



Young children are fascinated by New Zealand's giant weta.

SABINE BERNERT

Saving the 'god of ugly things': New Zealand battles to bring back its rodent-sized insects

By [Elizabeth Pennisi](#) Jun. 8, 2017 , 9:00 AM

CAMBRIDGE, NEW ZEALAND—In a cool, moist morning here, conservationist David Wallace and invertebrate ecologist Corinne Watts are standing outside the 16-hectare Warrenheip Reserve, which Wallace owns, discussing how to keep an insect fenced in.

New Zealand has plenty of invasive predators to keep out of the reserve. A 2.3-meter-high fence of mesh netting, a metal rim, and fine chicken wire—the wire also extends underground—blocks the rats, mice, cats, and weasels that would otherwise devastate the vulnerable native flora and fauna within. The reserve offers a glimpse of New Zealand's past. Lush with kauri, tree ferns, and five-finger bushes that shelter iconic kiwi, it is a striking contrast from the surrounding pastureland. But one creature the reserve is designed to shelter keeps getting free: the massive, and endangered, native insect known as the Mahoenui giant weta (*Deinacrida mahoenui*).

In other countries, insect conservation might be an afterthought. But New Zealand's weta, particularly the Mahoenui, are hard to overlook. In size and lifestyle, the giant weta is a mouse in cricket's clothing. To be sure, it lacks the crowd appeal of other indigenous species, such as the kiwi: More than once, neighbors of Warrenheip have called to demand that escapees be removed from their homes. But weta, which means "god of ugly things" in the language of the indigenous Maori, likely played key roles in New Zealand's original ecosystem. The mahogany-colored, fist-sized Mahoenui giant weta, for example, spends its nights foraging on leaves and hides from predators during the day, much like a mouse. Even its droppings are small and round like a mouse's.

But it and other weta have been losing ground to invasive mammal predators until recently.

Flightless and stingless, the odorous weta are easy prey for rats and even mice. "Their smell is so strong that any rodent just goes 'Boom!'" says researcher Danny Thornburrow, who, like Watts, works at Landcare Research, a public-private research institute in Hamilton, New Zealand. As a result, several species of weta, like New Zealand's flightless birds, have had brushes with extinction.

That's why Wallace and Watts worry about the weta that climb over this fence around Warrenheip—an improved fence is possible but too costly for now—and why they cherish the few thousand that remain inside. Warrenheip is part of an unusual effort in insect protection and restoration that has brought several weta species back from the brink. Of an estimated 83 species, New Zealand's government has designated 16 for protection. Government and private groups have accepted the challenge, sheltering the insects on small, mammal-free islands and creating safe habitats on the mainland, like Warrenheip, by erecting special fencing, eradicating mammal predators, and monitoring the weta inside.

Those efforts are paying off for weta. "Many appear to establish readily after being moved to new locations," Watts says. In terms of conservation, the weta represent "a pretty spectacular story," adds David Pearson, an ecologist at Arizona State University in Tempe. The ultimate goal is to establish multiple self-sustaining populations of the weta species most devastated by predators. In a world where **insects are generally shrinking in number and diversity**, these New Zealand giants are a hopeful exception.

GIANT Deinacrida

rugosa TREE Hemideina thoracica TUSKED Motuweta
isolata CAVE Gymnoplectron acanthocera Sometimes weighing more than 30 grams, the 11 giant weta species live mostly in trees and shrubs but descend to mate and lay eggs. Just three of these weta species are known in New Zealand. The various tree weta dwell in tiny tree holes, with one male presiding over several females and their young. Nonaggressive, cave weta hide in dark, damp spaces and use lengthy legs to leap from any danger. Supersized insects New Zealand's more than 80 weta species come in a variety of forms suited to different niches, from caves to trees. U.S. penny for scale (19.05 mm) Hind legs When threatened, they extend their back legs, which bristle with spines. Tusks Males have impressivetusks to ward off invading rivals. Jaws Males have big jaws to defend their harems and will bite people if provoked, but tree weta mostly eat soft leaves. Legs From antenna tips to the ends of their back legs, cave weta can stretch 300 milli-meters or more.

Supersized insects

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Deinacrida rugosa

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Tusks Males have impressive tusks to ward off invading rivals.

TREE

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CAVE

Gymnoplectron acanthocera

Nonaggressive, cave weta hide in dark, damp spaces and use lengthy legs to leap from any danger.

Legs From antenna tips to the ends of their back legs, cave weta can stretch 300 millimeters or more.

(GRAPHIC) V. ALTOUNIAN/SCIENCE; (PHOTO) UNITED STATES MINT/WIKICOMMONS

About 65 million years ago, relatively small, furry, four-legged creatures began exploding in

number and kind after the dinosaurs vanished. But New Zealand, which had split from other landmasses 15 million years earlier, ended up without mammals, save one bat, and biodiversity took a different turn there. The absence of mammalian predators opened the way for flightless birds and insects to expand; meanwhile, mountain-building and changes in sea level probably created new habitats and opportunities. Weta were among the big winners.

Over time, the 11 species of giant weta (*Deinacrida*) got bigger and bigger and began occupying niches filled by rodents elsewhere. Other groups, such as tree weta (*Hemideina*), lived in tree trunks and branches, with big-headed males protecting harems of females. Tusked weta (*Motuweta*, *Anisoura*), which stay underground during the day but emerge at night to hunt smaller invertebrates, evolved their long frontal weapons for defending territories against rival males. Still other weta retreated to caves by day, evolving grasshopperlike legs that help them leap out of harm's way when they venture out for food. As carnivores, and plant and detritus eaters, weta played crucial roles in New Zealand's food webs and may even help disperse native plant seeds.

Kiore—Pacific rats—however, landed in New Zealand some 800 years ago, hitch-hiking with the first Polynesians to colonize the islands. Other scourges, such as Norway rats and tree-climbing ship rats, arrived later with European explorers. The invaders swiftly wreaked havoc on flightless birds and ill-defended invertebrates, which "were sitting ducks," Watts says. Sometimes weighing more than 30 grams, giant weta cannot easily jump away from a threat, for example. Weta "have suffered greatly over the years," says Michael Samways, an entomologist at Stellenbosch University in South Africa.

Ironically, an invasive plant helped save the Mahoenui giant weta. A few were found in 1962 in a North Island pasture, hiding in gorse, a thorny, yellow-flowering bush that spread wildly after being introduced as a hedgerow plant in the 1800s. Conservationists soon realized that gorse browsed by goats, another nonnative species, became too dense and thorny for predatory mammals to get in—an accidental weta refuge.

In 1990, that pasture became an official preserve, where goats and gorse for years helped the giant weta thrive. Gorse patches are prone to burning, however, so conservationists have tried to reintroduce the weta elsewhere, near its original range and at new sites on the mainland and offshore. By the mid-2000s, three Mahoenui populations survived: in the gorse, where they were first found; on a small island, unfortunately within swimming distance of rodents; and in the Warrenheip Reserve.

But today, at the original preserve, native vegetation has overtaken the gorse, and weta numbers there have plummeted. "We're worried," Watts says. "Its original population may go extinct." That makes the giant weta at the tiny Warrenheip Reserve "one of the key populations," she says, which could ultimately seed new populations in other mammal-free reserves.

With transfers to islands free of mammals, New Zealand conservationists have rescued other species as well, including the Mercury Islands tusked weta, a mouse-sized predator of smaller insects and other invertebrates. In 1993, entomologists found the last few individuals on the 13-hectare Middle Island of the Mercury chain, a rat-free speck off the North Island. The three females and lone male were caught and bred in captivity, and the resulting broods were released on other islands made rat-free, primarily through poisoned bait. Although the weta are now gone from Middle Island, reintroductions to the other islands "saved the species from

extinction," Samways says.



A Mahoenui giant weta perches on gorse, a plant that—although not native to New Zealand—has provided a refuge for the species.

STEVE READER

Insect conservation efforts remain rare worldwide. Several zoos are raising American burying beetles and reintroducing them in the U.S. Midwest. In the U.S. Northeast, a campaign to save the rusty patched bumble bee (*Bombus affinis*) resulted this year in its protection under the U.S. Endangered Species Act. The "Red List" of threatened species, compiled by the International Union for Conservation of Nature, includes 1268 insects, yet most of them have gotten no attention. Indeed, the conservation needs of only about 0.7% of the world's 1 million named insects have been assessed, and for about half of those too little is known to make a clear call on their status.

"We have the task of conserving largely what is unknown," Samways noted in a 2015 commentary in *Current Opinion in Insect Science*. Nor is much money available for insect conservation. Yet when insects go extinct, Samways says, "extinction of other species may also follow."

Part of the problem is that insects, except for some colorful butterflies, don't have the same appeal as cute mammals and birds. Weta themselves, smelly and nightmarishly large, have an image problem. "A lot of the [New Zealand] population is anti-weta," says George Gibbs, an entomologist retired from Victoria University of Wellington. Young children start off fascinated by those insects, Watts says, "but when they get around 13 years old, something happens and they think [weta] are just horrible."

Watts envies the kiwi conservation clubs and the publicity surrounding an urgent effort to save the kakapo, New Zealand's flightless parrot. The comeback of the Mercury Islands tusked weta "should be one of New Zealand's biggest conservation success stories," she says, "but because it's not a bird, the story is not out there." As conservation budgets get squeezed, she worries that endangered weta might be left out and the progress to date, particularly for the Mahoenui giant weta, will be lost: "The next 5 to 10 years for this species is very critical."

Even as conservationists battle to save the insects, some scientists are trying to learn more about the unusual creatures. "I wanted to study something that everyone else thought was horrible," says evolutionary biologist Mary Morgan-Richards. At Massey University in Palmerston North, New Zealand, she and her husband, evolutionary biologist Steven Trewick, are tracking how still-common weta populations are expanding or contracting because of climate change.

And ecologists Daniel Howard and Carrie Hall, of the University of New Hampshire in Durham, are using Doppler lasers to listen in on weta communications. Some weta make noises, but this past January, Howard and Hall discovered that Mahoenui giant weta send vibrations through leaves and branches to warn off rivals, court females, and announce their presence. No one had known how the insect communicated, Howard says. "They are only silent if you are listening on the wrong channel."

Back in Warrenheip, weta of all kinds are thriving in their protected home. Pushing through the greenery, Watts quickly spots a tree weta, with an eager insect-eating bird called the fantail hovering nearby. Watts quickly examines the weta and then tucks it under the leaves, out of harm's way.

She doesn't see the Mahoenui giant weta until she is just centimeters away. It has nestled tightly between twin trunks of a kanuka tree. As she reaches for it, the weta adopts its defensive posture, stretching its hind legs and brandishing its spines. Watts hesitates and then backs off when she notices that its abdomen is bulging with eggs. This weta will lay some 200 eggs over winter, in batches of 10. Those eggs should hatch in spring and, Watts hopes, swell this small band of survivors. The battle to save New Zealand's homely insects continues.

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