Ruakumara tusked weta: Discovery, ecology and management implications

George Gibbs
School of Biological Sciences
Victoria University
PO Box 600
Wellington

Published by
Department of Conservation
Head Office, PO Box 10-420
Wellington, New Zealand

This report was commissioned by East Coast Conservancy

ISSN 1171-9834

Reference to material in this report should be cited thus:

Gibbs, G., 1998
Raukumara tusked weta: Discovery, ecology and management implications. *Conservation Advisory Science Notes No. 218,* Department of Conservation, Wellington.

Keywords: Raukumara tusked weta, species recognition, conservation management.

1. Introduction

This report summarises the state of knowledge of the Raukumara tusked weta made during the first two and a half years since its discovery. The weta was first found by David Rush, a Conservation Officer, at Lower Mangatutara Hut in the Raukumara Wilderness Area on 10 August 1995. The adult male specimen examined by us was deemed to be a new mainland species of tusked weta, most closely related to the species which occurs on Middle Island in the Mercury Group and which, to date, is still unnamed. Together with the small Northland tusked weta, *'Hemiandrus' monstrosus*, this discovery brings the total of tusked weta known in New Zealand to three species.

Since August 1995, Conservation Officers from Opotiki Field Centre have found three further localities for this weta while looking for Hochstetter's frog *(Leiopelma hochstetteri):* two in Te Urewera National Park, on the northern Ikawhenua Range near Saddle Biv. (March 1996); and one in the Urutawa Conservation Area (also March 1996). Further localities have been added during 1997 (Kakanui block, near Te Araroa; Karakatuwhero Valley, Pukeamaru block; and Waioeka Gorge). These widely spaced localities (see map) are along a 145 km line, indicating that the new weta is probably quite widespread throughout the indigenous forests of the eastern Bay of Plenty.

As a result of these discoveries, East Coast Conservancy organised a survey of the Motu Catchment, 9-13 April 1996, which involved three parties of three/four people, each including a biologist from Victoria University with some experience in weta research. The primary objective was to gather as much information as possible about the weta. The parties, based at Mangatutara Hut, Lower Mangatutara Hut, and Mangakirikiri Hut, each found evidence of tusked weta. Live specimens were returned to Wellington for further observations.

2. Description

The New Zealand weta fauna comprises five different types of ground-dwelling, flightless grasshoppers (Insecta:Orthoptera), belonging to two families. The family Rhaphidophoridae includes the cave weta - generally long-legged, agile forms that aggregate in suitable dark, damp refuges by day and forage as scavengers at night. About 50 species are known in New Zealand. One of about 30 mm total length was found quite commonly at the tusked wets sites in the lower Mangatutara Valley. The remainder of the weta fauna are in the family Stenopelmatidae, which have no common name here, but are known overseas as "king crickets". We divide these into tree, giant, tusked, and ground weta. Tree weta *(Hemideina)* are well adapted to modern life and succeed even in urban areas provided suitable holes are available in trees to enable them to find secure refuges. Giant weta *(Deinacrida)* are sometimes, but not always, larger than tree weta, and their overall naivity towards predators provides us with our main conservation worries. Two species rapidly became

extinct when European rats invaded mainland New Zealand but still survive on offshore islands (Little Barrier, Mana and Stephens). The "Mahoenui" weta is still clinging to life on the mainland. Ground weta *(Hemiandrus)* are the least understood group, although there are thought to be about 30 different species. They range in size from less than 10 mm to over 50 mm and live concealed in burrows on the ground. Some have very restricted distributions, which gives cause for concern over their conservation. One species of ground weta (18 mm total length) was found during the Raukumara weta survey at the lower Managtutara. Tusked weta and ground weta have some characters in common but overall, tusked weta are a highly distinctive group of three North Island species (if we include the recently discovered Raukumara weta).

Of course the most obvious features of tusked weta are the curved tusks which project forward from the jaws, something akin to elephant's tusks. Behavioural observations on the Mercury Island tusked weta show that these are used for male-male fighting over the possession of refuges. The battling weta lock heads together and jostle until one loses its footing. Tusks are only present in adult males, not on females or immatures. Tusked weta are thus only recognised as being special if the adult male is found, as was the case with Dave ("Spin") Rush's discovery at lower Mangatutara Hut. Had the specimen been a female or an immature stage of the weta, it could easily have been dismissed as "just a weta". This is probably the reason why Raukumara tusked weta has remained an unknown for so long. It is hard to believe that no human had ever seen one before when, in less than three years since the first one was recognised, over 100 have turned up over a range covering more than 140 km behind the Bay of Plenty! The diagnostic criteria for confirming tusked weta identification are given in the pictorial key below. They are most likely to be confused with cave weta or ground weta, especially if immatures are being examined, due to their relatively long legs with thin hind tibiae that lack the heavy fixed spines of the common tree weta. In the absence of tusks, the essential feature is the unique combination of "ears" and a forward-facing spine on the front legs. If in doubt, keep it alive and forward it to an expert!

Although tusked weta are not formally grouped together as a discrete taxon at present, we believe they will be, once genetic studies are completed on the world fauna. Our genetic investigations so far indicate that tusked weta are not closely related to the other groups of weta in New Zealand, but just how deep this split is will have to await further study. This type of weta is also known to occur in Australia and southern Africa, so tusked weta as a group seem to be of ancient origin, predating the split of Gondwanaland.

3. Morphology

A formal taxonomic description of the Raukumara tusked weta will ultimately be published, so the following notes are simply to enable further specimens of this weta to be identified with confidence.

First, the most obvious character: the adult male tusks. The tusks of all tusked weta are fixed, not hinged to the front of the jaws. They can therefore only be moved by opening the jaws. The tusks of Raukumara weta vary considerably in length, 3.8-11.1 mm in sexually mature adults. They are curved inwards, but less so than in the other New Zealand species, with the result that in many individuals they do not cross in front. Also, the tusks lack stridulatory pegs (tiny knobs which roughen the contact surfaces so the tusks can produce a rasping sound when crossed rapidly). In other tusked weta the tusks curve upwards like those of an elephant, but in this species they are nearly straight when viewed from the side or droop slightly.

The normal position of the head is at right angles to the axis of the body, never extended forward as in some male tree weta with enlarged jaws. The antennae are long (like a cave weta), approximately 2 times the body length and are used in a wide sweeping motion at night when the insect is perched on a branch. The compound eyes are black but, like the other tusked weta, the three ocelli show clearly between the bases of the antennae as bright yellow spots in torchlight.

In profile the Raukumara tusked weta, male or female, has a slightly hunchback outline, reminiscent of cave weta. However, the body proportion is larger than you would expect for a cave weta in relation to leg lengths. Their cuticle texture is smooth, but with a dull appearance when dry, or shiny when wet. Microscopic examination shows that the cuticle of all the plates along the back behind the head carry reticulate patterns of minute grooves which are responsible for the lack of reflection when dry. Cerci (two sensory projections at the rear end) are very long (5-6 mm) in both sexes and upturned. Stridulatory (=noise-producing) surfaces are present on the inner surface of the femur and on the sides of the abdomen where the femur contacts it. These take the form of fields of minute pegs which act like sandpaper; scattered toward the ends of the abdominal tergites (= plates along the back) 1 to 7, and about seven ridges of similar pegs on the lower part of the inner femur, with a continuous row near the front margin. The stridulatory morphology is almost identical to that of the Mercury Island tusked weta, but differs from the Northland tusked weta.

Leg morphology of tusked weta is distinctive. The front leg tibia (the joint between the "knee" and the "ankle") carries the "ear" or auditory tympanum. This is an oval patch just below the "knee" which shows on both sides of the leg joint. Ears like this occur on all tree and giant weta species, where they are more clearly visible, but it is a vital diagnostic character for tusked weta because the two most similar types of weta, ground and cave weta, lack this feature. Each front tibia also bears a single distinctive forward-facing spine below the ear, which is present in ground weta but not in any other type of New Zealand weta. **These two characters in combination (ear + forward spine on front tibia) can be used to confirm the identity of all Raukumara tusked weta, including females and immatures.** The hind legs are long with a very muscular femur which lacks spines and a thinner tibia armed with about ten pairs of small rigid spines down the back edge. In the Raukumara tusked weta the muscle bundles of the femur are clearly defined by a parallel series of thin black lines. At the outer end of the tibia four much longer movable spines overhang the foot. These tibial features are simi-

lar in tusked, ground and cave weta, but contrast with tree and giant weta, where the hind tibia is much heavier and is armed with only about five or six pairs of thicker spines.The four-jointed feet of tusked weta are equipped with four soft pads underneath and two long claws.

Some Raukumara tusked weta are instantly recognisable due to a unique bright orange-red coloured "saddle" mark on the pronotum (first thorax plate behind the head). This mark is very conspicuous in some immatures but in adults it becomes quite subdued. Adults are rich reddish-brown overall. The head and pronotum are dull red, usually with some diffuse black pigment along the mid-dorsal line especially where these two parts overlap at the neck. The abdomen coloration is dark brown-black on the back, fading to yellowish-brown on the sides, with a subdued yellow-brown banding between the tergites. The legs are orange-brown with some dark shading and the feet are very pale. Immatures vary in terms of the clarity of the saddle mark, but always have a jet black dorsum to the head, with many small nymphs being almost uniformly dark-brown.

One interesting feature of the Mercury Island tusked weta is the enormous variation in size and development of mature males between the smallest and the largest individuals. This species has now been surveyed for several years, revealing exceptional variation in measurements of males. Evidence of male size variation in the Raukumara weta has been found (McIntyre 1998) but is not as extreme as in the Mercury Island weta.

KEY TO SPECIES OF TUSKED WETA IN NEW ZEALAND

1. A small weta (adult less than 20 mm); with tusks in the male; female with ovipositor splayed at the apex; lacking a forward facing spine below the ear on the front tibia ..... Northland

   A medium to large weta (adult greater than 25 mm); with tusks in the male; female ovipositor normal, not splayed at apex; a forward-facing spine present on front tibia below the ear ..... 2.

2. Pigmentation uniform reddish-brown over entire body; myotomes on hind femur not outlined in black; male tusks strongly curved, with stridulatory pegs on contact surfaces; a pair of short, sharply pointed spines on sternum between bases of front legs ..... Mercury Is

   Pigmentation dark brown-black on abdomen, with subdued yellowish banding on sides, bright reddish-brown on pronotum and head; myotomes on hind femur outlined in black; male tusks slightly curved but often not crossing, lacking stridulatory pegs; a pair of rounded knobs on sternum between front legs ..... Raukumara

This raises the question of how you can tell when a weta is sexually mature. We have based our guidelines on observations of behaviour in captivity (the ultimate test ... mating) and measurements in the field. With males, the tusks

are the key, since they only develop in the final two instars. A mature male should have asymmetrical tusks of more than 5 mm, coupled with a hind tibia measurement of over 20 mm. With females it is the ovipositor that gives the clue. A mature female will have an ovipositor of more than 14 mm, coupled with a hind tibia measurement greater than 22 mm. The ovipositor is made up from three pairs of valves, and at maturity it curves strongly upwards to an apex which is slightly uneven due to one pair of valves being shorter than the others.

4. Life history

Collections of Raukumara tusked weta have been made in March, April, May, October and December apart from the initial specimen found in August. The size of specimens at each collection date enables us to make certain predictions about the life cycle. These data, discussed by McIntyre (1998), indicate a probable three-year development cycle in which adults would be maturing in late summer, mating and ovipositing in late autumn-winter and dying off through the winter.

An ovipositing female was observed on a damp night in the stream bed west of the lower Mangatutara Hut. The female was perched on top of a huge log lying in the stream bed with her ovipositor inserted into a layer of silt with a thin bryophyte carpet growing on it. The site was marked and examined in daylight next morning, revealing that the whole silt layer was only about 5 mm thick. No fresh egg was found at the site (evidently she was disturbed early in the operation) but three old egg cases were excavated from the patch of silt indicating that previous oviposition had occurred there. The location was 2 m above the gravel bed in a slight depression on the top of the log, hence in full sunlight. From its elevated position it was judged unlikely to be subject to erosion by flood waters. Other similar sites were excavated, but no further eggs were found. With the aid of night vision equipment, one of the captive females has been seen with her ovipositor buried in silt on the bottom of her container during late June and a small number of eggs have been retrieved.

Mating has been observed in captive specimens: first, in March with the pair sent from the Ikawhenua site, and later, until mid-May with specimens brought back from the Raukumara sites. Like the Mercury Island weta, they seem oblivious to their surroundings provided that the right stimulus is there and will readily mate by day, spending many hours copulating.

5. Ecology

New Zealand tusked weta are principally forest dwellers. This is especially true of the Raukumara weta, where all known habitats are within relatively

undisturbed, dense North Island podocarp-broadleaf forest dominated by tawa *(Beilschmiedia tawa),* kamahi *(Weinmannia racemosa)* and podocarp mixtures with hard beech *(Nothofagus truncata)* at the higher levels.

However, the single habitat feature that dominates all Raukumara weta discoveries to date is their proximity to streams. Not just any stream, but particularly small first- or second- order streams in steep gullies of undisturbed indigenous forest. Eroding gullies with a partially open canopy seem especially suitable. Although the initial specimen was discovered on a grassed river flat about 20 m from a very wide open stony riverbed, all subsequent specimens have been found in narrow stream beds where the water channel width is only 1-2 m. Most significantly, the weta are in burrows under stones on the gravel terraces within 0.5-3 m of the flowing water.

Light levels at the sites vary considerably. Reports from the Ikawhenua Range localities indicate that tusked weta were in steep rock piles in gullies under dense canopy. These are damp sites with some seepage water, often under carpets of wet moss. The weta were found in the type of microhabitat expected for Hochstetter's frog. Hochstetter's frog was common in forest canopied streams at the Raukumara localities, but the streams that were good frog sites yielded only one tusked weta. By far the majority of tusked weta were in unstable stream beds, where the canopy was completely open due to recent scree or rock movement into the stream, or was partly covered by colonising growth of *Cordyline banksii,* tutu *(Coriaria arborea),* wineberry *(Aristotelia serrata),* putaputaweta *(Carpodetus serratus),* toetoe *(Cortaderia fulvida)* and Himalayan fairy grass *(Miscanthus chinensis).* Frogs were not as common in these open eroding streams.

Tusked weta have occurred at a wide range of altitudes from 60 m near Te Araroa to 740 m in the Uretawa block.

By day, Raukumara tusked weta are found inside their refuges. These are either natural or excavated tunnels in the rocky, silty substrate beside streams. Many individuals, and especially the immatures, clearly used their cavities repeatedly. They were cleanly excavated cavities under a boulder, with a spacious interior which is much larger than the weta and smooth, lined with fine silty material. The entrance tunnel which leads out from under the boulder was frequently sealed with a silt plug, a behavioural feature which has also been observed in captive Raukumara tusked weta. Plugs, made from fragments of substrate congealed with saliva to conceal the entrance to an occupied tunnel, are known to be used in both Northland tusked weta and Middle Island tusked weta, so are evidently a tusked weta character. They are also known in some ground weta species. Adult weta often occurred in refuges that lacked the "finish" described above, giving the impression they had simply found a safe hideaway when the need arose after a night's activity. Some were in natural cavities under stream-side boulders, others wedged into angular cavities in screes. The presence of caked dry mud on the back of several active adult weta at night implies that they had probably forced themselves into a damp muddy crevice the night before, rather than occupying a carefully prepared "nest" like the immatures.

Tusked weta refuges were distributed only within the riparian zone close to streams and in many cases clearly within the normal flood-zone which would be covered with flood water many times in the course of a year. One wonders whether the weta stays put during a flood when the refuge is covered by water or whether it moves out. Perhaps sufficient air is trapped within the sealed cavity for the weta to remain in its refuge while the water flows over it, or perhaps it relies on its ability to move under water in order to escape drowning (see Behaviour). The close association of this weta to running water was confirmed on all occasions when weta were found. Tusked weta were absent from what appeared to be identical habitat a few metres up the bank above water-level.

The substrate in tusked weta streams was cohesive silty sand which filled the spaces between boulders and cobbles. They did not occur in large open riverbeds or where the substrate was coarse gravel lacking the fine silty binding material. The underlying geology varies between the different collection sites in the Raukumara Range. The Mangakirikiri site is Urewera Group greywacke-sandstone generally thick-bedded or massive, tending to form very steep slopes as the rocks are strong. The lower Mangatutara site, however, is just across the boundary to a different unit, the Waitahaia Formation, generally thin-bedded greywacke-argillite (sandstone-mudstone) of significantly younger Cretaceous age and less induration (hardness). It has markedly less mass strength so slopes overall are less steep, but much of the ground has deep-seated instability and erosion rates are probably higher. Although these eroding Raukumara sites were obviously very suitable for the weta, their presence in rock piles in the Ikawhenua Range suggests that they are by no means dependent on the above set of criteria. Any wet riparian site in forest would provide the basic components of their refuges: silt, boulders and a covering layer of bryophytes.

Some nematode parasites were found in the faecal slurry of Raukumara weta (see below). These cannot be identified beyond the fact that they are a type of pin worm (Order Oxyuroidea) similar to *Wetanema* described from tree weta (Dale, 1967). They live in the hindgut and are unlikely to have any significant impact on their hosts.

6. Behaviour

The diet of Raukumara weta was determined from: 1) faecal samples taken in the field when the weta were being measured, and 2) captive weta. When stressed, the Mercury Island tusked weta is renowned for its ejection of a foul-smelling faecal slurry from the anus. The Raukumara weta used the same technique. A faecal slurry from about ten adult and subadult weta was collected into a tube of alcohol while measurements were being taken at lower Mangatutara Hut. This material contained no compressed fibrous plant matter as you would expect from a herbivorous tree or giant weta. Instead it is semi-liquid, almost black with minute fragments of arthropod cuticle and much unidentifiable debris. The conclusion that these weta are largely carnivorous is supported by the diet of captive specimens which fed on various live moths, mealworms etc. However, they will also feed on slices of fresh carrot when

first brought into the laboratory and occasionally nibble tatipata *(Coprosma repens)* leaves. It seems therefore that the weta is essentially a predator, but that it may supplement this with some herbivory.

Observations of the nocturnal activities of 39 tusked weta were made along the stream west of lower Mangatutara Hut on four successive nights. Some were simply moving across the open streambed, others sitting in the entrance to cavities on the banks, still others perched amongst vegetation at about 1-3 m above the water level on overhanging Himalayan fairy grass, or tutu branches. Feeding was not observed.

Once again, the most striking feature of their nocturnal activity was the relationship with water in the streams. On several occasions, adult weta that had been disturbed by the observer jumped or rolled into the stream. This escape reaction appeared to be deliberate since the weta citing to the substrate under water, remaining in this position for at least five minutes. It seemed perfectly natural for the weta, and was clearly an excellent way of avoiding further attention. They were capable of moving across the cobbles tinder water and were invisible if in a stretch of torrent where the surface water was broken. One adult female was observed in torchlight on the streambed immediately adjacent to the water, glistening wet, and evidently just pulling herself from the stream. A test was made with an immature weta (18 mm total length) in a tributary of the Karakatuwhero River, near Te Araroa. When dropped into a shallow pool, it sank to the bottom and attempted to press itself into a crevice. It remained in this position for three minutes before moving across the bottom to a position where its head and first thorax segment were partly above water. After 15 minutes it was still largely submerged but had adjusted its position a few times.

Spotlight searching was done on four damp misty nights with occasional showers. At the lower Mangatutara site a total of 39 weta were observed in 20 person/hours spent on night searching, resulting in a "catch rate" of 2.0 weta per person-hour. These moist night conditions seemed to be ideal and were certainly more productive than clay searching, which yielded about 0.4 weta per person-hour at the same locality. Observations on Middle Island have shown that the Mercury Island tusked weta does not venture out in dry weather, prefering to wait until rain occurs. Raukumara weta were usually seen singly at night, but on two occasions three adults were found within a 10 cm radius on fairy grass: first two females and a male, then the next night at the same place, three females. They were not interacting or making direct contact at the time they were disturbed. (Note: for unobtrusive night observations it is essential to use night vision equipment, which was not available on this field trip.)

As with the other tusked weta species in New Zealand, both males and females of the Raukumara weta will readily adopt a threat posture in which the front of the body is raised off the ground so that the front legs are held high above the head and the jaws gape widely. This threat posture lasts only a few seconds before the weta returns to its normal stance. The same posture occurs in the ground weta group. In both tusked and ground weta it is associated with their head-toward-entrance-hole orientation in refuges. This orientation toward intruders contrasts with tree and giant weta, which enter their

refuges head-first, thus confronting their intruders with a formidable array of large spines on the rear tibia.

Fighting has not been observed in males of the Raukumara weta, but we can rest assured that it happens. Based on knowledge of the Mercury Island tusked weta, it is likely to be associated more with defending a good refuge than with settling an issue over a female. Stich antagonism over defence of refuges indicates that perhaps the refuges are of great significance in terms of attracting females for mating

7. Conservation status

Since its discovery, Raukumara tusked weta have been found at ten distinct localities spanning a distance of about 145 km through the ranges behind the Bay of Plenty (map). All sites seemed to have reasonable numbers of the species, with a total of 140 being seen to date. When one considers the total extent of possible habitat over this range, it is clear that the species cannot be regarded as a conservation worry at present.

Tusked weta were found in ten different first- or second- order streams during the Raukumara survey out of a total of about 18 streams or seepages investigated. Negative results could, in most cases, be explained by lack of the appropriate habitat features, once an understanding of the requirements for the weta had been grasped.

As mentioned above, night spotlighting in favourable habitat produced a catch rate of about 2 weta per person/hour. This indicates the weta is considerably more abundant at these sites than is the case with many other weta populations studied by this method. For comparison, during night searching near the lower Mangatutara Hut only four individuals of the common Auckland tree weta *(Hemideina thoracica)* were seen during the 20 person/hours of search time on this trip. Admittedly, the search was concentrated on the ground, but vegetation was also diligently examined.

Conservation status depends on the ability of a species to survive in today's environment with its habitat modification and alien predators. The fact that the Raukumara tusked weta is a mainland large-bodied species that was not discovered until the 1990s is surely enough evidence that it is a survivor! The present survey has confirmed this view.

8. Management issues

In the past, native predators of tusked weta in the Raukumara Range would have included kiwi and owls by night and perhaps huia and saddleback by day. These birds have suffered more than their insect prey from the impacts

of human invasion, with the net result that today, with the exception of morepork, the weta population has been essentially freed from native predators. However, to counter this relief, we now have a new suite of warm blooded, olfactory predators. The areas occupied by tusked weta in the Raukumara Range are infested with a number of alien predators. Ship rat is common, but apparently Norway rat, which is more at home in and near water, is not (Chris Ward, pers.comm.). The "semi-aquatic" riparian behaviour of this tusked weta might be a critical factor, allowing it to escape serious attention from ship rat by washing odours from its body and avoiding the hunting territory of this rat.

Other alien predators were observed, in particular feral cats, stoat, possum and pigs. Any control operations for these mammals would clearly benefit the weta populations but are not essential for their survival.

The status of alien weeds in the stream beds is perhaps more cause for concern. Buddleia *(Buddleja davidii)* and Himalayan fairy grass were common in the main riverbed and have the potential to occupy bare shingle areas beside streams. Both grow in the stream bed where the majority of our survey took place and both were used by the weta for perching at night along with native tutu. If, in time, these introduced plants increase to choke the eroded stream beds and reduce light levels, there might well be a negative impact on tusked weta populations due to the loss of what appears to be their favoured habitat. This situation will have to be monitored and, if necessary, control options must be considered.

Initially, it was thought that information from the Raukumara tusked weta might assist in the management of Merury Island tusked weta, since these two are thought to be each others nearest relatives. However, the contrast in their water relations, with one living in riparian zones alongside streams in a high rainfall area and the other on a small island with no free water and which suffers long droughts, indicates that their habitats have little in common. On the other hand, a study of the breeding biology of Raukumara weta could help with the captive rearing programme for Mercury Island weta, simply because it is more readily available.

9. Future action

While it is refreshing to find a brand new species of large-bodied invertebrate and, what is more, to find also that its population is in such good shape in spite of the diversity of predators in its habitat, there are no grounds for complete complacency.

The most urgent action is to make staff and visitors aware of the weta and to encourage searches for it in new areas. More finds are inevitable along the "transect line" of the present discoveries as people who know what to look for explore streams that drain into major rivers behind the Bay of Plenty. Discoveries in areas outside this `high liklihood' zone will be more exciting. For instance, does it occur further south in Te Urewera National Park; or in streams

closer to the coast? Does its distribution extend further to the east on the Raukumara Range?

Less urgent, but no less important, is to have a longer-term monitoring programme in place to check the known areas every five years or so for continued evidence of satisfactory populations and to keep an eye on the spread of weeds and predators. Complications are that expertise of observers will vary, and numbers seen will depend on weather, time of year, and method of searching. Night spotlighting in mild damp misty weather will probably be the most rewarding and consistent method.

From a research point of view, there could be some wisdom in persuing captive rearing of this species as mentioned above, with the purpose of establishing methodology that can be applied to the critically vulnerable Mercury Island tusked weta. There is also a need for genetic study to confirm the relationships proposed here. An extended genetic investigation of tusked weta in Australia, South Africa and New Zealand could provide backing for the special status of these weta in relation to other types of stenopelmatid weta. Dr Anne Gerber, University of Arizona, has material for DNA analysis of the three New Zealand tusked weta but no results as yet. Dr Mary Morgan Richards, Otago University, is following up Anne's study and has material of all three New Zealand tusked weta for analysis.

10. Acknowledgements

I am grateful for the high level of interest shown in this weta by staff of the Department of Conservation at Opotiki and Gisborne following its discovery. The Department and the Internal Research Committee of Victoria University funded the field trip into the Motu catchment. Amongst the many people involved, the following deserve special mention for enabling us to learn so much about this hitherto unknown insect in such a short time: David Rush (DoC) for finding it; Bruce Bancroft and Pete Shaw (DoC) for locating weta in the Ikawhenua Range and reporting on their habitat; Dave King and Chris Ward (DoC) for organising the Motu trip; Mary McIntyre and Mary Morgan Richards (VUW) for collaborating with field work and research.

11. References

Dale, P.S. 1967. *Wetanema hula* n gen et sp., a nematode from the weta *Hemideina thoracica* (White). *New Zealand journal of science 10(2):* 402-6.

Johns, P.M. 1998. The Gondwanaland weta: family Anostostomatidae (formerly in Stenopelmatidae, Henicidae or Mimnermidae): nomenclatural problems, world checklist, new genera and species. *Journal of Orthopterra research. 6:* 125-138-

McIntyre, M. E. 1998. Raukumara tusked-weta: Field and captive observations. *Conservation advisory science notes no. 219.*

1. **Face View:** how far apart are the antennae?

..... almost touching the bases

CAVE WETA

..... separated by about the thickness of the antenna base

GO TO 2

2. **Hind Legs:** spines on tibia:

..... about 5 pairs of very heavy spines

TREE WETA

more than 5 pairs of small spines with cluster of much longer spines at outer end

GO TO 3

3. **Front legs:** tibia with forward facing spine

..... without "ear"

GROUND WETA

..... with "ear"

TUSKED WETA

Fig. 1 Pictorial key to the types of weta found in New Zealand.

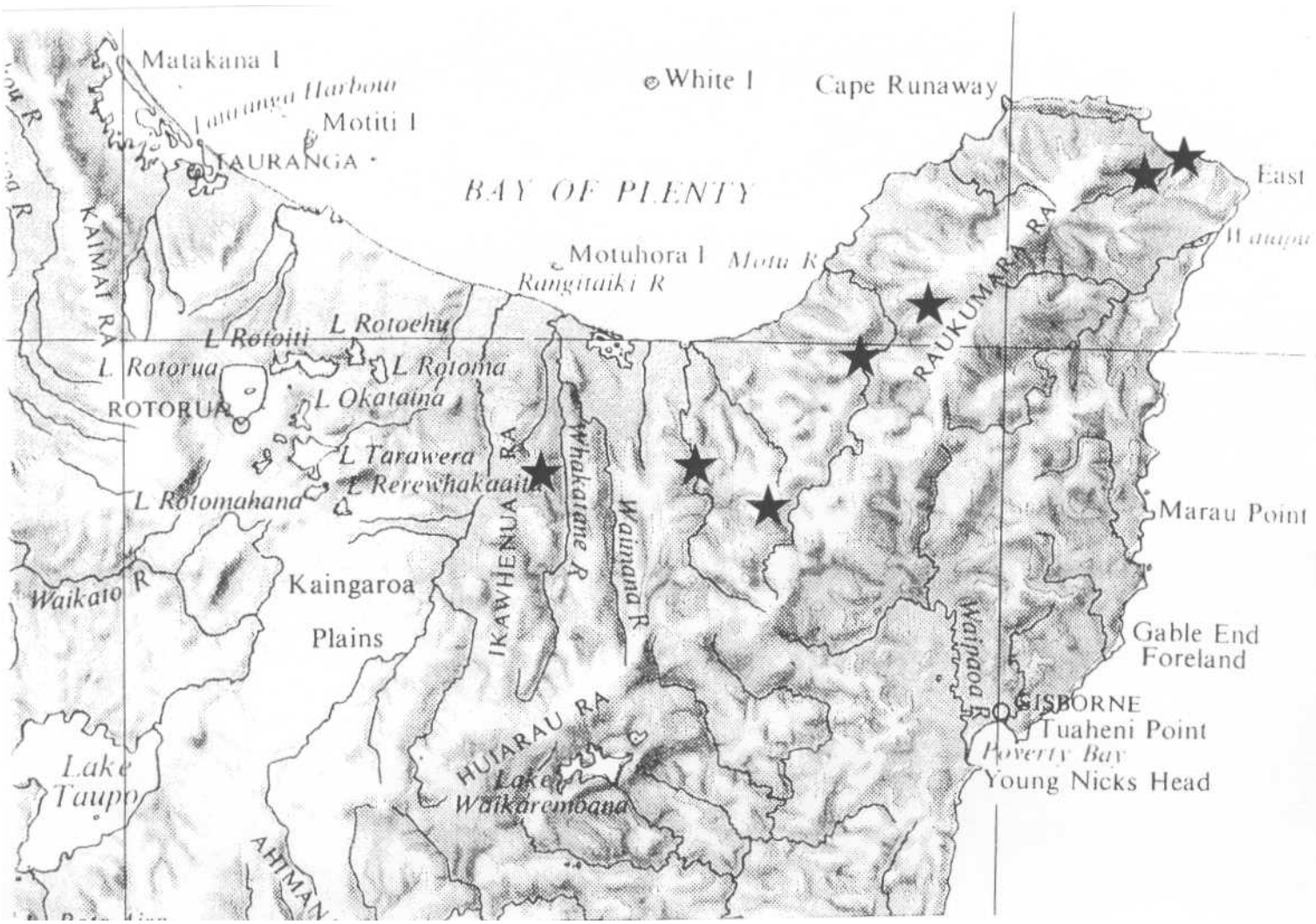

Fig 2. Collection localities of Raukumara tusked-weta, August 1995-December, 1997

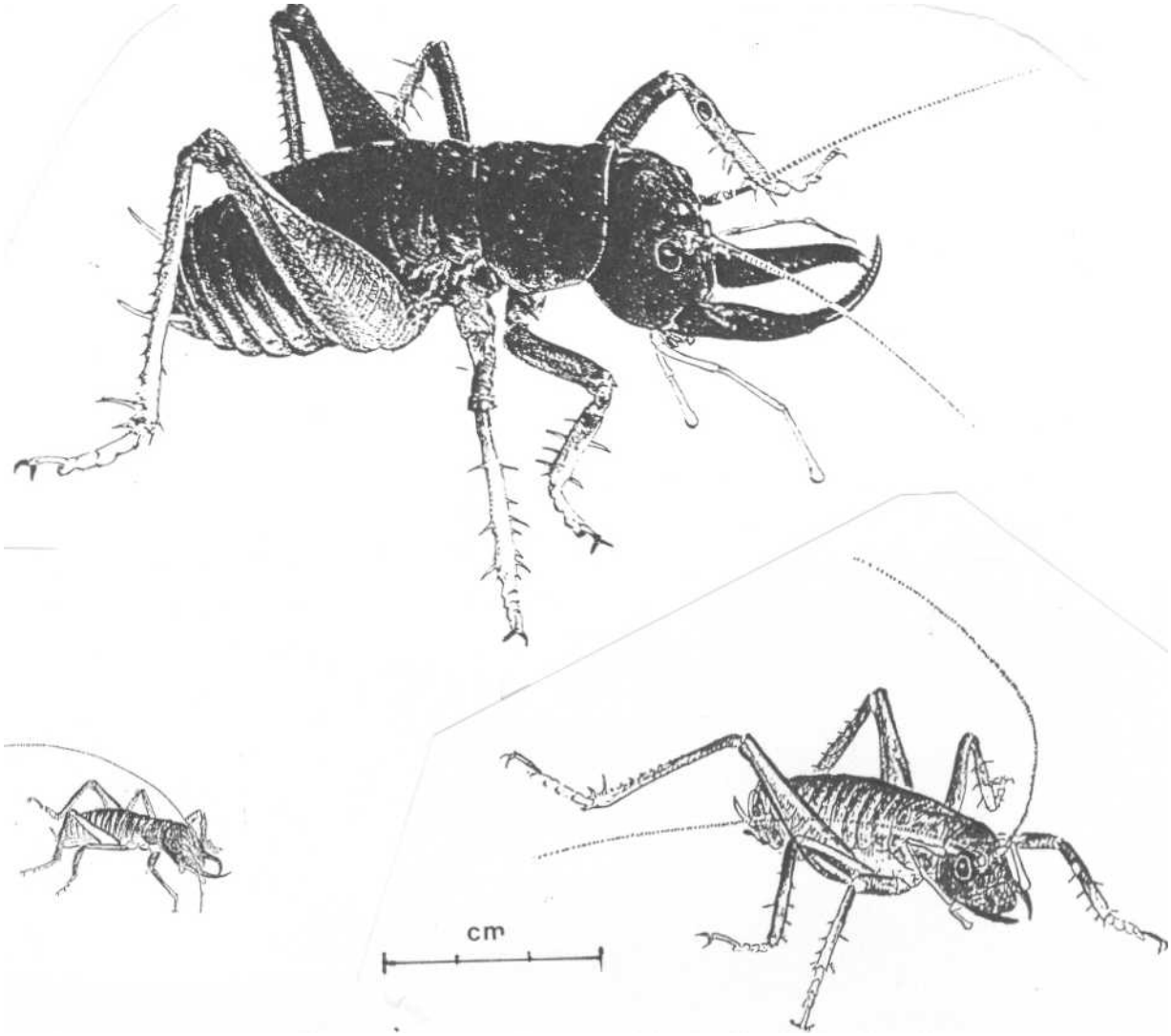

Fig. 3 Males of the three North Island species of tusked weta drawn to scale. Mercury Island species (*Motuweta isolata* Johns 1998) above; Northland tusked weta (*Hemiandrus monstrosus* Salmon 1950 = *Anisoura nicobarica* according to Johns, 1998) to left; Raukumara species to right. Scale 3 cm.

Continue to next file: casn218a.pdf