Weta males – some with facial tusks and others with long blade-like jaws – are not sexy in the sense of being attractive. But in 1920, New Zealand entomologist George Hudson suggested that weta weaponry illustrated the Darwinian principle of sexual selection by improving male success in getting a mate. Darwin and Hudson’s work inspired us to study weta sex, and Maud Island, in the Marlborough Sounds, seemed the perfect location because representatives of three weta groups are abundant there. Sadly, this is not the case on New Zealand’s mainland, where introduced predators have eradicated many species. Most large giant weta species survive today on conservation islands such as Maud. Our studies have revealed the mating of various weta to be every bit as fascinating as their structural splendour. We have linked weta behaviour, structure and even their body size to Darwinian sexual selection.

Our main quarry on Maud Island was the Wellington tree weta, *Hemideina crassidens*, and the closely related Cook Strait giant weta, *Deinacrida rugosa*. We also studied a *Hemiandrus* ground weta, an unnamed species and one checking in at only 3 per cent of the weight of the giant weta that occasionally looms over it. Each of these species possesses an entirely different mating pattern, unlike their relatives, crickets and katydids, where typically the female homes in on the male’s mating song because he provides a food-offering or the safety of a burrow. For weta, getting together is a silent endeavour, yet the key to understanding their variable mating still appears to be resources important to the female.

The mating biology of Wellington tree weta seems more akin to that of some mammals than insects because males defend harems. In Maud Island’s woodland, we found most harems in holes in mahoe trees. The most sought-after of these “galleries” are typically large with just one entrance. Each is guarded by a male with a big head equipped with mandible (jaw) swords sometimes as long as the rest of his body.

He faces inward to a cavity with up to a dozen females. Intruding rivals are confronted with the hind end of the harem master rather than his weapons. A fight starts when the resident is pulled out by his back legs. The rivals square off with jaws flared and the male with the smaller equipment scrampers away. In more even matches a contest ensues where mandible-weapons are locked, twisted and pulled. Fights end when a loser is tossed from the tree. Unluckily losers can receive a crushed head or have a mandible snipped off by their opponent.

These observations suggested that male tree weta were vying for long-term control of a resource – the best galleries. We tested this idea by daily tracking down individually marked weta. Surprisingly, males stayed only about a day and a half, about half that of the females, though males will stay longer if a harem is large. A gallery is not a male’s long-term home and fortress but instead appears to be a staging post hosting a series of itinerant and aggressive gigolos in search of receptive females.

A male appears to move on once he has mated with all the females. In an unconventional approach to mating, he unceremoniously hauls each female out of the gallery in much the same way as he would a rival. He attaches a sperm capsule to her, which, as in all weta, acts like a tiny turkey baster to inject sperm after the pair has separated. There is little opportunity for the female to reject his advances and if she removes the sperm capsule prematurely if another male coming to the gallery attempts to mate. By ejecting his female, a male appears to reduce the risk of having his sperm interrupted. Worse than interrupted ejaculation is not mating at all – yet this would seem to be the fate of small-headed males.
I nterest in the mating habits of giant weta, Motuweta isolata, prompted us to track all tagged males over a single night in the years 2001, 2002, and 2003. The 20 early males that were collected on or near Motuotua Island were tagged with radio transmitters that emitted a continuous signal for at least 24 hours.

At this point we disrupted the love nest to measure the quality of the male. A radio tag is attached to a giant weta on Maud Island. Photo: Clint Kelly

While we knew little about the mating habits of tusked weta, except that male tusks are used in fights in the endangered Motuweta isolata. There is some hope, however, on two fronts. First, Motuweta riparia – Motuweta riparia – is now known. Near a pristine North Island forest stream we have found a healthy population that is currently under study for future use. Motuweta riparia has elaborate male tusks and enormous bulk. The only native survivors were on a tiny island in the Mercury group.

In 2002, one of us took part in a Department of Conservation search for this species. We found none and the outlook seemed grim because no individuals have since been found on the island. However, thanks to a captive rearing programme by DOC and release of this big tusked weta on to other islands in the Mercury group, the species now thrives. In 2002, it was a thrill to join in the discovery of the first hatchling tuskers on one of these other islands. So there is hope that healthy populations of M. isolata will eventually be restored to the New Zealand landscape and that future research will reveal this unique elephantine insect as another fine example illustrating the Darwinian mechanism of sexual selection.

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**Big, ugly and struggling**

Large, flightless weta are walking meat pies for foraging introduced mammals such as rodents. Particularly vulnerable – to both predation and habitat change – are giant and tusked weta that live on the ground and use retreats in shallow burrows or low vegetation.

They have survived mainly on rodent-free offshore islands that have turned out to be valuable sources for successful translocation to other areas, especially islands. The first translocations involved Cook Strait giant weta that were moved from Mana Island to Maud Island in the 1970s and, more recently, in the Wellington area, to Matiu-Somes Island and Karori sanctuary (Zealandia).

Motuweta isolata and Motuweta riparia are two different species of large ground weta that were originally found in one small mainland area of goat-browsed dense gorse. Non-native gorse, ironically, protects weta from rodents. Translocations have produced healthy populations, including one on Mawhanga Island, off the Coromandel Peninsula. Since the first translocations in 2001, growing populations of Mercury Island tusked weta now exist on five Mercury islands.

**Dinner date**

Well over half of New Zealand’s weta species are tiny Hemiandrus. These ground weta are virtually unknown compared with their larger and well-armed cousins but they have unique mating habits and structures that – as in other weta – are related to a resource important to females. The newly mated Hemiandrus female grasps and eats a nutritious doughy mass that is ejaculated by her mate along with his sperm packet. The lack of this meal in our other weta is unusual as it is widespread in related insect families.

We discovered that, unlike most relatives, the male giant weta on Maud Island does not attach his nuptial gift to the sperm packet. Instead he places it pathway up his partner’s underside so she simply sucks it “chink” down to eat it.

Daryll Gwynne radio tracks giant weta on Maud Island. Photo: Clint Kelly

The males of this and other ground weta advertise their offerings by tapping the abdomen on a leaf. After being attracted to this seismic signal, the female erects a bizarre appendage pathway up her abdomen that functions as a secondary copulation site to which the male attaches while his genitals squeeze out the gooey gift. This abdominal appendage varies greatly between species: from a two-lobed structure in our Maud Island Hemiandrus to a bizarre, long elbowed device in the related Hemiandrus pallitarsis. Such species differences in female “secondary” organs is opposite to the familiar Darwinian pattern of species variation in male ornaments or armaments. Behavioural evidence such as a male ground weta rejecting a female after apparently assessing her abdominal ornament suggests that sexual selection of females has led to the evolution of these highly unusual structures.