatory mammals that trickled into their forest.

First came the rats. Guided by stars and carried by the sea, Polynesian explorers touched down between 1200 and 1300 AD and brought with them rats, dogs, and hunting. Unable to withstand these new pressures, several species were wiped out, including the moa. Ranging from the size of a turkey to a linebacker, all nine species of these emu-like birds were soon extinct. With its primary prey source gone, the Haast's eagle followed. It was the largest eagle ever known to have existed, with talons the size of a tiger's and a three-meter wingspan.

Next came the mice. And bigger rats. In the 1700s, more rodents sailed ashore with European settlers. Then came the cats. Captain James Cook's cat is believed to have been the first feline to step foot on the mainland, but others followed. Three wren species quickly disappeared, including the only flightless songbird ever seen by human eyes.

Then came the brushtail possums. Introduced to establish a fur trade, the commodity never took off, but the possums did. It's true that there are more sheep than people in New Zealand, but it turns out there are even more possums than sheep.

Then came the rabbits. And hedgehogs. And stoats...oh my.

There are now thirty-two species of non-native land mammals in New Zealand. Like many early settlers the world over, Europeans brought in four of these animals to control mammals they had *previously* introduced. When the rabbit population exploded, for example, settlers decided to release some stoats. What could go wrong?

As it turns out, a whole awful lot.

With bird populations plummeting, New Zealand's Department of Conservation (DOC) took serious measures to prevent more loss, centered primarily around one goal: eradication of

invasive pests. Traps and hunting can help lower pest numbers, but DOC recognized that some birds needed more drastic measures; they needed to live without any predators at all.

Today, some rare birds can escape their mammalian enemies on predator-free islands. One such island sanctuary is found just off the coast of Auckland, visible from the bustling waterfront. For a small fee, you can step onto a ferry and cruise into the past. After, of course, you clean your footwear and check every pocket in your pack. Because the past is pest-free, and they'd like to keep it that way.

On the other side of the ferry ride is Rangitoto, the sister island to Motutapu. The two islands are connected by a causeway, but could not look more different. With rolling green hills and patches of farmland, Motutapu formed 180 million years ago and is one of New Zealand's oldest islands. Rangitoto is one of its newest. The result of a volcanic eruption 600 years ago, Rangitoto is covered in charcoal-like lumps of what was once lava.

But today, they both share the distinction of being completely free of invasive mammals. Wallabies, possums, stoats, rats, mice—all wiped out by a combination of poison pellets and trapping. After two years of work, DOC declared the islands pest-free in 2011. That's where Hazel Speed entered the picture. "DOC decided this is a safe haven for our native species," Speed said. "Either ones that would naturally occur here, or that have no place else to go."

Once the pests were gone, Speed partnered with DOC recovery groups to assess Motutapu's habitat and predict which birds could build a new life there. They decided to start with two ancient species: takahē and tīeke. Once those birds had settled in, they brought over whiteheads and Coromandel brown kiwi.

For some species, a space without predators is essentially all they need to rebound. The translocated tīeke, kiwis, and whiteheads on Motutapu are doing well without any major interference. "There's no need to continue to monitor them because they're everywhere," Speed said. "Once something is doing well, then we need to put our resources into other species."

Motutapu was also a great choice for another species under siege: the shore plover. But unlike some of its neighbors, this bird's numbers have dwindled incredibly low and it needs far more help to stay alive.

I visited Speed on Motutapu Island in the middle of shore plover nesting season. She picked me up by the causeway between Motutapu and Rangitoto wearing a button-up ranger shirt with a green DOC patch. Her grey hair was swept back and when she lifted her sunglasses, tiny lines creased around her eyes and mouth, signs of a life lived outside. Speed has worked in conservation for more than thirty years. She drove us around the bumpy island roads to point out "all the cool birds" as I craned to hear over the clanking from the truck's worn joints. Young heifers dotted the green-gold hillside. I hadn't expected Motutapu to have so much farmland. If I visit again, I may see much less; the Motutapu Restoration Trust started a replanting program to grow native forest on the island and have already covered 100 hectares. They don't plan to cover the whole island—the farmers wouldn't like that and neither would the pasture-loving takahē—but it's an impressive step in Motutapu's journey into the past.

Shore plovers were once abundant, but they stood no chance against rat predation. They disappeared from the mainland by 1880. Fortunately for the species, a small population was found on Rangatira Island, one of a collection of offshore islands called the Chatham Islands. Today, with 120 birds on its shores, Rangatira is still home to most of the world's shore plovers.

Houston, Speed, and their colleagues in the shore plover recovery group are trying to change that. Drawing from the Rangatira population, DOC brought a number of birds to captive breeding facilities and then translocated some to Motutapu, as well as several other islands that had been cleared of predators.

A project this large—eliminating predators and keeping them out, managing introduced species, growing new forest—requires many hands. Speed said it's beyond the capacity of one group. She works closely with other DOC rangers, scientists, volunteers, and communities of the indigenous people of New Zealand, the Māori. All around the country, DOC has similar recovery groups and collaborations to help save a number of threatened species. This past summer, Speed also had the help of volunteers who came to the island for two-week stints as well as one full-time intern named Baylee. Baylee and the volunteers are helping Speed and a graduate student working on the island by observing the shore plover nests to figure out why the chicks keep disappearing, keeping an eye out for signs of attack or illness.

I saw my first living shore plover moments after Baylee first took me down to the beach. She pointed to a set of rocks where one breeding pair had a nest. As I looked to where she pointed, a streak of white and black flashed by and landed by the rocks, chirping in irritation. The male plover was tough to spot at a distance, but his bright orange beak popped against the sandy dunes. Baylee passed me the binoculars so I could get a better look at his black mask and the white stripe above his eyes. It was hard to tell what he was chirping at, his fluffy white chest puffing with each peep.

Shore plovers are protective parents, Baylee explained. When they sense a threat to their chick, they zig zag around each other through the air, calling out with a voice that outsizes their small frame. The spindle-legged little warriors can shout for hours. But given the number of lost chicks, it seems their big bark and lack of bite may not be fooling anyone. She and the other volunteers were clearly upset about the dead chick. They'd spent their summer staring through binoculars and pouring over video footage. They knew the birds' names and personality quirks. Their hours of observation were meant to prevent the type of losses witnessed the previous summer, but so far in 2019, the chicks had fared no better. All but two shore plovers born that summer had died. And they still didn't know why.

But later that day, Speed and Baylee learned that another chick had hatched. Speed responded with her usual optimism and humor. "Three chicks," she said. "Plus two eggs, so soon to be five. Coming back from the brink!"

Despite having their very own island sanctuaries, shore plovers have proven difficult to save. "They're always finding new and inventive ways to kill themselves," Houston said.

Take the translocated birds. As Speed works to save the chicks on Motutapu, her counterpart, Helen Jonas, is managing the shore plover population on Waikawa Island. After the first birds arrived on the island, Jonas said the population steadily climbed in the absence of rats and stouts. Over the next few years, the population of 10 or so birds climbed to nearly 100. But in 2013, disaster struck.

“We never found the rat,” Jonas said. “But the population had been hit big time.” Jonas and her team returned to the island one day to find that most of the birds had been wiped out. They also found rat scat. By the time they confirmed the rat was gone, they were back down to 10 birds. The team had worked for six years to translocate birds, release captive-reared juvenile birds, and build up a strong population. “And then one rat can come along and just undo all that work,” Rose Collen, captive coordinator for shore plover at the Mount Bruce National Wildlife Center, said.

Today, after six more seasons of monitoring and introductions, the Waikawa Island shore plovers have rebounded to a population of 55. Jonas’ team now visits the island monthly, bringing in rodent-detecting dogs twice each year. But knowing the damage one rat can do, the fear of another incursion looms large. “They’re such a naïve bird,” Jonas said. “Every time I go over to the island, I worry—has a rat arrived?”

And it’s not just rats. Jonas says shore plovers face an array of threats: dogs brought onshore by visitors, invasive ants that swarm the chicks, and even a new nearby rocket launch facility that she worries may frighten them. Not to mention the fact that the plovers can take off whenever they so choose. “Being shorebirds, they tend to like wandering,” Collen said. “So they visit the mainland and wander around exploring the local sites. And possibly get eaten while they’re doing that.”

With the wild populations vulnerable, one might think the captive birds that Collen looks after have it better. But not so for the shore plover.

The first issue is their limited bloodline. Since most of the shore plovers in captivity came from a single population, the team has to carefully analyze their genetics and lineage to select pairs for breeding. Even when they do successfully breed, captive birds are more susceptible to avian pox virus, an illness that causes bleeding lesions on their legs and feet. It doesn’t usually kill infected birds, but they often need months of isolation, attentive care, and antibiotics. Then there’s another hurdle. “Well, it would seem that they’re extremely tasty,” Collen said. “They get eaten by everything.”

In the wild, shore plovers nest under grass or rocks. While useful for avoiding avian predators, this strategy makes them sensitive to ambush. Tucked away and unable to escape, a single rat can easily take them out one by one. But even in captivity, the birds are vulnerable. When New Zealand falcons and harriers fly over the aviaries, shore plovers are so frightened by their natural predators that they panic and fly into the mesh of their enclosures—often injuring themselves or even dying in the process. The team is working to develop better netting and protection for the birds amid all of their other efforts.

Frustration runs high, but Collen says she can't imagine why anyone wouldn't want to work with shore plovers. "They're very bold and plucky and beautiful," she said. The shore plover's small-but-fearless attitude also tugs on the heart strings of Speed and the Motutapu volunteers. "They've very brave for their size," Baylee said. After watching a pair defend their nest for three hours, she said, "they had to stop and stand there with their beaks open for ages, panting for air. But they weren't going to let that stop them."

They may be pint-sized powerhouses when it comes to parenting, but very few shore plover chicks have survived to adulthood on the island. And some breeding pairs haven't produced a single egg yet. "They've given up on saving the species," Speed said. With so many challenges before her to keep the shore plover alive, I wondered if Speed ever feels that saving birds in New Zealand is just too hard. I ask what keeps her going. Is it a sense of responsibility that inspires conservation? Speed thinks it goes deeper than that.

"It's one thing to think about it intellectually," Speed said. "But when you feel it with your heart, that's when you go from 'I should do this,' to 'I must do this.'"

Speed is far from alone in her determination. The shore plover plight is a familiar one in New Zealand, and the loss of millions of native, often endemic birds is a matter of national significance. In a word, New Zealand's birds are special. They've come to represent the wild, natural beauty of the country itself. They are a clear point of national identity and pride.

The bird that demonstrates this deep-seated connection best is, of course, the kiwi. "New Zealand not only has birds on all of its bank notes, but people here call themselves Kiwis," Clout said. "People identify strongly with the kiwi."

Graceful? No. Beautiful? Not really. Lovely song? I sure don't think so. They may not share many of the finer avian qualities, but kiwis just seem to have that *je ne sais quois* star factor. At zoos and sanctuaries around the country, it's possible to spot a kiwi rustling through the darkness of a nocturnal enclosure. Fluffy and round, they're about the size of a chicken (although their eggs are the size of an ostrich's—ouch). Their poor vision is balanced out by a keen sense of smell thanks to a long beak with nostrils at the tip. Trotting from foot to foot, their forward lean and lack of wings gives the impression they may topple over headfirst at any moment. They move mostly at a slow pace, tiptoeing through the bush and poking their beak into the leafy forest floor. Every now and then, they abruptly take off into a sprint. Watching people press their faces up to a glass enclosure, it's clear they easily capture hearts. Finally seeing one dart out of hiding almost guarantees a smile.

In the wild, catching sight of a kiwi is no small task. Not only are they nocturnal and shy; their numbers took a heavy hit after years of predation and several species are now threatened. But like the kangaroo in Australia or bald eagles in the United States, kiwis are a national symbol. They are entwined in the nation's culture, and it's unlikely New Zealand will let their kiwis go the way of the dodo—or the moa—any time soon.

“The idea that kiwi could go extinct within our generation is really motivating to people, especially because it's tied in with our national identity,” said DOC kiwi ecologist Jess Scrimgeour. “So we have lots of funding externally, lots of interest, lots of support.” The kiwi has become a posterchild for conservation in New Zealand, a species so loved people will do all they can to save it. There’s only one bird that comes close to rivaling the kiwi’s iconic status. Meet, the kākāpō.

Clumsy. Clown. Unlucky in love. The kākāpō has been called many names, but this playful bird is well loved in New Zealand—the only place in the world they call home. Bright green save for the long, sandy-colored whiskers that frame its grandpa-like face, the seven-pound bird is somehow hard to spot amid its lush, fern-filled forests habitat. The world’s only flightless parrot, kākāpō tend to freeze when threatened. This may help them hide as aerial predators soar by, but it sure makes them an easy target for a stoat.

Kākāpō only breed when the unpredictable rimu tree produces enough seeds to sustain hungry females. Every few years when this occurs, the males employ a “lek mating system” to draw attention—digging bowls in the ground, calling out with loud booms, and, of course, dancing. After breeding, the males trot off into the forest, leaving the females to defend themselves and their eggs. With predators slinking through the brush, she is a sitting duck, if you will, and her eggs are as good as gone.

With so many quirks and vulnerabilities, predacious mammals proved disastrous for the kākāpō. Pushed to the brink of extinction, sixty-two surviving birds were whisked away to island sanctuaries—much like the shore plover. But when it comes to recovery neediness, they may have the shore plover beat.

“The kākāpō might be an extreme example,” Clout said. “Every single Kākāpō in the world has got a name. It's got a radio transmitter, they're all monitored. Every nest site is found, and they're fed. You can't manage every bird species as intensively as that.”

But why so much attention on this one green parrot? “Kākāpō were in a critical situation,” Clout answers. “I think also, to be honest, they are an iconic species. People enjoy seeing it as the world's biggest parrot. It's flightless, it's nocturnal, it's lek mating, it's just completely weird.”

One kākāpō in particular found international stardom after a rather embarrassing leaked sex tape went viral: Sirocco the kākāpō tried to breed with an unsuspecting zoologist during BBC filming of the *Last Chance to See* series in 2009. Host Stephen Fry could hardly contain himself and famously said, “You are being shagged by a rare parrot.” Imprinted on humans, Sirocco is a charismatic character with his curious, expressive face and overly friendly ways. He now has a loyal fanbase, including a Twitter account with nearly 20,000 followers. Sirocco is even the inspiration for the “Party Parrot” meme.

Extreme as they may be, these recovery efforts are working. 2019 was a record-breaking year for kākāpō breeding. DOC rangers took full advantage of a major rimu tree seedfall year to intensify their breeding efforts and wound up with 200 eggs. The total adult population is up to nearly 150.

Sirocco had a good year as well: he went on his first tour to visit fans since his temporary disappearance in 2016 due to a broken transmitter.

Not every species is so lucky. Most birds in the country aren't as readily identifiable as a kiwi or a kākāpō and they certainly don't have thousands of Twitter followers. But as symbols of the country's natural heritage, the kākāpō and kiwi act as vectors for the less charismatic, attuning the public to the importance of their native birds and conservation in a broader fashion. Lincoln University in Christchurch runs an annual survey to assess the public's impressions of the state of the New Zealand environment. In 2016, respondents listed the kiwi as the country's species most at risk and most in need of protection. The kākāpō was listed as the second most at risk, and third most important species to protect. But even with this level of adoration and support, both birds still require pest-free habitat if they have any hope of recovering.

After all, one hundred fifty kākāpō does not a robust population make. But Clout said that if numbers keep climbing, they may someday take kākāpō from the island sanctuaries back to the mainland. It would be their first return since 1975, when a kākāpō named Richard Henry was the last survivor rescued. They wouldn't be released just anywhere, of course. Instead, kākāpō may be bound for a fenced-in sanctuary.

A few days after leaving Motutapu Island, I found myself winding along hairpin turn after hairpin turn before I finally approached a straight stretch of road. A tall black fence stretched deep into the forest to my left and curled into a spiral near the ocean's edge to my right. Straight ahead were the gates to Tawharanui Open Sanctuary. As the automatic doors slid open, it felt like driving into Jurassic Park. They're not so different, really. Both represent a return to the past—to a time when the landscape and wildlife looked quite different. Some of the creatures inside Tawharanui were even once believed to have gone the way of the dinosaurs.

Take the takahē, a large flightless bird with deep blue and green feathers. For fifty years, it was believed to be extinct due to mammalian predation. In 1948, the country was shocked to find a small population in the remote Murchison Mountains. Scientists still don't understand how they managed to hold off the stoats and possums. Takahē were whisked away to island sanctuaries like Motutapu, and fenced-off sanctuaries like Tawharanui. Endemic to New Zealand, there are now roughly 350 takahē left.

Island sanctuaries are far-removed from predators, reducing the chance of incursion. But there are only so many islands with enough space and habitat to support rare birds. Given the success of these programs on islands of gradually increasing size, the New Zealand government decided to see if they could apply these same approaches to create predator-free habitats on the mainland. They began to block off areas to create sanctuaries called "mainland islands." In 2004, a 1.5-mile pest-proof fence was built from coast to coast on the Tawharanui Peninsula to keep rats, stoats, possums, and cats on one side, and threatened species on the other. With only a few mice and rabbits to contend with, sixteen species of native land birds and fifteen species of native coastal birds now fly, trot, and nest around the peninsula.

In particular, Tawharanui provides crucial habitat for birds that spent most of their lives flying over the open ocean. Sometimes called the seabird capital of the world, New Zealand has more threatened seabirds than anywhere else on the planet. “We have one or two seabirds which are numbered only in the tens,” said Chris Gaskin, one of the founders of the Northern New Zealand Seabird Trust (NNZST), noting that the New Zealand fairy tern is down to just 40 birds. “That’s the entire global population.” For seabirds in particular, Gaskin said protecting them can have enormous benefits that trickle throughout the marine environment. Seabirds transport nutrients that can help make terrestrial and surrounding marine ecosystems more productive.

As James Ross, a NNZST Trustee and volunteer at Tawharanui, showed me around the sanctuary, he pointed out the nesting boxes they’ve set up for shorebirds and seabirds. He also showed me the speakers they set up to playback recorded seabird calls in the hope of attracting breeding pairs to the safety of the peninsula’s protected cliffside. The strategy involves less interference, and it’s much easier and cheaper than translocating difficult-to-find birds.

Free and open to the public, the 588-hectare sanctuary is made up of lush, regenerating forest and wetlands, 170 hectares of farmland, and public beaches. This mixed land use is no accident. Ross explained that part of the idea is to show that native birds can fit into modern life—as long as there are far fewer pests.

“In the U.S. and Europe and elsewhere, it’s habitat, it’s human interference, it’s all of these other issues,” said Clout. “Whereas here, it’s introduced mammalian predators. That’s it. It’s far and away the biggest threat. Some birds just need a predator-free site and they will flourish.”

Protected peninsulas like Tawharanui are valuable because a single fence can easily block off a sizable chunk of land. But some safe havens are popping up closer to major cities. After a fenced-in sanctuary called Zealandia was built on the edge of Wellington, birds like the kākā and tīeke have trickled out into the city and surrounding suburbs. This puts them at risk for predation, but it also gives people a chance to witness conservation success in action. People are seeing these special birds up close in their own backyards—often for the first time ever.

With fenced spaces and islands popping up around the country, New Zealand is slowly allocating more land as sanctuaries for native birds. There are now 117 predator-free islands and more than a dozen fenced-in sanctuaries around the country. The DOC now considers 2.4 million hectares of land as sustained management area—nearly ten percent of the country. Beyond these numbers, many community organizations and individuals around the country carry out their own predator management in their neighborhoods. These efforts have likely kept a number of highly vulnerable species like the shore plover around for the time being, but the fact remains: invasive predators continue to take out millions of native birds every year. To reverse this trend, the New Zealand government recently decided to dramatically increase eradication in the name of conservation.

On July 26, 2016, former New Zealand Prime Minister John Key announced plans for the biggest predator control effort ever undertaken in the country. In fact, Key called it “the most ambitious conservation project attempted anywhere in the world”: Predator Free 2050, a government-sanctioned goal to get rid of every last rat, stoat, and possum in New Zealand.

With DOC as the lead government agency, Predator Free 2050 is a system of more than a dozen agencies, numerous community groups, non-governmental organizations, and individuals working to eliminate three mammalian predators in the next thirty-one years. The name Predator Free is of course a bit of a misnomer; there are other bird-eating mammals that will remain in the country, including mice, cats, and dogs, but the project targets three of the top predators. DOC is currently developing its strategic plan, which they aim to finalize by July 2019.

Brent Beaven, DOC's Programme Manager for Predator Free 2050, said the decision was built on forty years of conservation experience and the success of previous pest-free efforts. "Suddenly those six or seven mainland islands created tools and techniques that were relatively easy for other groups to pick up," Beaven said. "People started to think around a bigger scale."

The government's initial investment created a charity called Predator Free 2050 Limited, designed to partner with and support community-led projects around the country. Dan Tompkins, Project Manager for Predator Free 2050 Limited Science Strategy, said this major step also followed years of momentum and increased philanthropic support for predator-elimination projects. Predator Free 2050 Limited began by funding five predator control sites. From peninsulas, to urban environments, to forests, to farmland, the sites contain varied habitats but all aim to eliminate at least one predator species. "If we can start to remove pests from large areas and defend them, then we can start to roll out a patchwork or mosaic of effort across the country," Beaven said.

The problem of contending with rats and other invasive predators is not unique to New Zealand; islands in the UK, the Galapagos, and elsewhere have also attempted rodent eradications. What sets New Zealand apart is the scale of their goals—and how far they're willing to go to reach them. "I can't think of anyone that's taken a countrywide approach" Clout said. "Nothing quite like this." The late Sir Paul Callaghan, a famed New Zealand scientist, called it the nation's "moonshot." "When we talk about Predator Free 2050, people just get it," Beaven said. "They understand their place within it or how they can be active within that space."

For recovery groups racing to save birds like the shore plover, kākāpō, and kiwi, the program could bring relief by reducing predation pressures on rare birds. In his announcement about Predator Free 2050, Prime Minister Key noted that pests cost the economy and private sector \$3.3 billion each year, so their elimination could ultimately free up funds dedicated to these efforts. Proponents of the plan also point to the many other ways that mammalian pests interfere with New Zealand's native ecosystem. Rats, for example, eat seeds, fruits, and foliage from native plants, and studies suggest that their feeding could negatively impact forest regeneration. New Zealand has an estimated four thousand species of plants and animals considered at risk. "It's not just about birds," Clout said. "We have threatened reptiles, lots of endemics skinks and Geckos, and unusual insects like weta. They're highly vulnerable to predation by rodents."

While previous programs have focused on preserving biodiversity hotspots, Beaven said some of their larger-scale projects have shown that simply removing pests can help forests and many species within them bounce back. "One of the things Wellington shows us is that once you take the threats away, your biodiversity values do actually increase quite considerably," Beaven said.

Still, the goal is undoubtedly daunting. “It’s still early stages—a vision,” Clout said. “We don’t know yet if it’s even feasible to get rid of all the rats from a whole country. And not everybody is behind it.”

Much of the opposition to Predator-Free 2050 stems from one of the program’s primary tools of attack: a poison called 1080.

Sodium monofluoroacetate, commonly referred to as 1080, is a compound that was developed in the 1930s as a rodenticide. In New Zealand, 1080 has been used to target invasive pests for more than 60 years, playing a crucial role in the success of large-scale pest elimination projects in places like Motutapu and most other pest-free islands and fenced-sanctuaries.

In some ways, 1080 is well suited to New Zealand’s mammalian pest problem. For one, it is highly effective at suppressing predator populations. Scrimgeour said her team has observed dramatic reductions in predator numbers after using 1080. “Over six months, all the rats, all the stoats are gone for an entire breeding season,” she said. “The success you can have with your threatened species in just one breeding season is astonishing.” 1080 has also proven effective and cost efficient against possums. “It is literally the most effective tool that New Zealand has,” ecologist Shaun Ogilvie said. “For relatively little cost and little effort, you can get 99% reduction in certainly possums over really large areas of quite inaccessible terrain.”

The compound is also more toxic to mammals than it is to birds, which is useful for New Zealand’s specific pest problems. But therein lies one of the concerns about its use: If 1080 can take out a possum, what could it do to people?

In the United States, 1080 is rated as a Category I toxin by the Environmental Protection Agency, the highest possible rating. It has been banned in the U.S. since the 1970s, with limited exceptions made for use in sheep collars, poisoning any coyotes that attack these sheep. A few droplets of the pure compound could kill a human. Fortunately, the amount used in pest baits is highly diluted, but some people in New Zealand are still very concerned about 1080 exposure. “There’s a lot of very emotive messaging around poisoning our water,” Ogilvie said. “But there aren’t any obvious pathways in terms of human health risk.”

One study by Alastair Suren of the National Institute of Water & Atmospheric Research Ltd, for instance, examined 48 streams in areas where 1080 had been applied aerially. Suren also experimentally added more 1080 to the streams see if he could detect it. He found no apparent effect on fish or invertebrates and “1080 was detected in the water for only a short duration. Concentrations were all low, and below Ministry of Health’s guidelines.”

According to Ogilvie, 1080 degrades rapidly in water due to its simple compound structure. Once it breaks down in water, “it’s not toxic anymore,” Ogilvie said. “The concept that people could be poisoned by drinking water just doesn’t have any basis or any data.”

Ogilvie and Gaskin also said that the government has taken more safety precautions in recent years, including developing stronger pellets so that 1080 doesn’t shed off the bait and impact

non-target species. GPS has also allowed the delivery teams to be more accurate about where the pellets are released, and the government has reduced the overall amount of bait used. Even at lower levels of use, 1080 has still proven to be an effective eradication tool. “The application rates have come down,” Gaskin said. “It’s quite remarkable how little they use to get rid of rats on islands.”

Given the way that 1080 is currently used, scientists like Ogilvie say it is not a risk to humans. But these study findings haven’t done much to dispel concerns. “There’s this anti-1080 campaign growing, online especially,” Scrimgeour said. “There’s all of this misinformation. It feels very similar to anti-vaccinators or non-believers in climate change.” The debate has not been limited to internet disputes. DOC staff have found themselves targets of violence and harassment due to 1080 contention. “There’s so much anger and so much hate around 1080,” Scrimgeour said. “We have to check our cars before we jump into them because wheels have been slashed, wheel nuts have been loosened, death threats have been delivered to people’s homes.”

While some people are more accepting of the idea of using 1080 pellets in pest traps on the ground in certain target areas, DOC says that ground-based efforts are too slow to adequately respond to predator population booms. Some years, warmer temperatures and high volumes of seeds in the forest lead to sharp increases in predator numbers. Aerial distribution of pellets with 1080 by helicopter allows conservation groups to respond quickly and prevent predator numbers from skyrocketing. In a country as mountainous as New Zealand, helicopters are also the best way to distribute 1080 over terrain that isn’t easily accessible by foot.

“What bothers people is the concept of poison raining from the sky,” Scrimgeour said. “It’s a really emotive image.” Ogilvie said this can be especially true for people, including some Māori communities, who live outside the major cities and have a personal or spiritual connection with the forest. “It’s entirely understandable,” Ogilvie said. “But I guess that has to be underpinned by an acceptance of the damage that possums do in the forest.”

When I had first landed in Auckland after three long flights, 31 hours after leaving home, I couldn’t wait to get my restless legs off the plane. But the captain asked us to stay put. It would just take a moment, he said, for the flight attendants to spray insecticide onto our carry-on luggage. The attendants began to walk the aisles, sending a pale purple mist into the overhead compartments. Despite the captain’s voice assuring us that the spray was safe, I couldn’t help but squirm a little as the fog swirled around the plane. The woman next to me was pregnant. She tucked her nose into her shirt, one hand on her belly. Leading up to the trip, I’d spoken to scientists about how 1080 remains controversial despite piles of scientific evidence pointing to its safety. *I’m sure people will come around*, I remembered thinking to myself. But watching the purple fog of insecticide curl above me, I suddenly felt less certain.

The concerns about 1080 extend beyond public health. Pet owners worry that dogs, which are highly sensitive to this particular poison, will be exposed if they run into a possum or rat that consumed a bait pellet. For recreational hunters, aerial 1080 drops are a potential threat to deer populations. While deer are also introduced mammals, hunting has become a popular pastime in New Zealand. “I can completely understand where they’re coming from,” said Ogilvie. “But a

different point of view is that deer themselves have fairly substantial impacts around forest regeneration. That becomes a values issue.”

Others are concerned about the manner of death for the targeted pests. New Zealand’s Society for the Prevention of Cruelty to Animals released a statement in opposition to 1080 distribution—and all poison for that matter. They advocate for a ban on these substances and for research into “humane non-lethal methods, such as limiting reproductive abilities.”

Clout acknowledged that some of the concerns about these measures are understandable. “Most people don’t like killing things. I certainly don’t,” Clout said. “But they don’t seem to get the other side of the argument: If we have those other animals at high densities, then a whole lot of native birds are going to suffer, and maybe go extinct.”

New Zealand has an independent Officer of Parliament in place to provide independent advice about environmental issues. In 2011, Parliamentary Commissioner for the Environment Jan Wright investigated the usefulness and risks presented by 1080. Her findings were clear: “It is seldom that I come to such a strong conclusion at the end of an investigation. But the possums, rats and stoats that have invaded our country will not leave of their own accord... It is my view based on careful analysis of the evidence that not only should the use of 1080 continue (including in aerial operations) to protect our forests, but that we should use more of it.” Even with statements like Wright’s, Ogilvie said there is a lack of clarity in the public about how the poison works and the difference it can make for recovering bird populations. “There seems to be this gap between the science knowledge and the public perception,” Ogilvie said. “There’s a space in between where the two things should be able to meet and discuss, but it doesn’t really happen. The message doesn’t seem to be getting through.”

While the methods remain a point of contention, some surveys suggest that many people in New Zealand support the overall Predator Free 2050 goal. In the same 2016 Lincoln University survey mentioned previously, fifty percent of the respondents “thought that the Department of Conservation and/or Regional Councils should be doing much more than their current efforts to control rats, ferrets, stoats and possums.” So just before the Predator Free 2050 announcement, half of the people polled in this survey wanted more action on predator elimination. A recent survey by Wellington City Council found that 92 percent of respondents supported Predator Free Wellington, a project that aims to eradicate rats, possums, and stoats in the nation’s capital. This statistic was up from 84 percent in the 2017 survey. “Wellington are the leaders in terms of social engagement,” Tompkins said. “But the rest of the country is falling behind quite closely.”

Some argue that reaching this goal by 2050 is not feasible without scientific advances and new technologies. According to Tompkins, national eradication of at least one of the target species—the brushtail possum—should be achievable with existing strategies. “When you get down to the rats, it’s a totally different ballgame,” Tompkins said. “Something new is needed for urban and rural situations if we’re going to eradicate rats at scale.”

With this in mind, Predator Free 2050 is also investing in scientific research to explore new predator control tools, including drones and other technology to detect pests, as well as improved data collection, sharing, and modeling. Some scientists are also trying to develop toxins that

could be safer or more humane than 1080. Beaven said DOC is currently studying a carnivore-specific toxin, for example. But the problem with these studies, he said, is that the controversies surrounding 1080 are likely to translate to any new toxin developed. Ogilvie, who has also studied 1080 alternatives, said that some of the ones he's encountered were less humane and much less understood. "There's a whole lot of science that's already been done on 1080 that would have to be repeated with the other compounds," he said.

Scientists in New Zealand are also exploring ways in which genomics could advance conservation. Beaven said DOC is assessing whether genome sequencing could identify any species-specific weaknesses that they might be able to target. Tompkins, who is part of the International Union for Conservation of Nature (IUCN), said there is a lot of potential in these strategies, but they are not yet ready for use. "We've come to the realization as the IUCN that we're roughly a decade away from application to mammal pests in the shortest term, and that's only if it actually works," Tompkins said. Given the complexities of how ecosystems operate, he said it's still very unclear how these steps would unfold in the real world. Not to mention whether such actions would be approved; while New Zealand does allow genetic modification in research, genetically modified products are not currently commercially available in the country.

Beaven said Predator-Free 2050's current approach is to simultaneously explore new measures, while also using the best available tools to protect birds today. "While we're learning how to achieve eradication at scale, we need to maintain the health and wealth of our wildlife," Beaven said. "At the moment, 1080 is our best large, landscape-scale tool for protecting broad areas of the country and keeping those birds and trees here until we come up with a more permanent solution."

For vulnerable birds like the shore plover, waiting for new methods could be too little too late. "It's a race against time really," Collen said. "Or a race against rats."

Hazel Speed, for one, worries that Predator Free 2050 could have unintended ecological impacts. The outcomes of large-scale ecosystem changes are difficult to predict. Just ask the folks that introduced possums to New Zealand. "When you have a suite of introduced predators out there, you can't just take out one and think everything else is going to remain the same," Speed said. "By removing stoats, maybe the weasels take over. By removing rats who kill the mice, maybe mice explode. How is all this going to play out in long term?"

One major benefit of the goal, Speed said, is that it's led to more discussions about the nation's values and the state of its threatened birds. Meanwhile, she continues to focus on doing all she can for the shore plover. I asked whether she's worried about the future of the species. "I think you have to be an optimist when you're in conservation," she said. "Otherwise you'll give up in despair."

Speed's optimism is not unfounded. She previously helped recover a population of North Island kōkākō, an endemic slate-gray songbird with a distinctive blue wattle, that had dwindled to just one breeding pair in a hilly region southeast of Auckland called the Hunua Ranges. The South Island kōkākō is presumed extinct, and the North Island species has very few remaining populations due to predation and habitat loss. Speed and her team carefully crossbred that single

pair with kōkākō translocated from other regions and slowly increased their genetic diversity. “It was Brave New World stuff back then,” Speed said. Today, there more than 100 pairs of kōkākō in the Hunua Ranges.

The kōkākō and shore plover may still be under threat, but Speed takes comfort in knowing that there are places set aside where they can be safe. “I can sit on this island and look out to two other islands that I know are predator-free,” she said. “A few years ago, I wouldn't be saying that.”

Speed and Scrimgeour said that without these efforts, many other birds would surely be lost forever. “It's probably true for all New Zealand species, that if we do nothing, all of them will eventually become extinct,” Scrimgeour said. “We've seen large-scale disappearances in our lifetime. They're just completely unable to adjust to the introduced predators we've brought into the country.”

A plan as unprecedented as Predator Free 2050 is bound to be rife with controversy. Conservation decisions the world over can create conflict, especially when the path to success requires assessing human values and ethics, changing habits, and—to put it simply—difficult decisions. Should the people of New Zealand stand by and watch their birds die? Or step in with mass exterminations? As Gaskin told me, “New Zealand is the land of birds.” To stay that way, inaction isn't an option.

On my last day on Motutapu, I jumped in the back of Speed's pickup truck and we set off for the day's long list of tasks. Set up a “chick cam” in Sandy Bay. Stake out a new takahē enclosure. Then, there was a surprise: three kiwi birds were being delivered from a neighboring island. Speed immediately switched gears and we set off to find some release boxes.

When kiwis are translocated, rangers place them in release boxes that mimic their burrows. One end is blocked and the other is open to the world, covered in leaf litter to block out the light. This gives the nocturnal creatures a chance to hide during the day, and then explore their new home in the safety of night. Speed knew roughly where the boxes had last been used, so we set off to track them down.

As we hopped a fence to enter the forest, I noticed a brace on Speed's knee and asked her about it. “Just for sympathy,” she joked as she began searching through the trees and shrubs. “I don't like being held back though. Makes me grumpy.” It was easy to see why; Speed's entire life's work revolved around the outdoors. Yet I could hardly keep up as she navigated the steep, slippery hillside and dense trees with easy grace and familiarity—knee brace be damned. We quickly located three boxes, and Speed grabbed a fourth in case the team brought along an extra kiwi.

After a few hours, the guests of honor arrived. Four kiwis—just as Speed had predicted. Several other conservationists and Māori representatives brought the birds down the steep pathway to the spot Speed had selected in the forest. After a few words from a Māori representative and a few

words from Hazel, the birds were brought out of their transport carriers. Sunlight cut through the forest leaves, making the kiwis blink with sleepy, confused eyes. Speed carefully held them against her chest and let each person take a look before lowering them into the release boxes. A dozen or so people stood in respectful silence, peering at the kiwi with awe and excitement. Even though Speed didn't understand the Māori words spoken, both women had said essentially the same thing: We wish you well, little birds. We respect that this was traumatic for you to be uprooted. But we hope you will be safe here.

Safety for the kiwi comes at a high cost, from the mammals that must die to the enormous effort across each island, sanctuary, and now, the entire country. But for many people in New Zealand, these steps bring them closer to creating the type of place where they want to live—closer to protecting the very heart of their natural world. As Speed said, it really boils down to a single decision.

“Do we want New Zealand to be the home of rats and stoats and ferrets? Or the home of kiwi and tīeke and shore plovers?” Speed said. “We have to make a choice.”

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