

Threatened Weta Recovery Plan

THREATENED SPECIES RECOVERY PLAN NO. 25

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Cover photo: Middle Island tusked weta (*Motuweta isolata*) from Middle Island, Mercury Islands group. Photo by E. Humphries, from the Department of Conservation Collection, Wellington.

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Recovery Plans

This is one of a series of recovery plans published by the Department of Conservation. Recovery plans are statements of the Department's intentions for the conservation of particular plants and animals for a defined period. In focusing on goals and objectives for management, recovery plans serve to guide the Department in its allocation of resources and to promote discussion amongst a wider section of the interested public.

After preparing a technical report which was refined by scientists and managers both within and outside the Department, a draft of this plan was sent to the relevant boards and authorities for comment. After further refinement, this plan was formally approved by the Regional General Manager, Central in December 1998. A review of this plan is due after five years, or sooner if new information leads to proposals for a significant change in direction. This plan will remain operative until a reviewed plan is in place.

The Department acknowledges the need to take account of the views of the tangata whenua and the application of their values in the conservation of natural resources. While the expression of these values may vary, the recovery planning process provides opportunities for consultation between the Department and the tangata whenua. Departmental Conservancy Kaupapa Atawhai Managers are available to facilitate this dialogue.

A recovery group consisting of people with knowledge of weta and an interest in their conservation has been established to review progress in the implementation of this plan and to recommend to the Department any changes which may be required as management proceeds. Comments and suggestions relating to the conservation of weta are welcome and should be directed to the recovery group via any office of the Department or to the Biodiversity Recovery Unit.

1. Introduction

Weta are large-bodied Orthoptera belonging to the Families Anostomatidae (formerly Stenopelmatidae) and Rhaphidophoridae, and are endemic to New Zealand. They have become icons for invertebrate conservation in New Zealand because many species are threatened or endangered. One feature of weta conservation is the lack of basic information on distribution, abundance and ecology of most threatened weta. Therefore a major objective should be gathering information about individual species. Other objectives are: to develop reliable monitoring techniques; to implement management programmes; and to increase public awareness and appreciation of these endemic insects.

This plan is an evolving document, as illustrated by the recent discoveries of new species. Since 1991, five new species of giant weta or tree weta have been discovered, e.g., *Hemideina trewicki* (Morgan-Richards 1995). New species such as *H. trewicki* may deserve inclusion in future editions as information is obtained on their distribution and abundance. These discoveries also point to the need for further survey work, preferably in conjunction with biosystematic research, and the need to update the plan as required.

Weta were protected under the Seventh Schedule of the Wildlife Act 1953. Many of the giant species are protected (*Deinacrida carinata*, *D. fallai*, *D. heteracantha*, *D. rugosa*, *D. parva*, *D. tibiospina*) as is the Banks Peninsula tree weta *Hemideina ricta*. For other species, there are no restrictions on handling, collecting, or any other form of interference with weta, unless they occur on land which requires a permit for collecting (e.g., National Park, Scenic Reserve).

1.1 THE PLAN

This Recovery Plan presents a programme for the conservation of threatened weta for at least five years. It is designed as a “primer”—an initial guide for a recovery group which can be modified as new priorities emerge, as a result of new information and successful management. All recognised species of threatened weta are included because many share similar conservation problems and require similar management actions.

Chapters 1 to 7 of this plan contain general information on threatened weta, identify management and research tasks applicable to all species, identify species priority, and describe the purpose and function of the recovery group. Chapter 8 provides an overview of each weta species, including description, ecology, and threats faced. It also identifies specific conservation tasks which require implementation. This is not intended as a comprehensive technical document covering all weta. Information pertinent only to the management and conservation of each species has been recorded.

1.2 SUB-ANTARCTIC ISLANDS

Weta from the sub-antarctic islands (*Eschyroplectron isolatum* from the Snares and Bounty Islands, *Denodroplectron aucklandensis* from the Antipodes and Auckland Islands, *Notoplectron campbellensis* from Campbell Islands), and from the Kermadec and Chatham Islands are not included in this plan because so little is known about their ecology, biosystematics, and/or their conservation status. Conservation management of sub-antarctic island species clearly needs to be embodied in the management plans for the islands where they occur (or Department of Conservation Conservancy Management Strategies).

On the Antipodes Islands, mice (*Mus musculus*) are likely to prey on weta on the main islands. Weta may also occur on the mouse-free outlying islets. A large scale eradication of mice from the main islands may be impractical in the foreseeable future. The Bounty Islands are low lying, with little vegetation and no soil. The islands are being heavily eroded and weta resident there are threatened by the continuing disappearance of suitable habitat. However, translocation of weta outside of their natural biogeographic distribution is still the subject of debate. A policy resolution is needed before any action can be taken. It is likely that the ultimate protection of this species will rely on translocation. In the meantime, the establishment of a captive population may provide insurance against dramatic decline in populations, at least in the short term.

2. Taxonomy

Weta are large bodied, slow moving insects. They belong to the large Order Orthoptera which also contains grasshoppers, locusts, crickets, and katydids. There are over 70 species of weta in New Zealand, all of which are endemic, and 16 of these species are considered threatened. The word “weta” is abbreviated from the Maori term “wetapunga”, the name given to the giant weta which were once present in Northland. West Coast Maori described *Hemideina broughi* and *H. crassidens* as “taipo”. Europeans used the word “weta” nearly 70 years ago as a generic name for cave weta.

Many of the original descriptions of weta species were made from single specimens, or from specimens from a single locality. With an increase in our knowledge of the distribution of weta and in the number of specimens collected, it has been shown that there is a good deal of morphological variability within species. Genetic analyses have shown that although “species” like the Cook Strait weta (*Deinacrida rugosa*) and the Kaikoura weta (*D. parva*) are morphologically and ecologically distinct, genetically there is little difference between them. Morphological and genetic techniques were combined in a Victoria University study, which showed that the relatively common South Island scree weta, *Deinacrida connectens*, is genetically similar throughout its range despite a great deal of morphological variation.

There are two distinct families of weta: Stenopelmatidae or Anostomatidae (which includes the tree weta, ground weta, and giant weta); and Rhabdophoridae (which includes the cave or jumping weta). Biosystematics of weta are still being developed, as some species have yet to be described. Some existing classifications are being reviewed through on-going research (see Appendix 2 for list of species). A review of the North Island weta of the genera *Deinacrida*, *Hemideina*, and *Hemiandrus* is currently being prepared by G. Ramsay (associate researcher with Landcare Research) and Peter Johns (Zoology Department, University of Canterbury).

3. Distribution and causes of decline

Little is known about the distribution of weta before recent times. Weta were not recorded among the insects collected during Cook's voyages to New Zealand. A giant weta and a tree weta from forests in Northland were first described by Adam White in 1842 during the voyages of H.M.S. *Erebus* and H.M.S. *Terror*. Information on their distribution and population decline has been poorly documented. Formerly, wetapunga (*Deinacrida heteracantha*) was a more abundant species and was frequently found in and around the forests north of Auckland, and on Great Barrier Island (Buller 1867), whereas now they are restricted to Little Barrier Island. The Cook Strait weta (*D. rugosa*) is another species which was once common on mainland New Zealand (first recorded from Wanganui, Buller 1895), and is now confined to offshore islands. The decline of most giant weta can probably be attributed to three major causes: the introduction of mammalian predators; habitat destruction by humans; and modification of habitat from browsers.

Introduced mammalian predators include kiore (*Rattus exulans*), Norway rat (*R. norvegicus*), ship rat (*R. rattus*) and probably possums (*Trichosurus vulpecula*), mustelids (*Mustela* sp.), cats (*Felis catus*) and hedgehogs (*Erinaceus europaeus*).

Weta have evolved alongside native predators which include birds, reptiles and bats. However, the introduction of mammalian predators has resulted in a sharp increase in the rate of predation (Moors *et al.* 1989) which has been detrimental to populations of many weta species. Some exceptions to this include:

- The tree weta which shelter in galleries within standing timber, and are largely out of reach of rodents
- Wetapunga on Little Barrier Island which probably avoided kiore predation by living in trees which kiore are reluctant to climb
- The Mahoenui giant weta which have avoided predation by hiding in dense gorse foliage (Sherley and Hayes 1993)
- Weta with alpine distributions in the South Island where rodent numbers have been reported as low (Sherley 1989).

The Mahoenui weta (*Deinacrida* n.sp.) has declined markedly over the past decade in tawa (*Beilschmeidia tawa*) remnant forest patches. This is most likely a consequence of modification of the understorey by introduced browsers (Sherley and Hayes 1993).

Other "natural" mortality factors are known to exist which result in large numbers of dead or dying weta. In particular, large numbers of dead *Deinacrida parva* are periodically discovered in rock pools along stream beds in the Mt Fyffe region in the Seaward Kaikoura Range. Apparently parasitic worms are associated with their deaths, but the impact of these worms on weta populations is still unknown (Meads 1989b).

4. Ecology

Weta are generally nocturnal and occupy a variety of habitats including grassland, shrubland, forests and caves. They either excavate holes under stones, rotting logs or in trees, or occupy pre-formed burrows. Male tree weta may develop extraordinarily large heads, a phenomenon assumed to be related to defence of galleries and harems, although this remains untested. Juveniles may jump away to avoid danger whereas adults raise their spiny hind legs towards the source of aggression (Sherley pers. obs.). Weta are mainly herbivorous in the wild but are also known to eat insects (Barrett 1991). Most weta have protracted annual cycles with various ages present at all times of the year (Ramsay 1978, Sherley and Hayes 1993).

4.1 GIANT WETA (*Deinacrida* spp.)

The three northern giant weta — wetapunga (*Deinacrida heteracantha*), *D. fallai* and the “Mahoenui” weta (*Deinacrida* n.sp.) — are all arboreal but do venture to the ground at least for oviposition. On Little Barrier Island, wetapunga have been found on pohutukawa (*Meterosideros excelsa*), epiphytes, nikau palm (*Rhopalostylis sapida*) and ponga (*Cyathea dealbata*). Their arboreal behaviour has been successfully observed using radio telemetry (Mary McIntyre pers. comm.). This habitat use has obvious implications for survey work in future.

The Cook Strait giant weta (*Deinacrida rugosa*), the Kaikoura weta (*D. parva*), and the Herekopare weta (*D. carinata*) occur in grasslands, low-growing shrubs, clearings and forest margins. The Nelson alpine weta (*D. tibiospina*) lives in sub-alpine tussock and herbfields (Meads 1989a). *D. parva* occurs from low altitudes to at least sub-alpine forest (Meads 1989b, Sherley pers. obs.). On the Cook Strait islands *D. rugosa* are found in tauhinu scrub (*Cassinia leptophylla*), rank grass and low wind swept and tangled *Coprosma propinqua*. During the day, these weta hide in dry sites close to the ground, among the tangle of vegetation and dead leaves that accumulates at the bases of the plants. *D. rugosa* emerge soon after dusk to feed on a wide variety of nearby shrubs, weeds and grasses, and are especially attracted to flowers. Like other giant weta, they are thought to be primarily vegetarian, and invertebrates only form a minor part of their diet.

4.2 TREE WETA (*Hemideina* spp.)

Adult tree weta are variable in body length, with *Hemideina crassicururus* reaching between 60 and 85 mm in length, and *H. broughi* up to 90 mm. Tree weta living below the alpine zone typically live in galleries created in trees and shrubs of forested areas (Barrett 1991). The galleries are thought to have originated through burrowing larvae of moths and beetles. After the larvae have

departed, the weta apparently excavate the holes to form galleries. The galleries are frequently large enough to accommodate an adult male and a group of females. The male aggressively defends the harem against other males by defending the entrance to the gallery (Field 1993). Egg laying occurs in the ground, but the rate of egg and instar development in the wild is unknown. Tree weta are thought to be omnivorous (Barrett 1991).

4.3 GROUND WETA (*Hemiandrus* spp.)

The taxonomy of this group is being revised (P.M. Johns pers. comm.). It includes species which differ markedly from each other in body size. Males of some species also have tusk-like extensions to their lower mandibles, one — *Hemiandrus monstrosus* — is from 20 to 25 mm long and occurs on the mainland, north of a line between Waipoua and Whananaki. This species may be found either on the ground or in galleries in trees (Bellingham 1991), although most other species live in burrows dug into the ground, and occur at all higher altitudes (including on offshore islands).

In 1996 a new species of tusked weta was discovered in the Raukumara ranges, living on the edges of water courses. The conservation status of this species has not been established, but the discovery infers that further mainland surveys could well reveal other new species of large-bodied weta (see Appendix 1).

4.4 MIDDLE ISLAND TUSKED WETA (*Motuweta isolata*)

One newly described species of tusked weta (*Motuweta isolata*, Johns 1997) is a large species about 55 mm long. It occurs on Middle Island in the Mercury Islands group. This is a monotypic genus, the Middle Island tusked weta being its only member.

4.5 CAVE WETA (FAMILY RHAPHIDOPHORIDAE)

In contrast to their name, cave weta are mainly forest species which occupy dark, damp, cool spaces that have ready access to the outside for foraging at night, and possibly for oviposition. They may often gather in large numbers in these shelters during the day. Females lay eggs in the ground and what is known of their life history is mostly described in Richards (1954, 1961). Cave weta are best known for their exceptionally long hind legs in comparison with the rest of the body. For example, *Gymnoplectron giganteum* from the Poor Knight's Islands may reach 450 mm (including the hind legs and antennae). Females often have disproportionately large scimitar shaped ovipositors. Both sexes display distinctive body markings in some species.

5. Species recovery

5.1 MANAGEMENT AND RESEARCH TO DATE

5.1.1 Giant weta

“Mahoenui” giant weta (*Deinacrida* n.sp.)

- Annual monitoring of the main population and mainland founder populations is in place.
- Research has been completed on habitat use, life history, dispersal and reproductive biology.
- Captive rearing techniques have been developed and captive reared weta have been used for establishing founder populations.
- Introductions have been made at three mainland sites and on Mahurangi Island.

Wetapunga (*Deinacrida heteracantha*)

- A survey to assess conservation status of wetapunga has been completed although the results are equivocal.
- Research has been initiated on the habitat use and potential for recovery of the species following kiore eradication.

Cook Strait giant weta (*Deinacrida rugosa*)

- A self-sustaining and expanding population has been established by translocating weta from Mana Island to Maud Island.
- Transfer of weta from Mana Island to Somes Island was initiated in 1996.
- Captive breeding techniques have been developed.
- Field research on dispersal behaviour and habitat use has been completed.
- Mice (presumed to prey on weta) have been removed from Mana Island which is considered to be the species stronghold.

***Deinacrida parva*, *D.* “Mt Cook”, *D.* “Bluff”, and *D.* “Mt Faraday”**

- Surveys of the Main Divide, Seaward Kaikoura Ranges (for *Deinacrida parva* and *D.* “Bluff”), Mt Somers (*D.* “Bluff”) and Mt Faraday in the Paparoas have been completed (Gibbs and Richards 1994, Meads and Notman 1992b, 1995c).
- The conservation status of *D.* “Mt Cook”, *D.* “Bluff”, and *D.* “Mt Faraday” is still uncertain.
- Genetic comparisons of *Deinacrida* “Bluff” and *D.* “Mt Faraday” with other giant weta have found that the “Bluff” and “Mt Somers” weta are the same species, and while the “Mt Faraday” weta is distinct from all others, it is most closely related to the “Mt Somers” weta (Richards 1995).

Herekopare (or Foveaux Strait) giant weta (*Deinacrida carinata*)

- Surveys of Herekopare and Pig Islands have been completed (Meads and Notman 1995a).

Poor Knights giant weta (*Deinacrida fallai*)

- Surveys of the Archway Islands in the Poor Knights group found signs of weta presence in 1996.
- This species has been successfully bred in captivity at Wellington Zoo, and is also used there for public education.

5.1.2 Tree weta

Banks Peninsula tree weta (*Hemideina ricta*)

- A survey of Banks Peninsula has been completed and the conservation status and biosystematics of the species has been clarified (Morgan-Richards and Townsend 1995).
- Research on habitat use has been completed (Brown and Townsend 1994, Townsend 1995).

5.1.3 Tusked weta

Middle Island tusked weta (*Motuweta isolata*)

- Captive breeding has been successful at one insectarium.
- Field research on their life history and behavioural ecology has been completed (Mary McIntyre pers. comm.).
- Field research on habitat preferences and breeding ecology has started (1998).

Northland tusked weta (*Hemiandrus monstrosus*)

- Recent discoveries have been recorded and informal surveys have been conducted. Although information on the distribution and abundance of this species is incomplete, it has clarified the conservation status of the species.

5.2 POTENTIAL FOR RECOVERY

Invertebrates generally respond well to management because they have an intrinsically high potential rate of productivity compared with vertebrates. Many weta are flexible with respect to their habitat requirements, for example the Mahoenui giant weta has adapted to living exclusively in a community of introduced plant species. Invertebrates also require smaller areas to survive than vertebrates do, and they can persist in tiny fragments of original or modified habitat. The implications of this aspect of their ecology in terms of management are:

- Management of sufficient areas of habitat to sustain a species is affordable
- The identification of representative areas for protection must recognise the difference in scale that invertebrate conservation can entail.

Invertebrate species lend themselves to captive breeding programmes and subsequent re-introductions into the wild because of their high productivity, short generation times, and their ability to be manipulated (Sherley 1994). Protocols and methods of captive rearing for many types of insects are well established within the agricultural industry, particularly where there is biological control of invertebrate pests. The benefits of captive breeding for

conservation management include providing progeny for the establishment of new populations, and providing detailed knowledge of the ecology of weta species which is often difficult to obtain in the field.

5.3 SPECIES PRIORITIES

Molloy and Davis (1994) rank the priority of New Zealand's threatened species for conservation action. The ranking system is based on criteria which include taxonomic distinctiveness, population size and numbers, geographic distribution, and the rate of population decline. Threats to the species (which might include habitat modification and impact of predators) are also used as ranking criteria.

5.3.1 Conservation status

The following weta are listed in the A, B, C, and I categories of Molloy and Davis (1994). They are ranked here in order of greatest urgency for management action, as assessed by the Recovery Group:

Urgent recovery work

- A Middle Island tusked weta (*Motuweta isolata*)
- B Wetapunga (*D. heteracantha*)*
- B Central Otago ground weta (*Hemiandrus* sp.)

Short term recovery work

- C "Mahoenui" weta (*Deinacrida* n.sp.)
- B "Mt Faraday" giant weta (*Deinacrida* n.sp.) Listed as *D. "talpa"* in Molloy and Davis (1994).
- B Banks Peninsula tree weta (*Hemideina ricta*)
- C Northland tusked weta (*Hemiandrus monstrosus*)

Medium term recovery work

- B(L) Poor Knights cave weta (*Gymnoplectron giganteum*)
- C(L) Poor Knights giant weta (*D. fallai*)

Species about which little is known

- C Herekopare (or Foveaux Strait) giant weta (*D. carinata*)

Low priority — species secure in the medium term

- C Nelson alpine giant weta (*D. tibiospina*)
- C Cook Strait giant weta (*D. rugosa*)
- C Kaikoura giant weta (*D. parva*)
- B "Bluff" (= "Mt Somers") giant weta (*Deinacrida* n.sp.)
- I "Mt Cook" giant weta (*Deinacrida* n.sp.)

5.3.2 Status of unlisted weta

Not listed in Molloy and Davis (1994), but considered to be threatened:

- "Raukumara" tusked weta (Anostomatidae n.sp.) (see Appendix 1.)

* Recent surveys indicate that the single population of this species on Little Barrier Island may have declined in recent years due to kiore (*Rattus exulans*) predation (Dr George Gibbs pers. comm.).

(L) Not perceived as currently under threat, Molloy and Davis (1994).

6. Options for recovery

Option 1. Do nothing

Under this option some mainland populations may well continue (e.g., some populations of *Deinacrida parva* and “Raukumara” tusked weta), and most island populations will remain abundant. However, some populations could become extinct (e.g., *Deinacrida heteracantha*, Central Otago ground weta).

Option 2. Management of selected populations and their habitats

This would involve the rehabilitation of vegetation, predator control or eradication, establishment and implementation of fire control plans, and regulation of visitor access where necessary. Examples of priority populations could include; populations with a high degree of genetic or morphological variation, those that are the only remaining population of a species, populations which are important from an ecological perspective, or populations which are important numerically. This could lead to the extinction of some populations, but the species as a whole would be secure.

Option 3. Management of all populations and their habitats

This would involve the same actions as required for Option 2, but greater management input, and hence cost, would be involved due to the incorporation of all populations. This option would result in the majority of populations surviving and increasing in the long term — assuming the costs of this option could be afforded. If not, then there would be a high chance of this option failing.

Option 4. Establishment of multiple populations of each species

This would involve translocating weta populations to additional suitable sites, either on islands or the mainland, but preferably within the species’ known or likely historical range. For mainland translocations, management of the sites may be necessary to maintain the species. Weta for translocation would be obtained either by harvesting source populations or using captive reared weta. This option would require detailed preparatory research on (1) the best methods to use; (2) intensive post-translocation monitoring and probably follow-up re-introductions; and (3) undesirable impacts on existing biota in accordance with translocation protocols in the Department of Conservation’s translocation protocols policy. Practical problems also beset this option such as the extreme difficulty in finding translocated weta in low densities. In theory, the translocation option would ensure the long-term survival of all taxa.

FOR THE DURATION OF THIS RECOVERY PLAN, OPTIONS 2, 3, OR 4, WILL BE USED, INDIVIDUALLY OR IN COMBINATIONS, TO ENABLE THE LONG-TERM GOAL TO BE ACHIEVED FOR EACH SPECIES.

7. Recovery strategies

7.1 GOALS AND OBJECTIVES

7.1.1 Long term goal

Goal is to maintain all Category A, B, C species (Molloy and Davis 1994) and new species which qualify as threatened, in multiple self-sustaining populations.

7.1.2 Objectives

The following objectives are applicable to most species of weta in Categories A, B, C and I (indeterminate—not enough known to rank in A, B or C categories). Not all objectives will apply universally and there will be differences in priority accorded to each objective depending on the species being managed. Chapter 8 of this plan lists the specific tasks required to achieve the objectives for each species.

Objective 1. Determine the taxonomic and conservation status of all weta species in Category A, B, C, and I

Explanation: It is essential to understand the taxonomic distinctiveness of a species before assigning priority to populations for protection. The resolution of taxonomic status can often provide important information on life history, ecology and behaviour, and is a high priority in the conservation of all threatened weta species. Genetic techniques can be used to differentiate between species and subspecies, and genetic comparisons should be undertaken as soon as possible, in addition to classical taxonomic methods.

Objective 2. Develop standardised techniques for survey and monitoring of the major weta groups

Explanation: Development of a systematic and standardised survey method is required to reliably detect presence/absence and population trends of weta. Weta often occur at very low densities, further complicating efforts to provide reliable information on distribution and abundance of weta, and to enable clarification of their conservation status. Distribution surveys (presence/absence information) are required for most threatened species and should be seen as the minimum information required for decisions on conservation management. Some general guidelines for collection and monitoring are proposed in Appendices 3 and 4.

Objective 3. Co-ordinate the collection of survey and monitoring data

Explanation: Distribution surveys often provide essential and basic information on species' life-history and ecology, and need to be collated, managed and made available as a database at one location both for researchers and managers. This task would ideally be undertaken by the Science, Technology, and Information Services Division. Information provided by the public should also be included in the database, as, for example, sightings reported by the public have led to the discovery of new weta populations. Networking with the public should be encouraged. Efforts to date have resulted in a better understanding of our weta fauna.

If specimens are to be collected for any purpose (such as taxonomy, captive breeding, island transfer, etc.), an assessment of the impact of this activity on the viability of the source population must be made (Appendix 4).

Objective 4. Maintain the present distribution of weta populations

Explanation: It is essential that all known weta populations be maintained within their natural range, even though the biosystematics of many species remains unresolved. For example the currently undescribed “Mt Cook” weta may comprise more than one species, which would significantly alter the conservation status under the Molloy and Davis (1994) classification system.

The ability of a species to recover in the wild, is largely dependent upon the removal of the threat that has placed it in jeopardy. Most declines in weta populations are due to one or both of two factors: reduction or change in their habitat, and greater predation through an increase in existing predator numbers or the establishment of introduced predators.

The reduction of predator and browser numbers is presently being undertaken at many mainland management sites. Management at these sites should be updated to take account of invertebrate conservation requirements. Specific management programmes for weta could include control of predators and browsers, and management of habitat so that suitable refuges are available.

Objective 5. Establish additional populations of threatened or endangered species as a safeguard against further decline

Explanation: It is essential that there are at least four wild populations of each weta species. This can be achieved by transfer of weta to predator-free islands or to ‘safe’ mainland sites. Ideally, translocations should be carried out within the historical range of the species (although this information is lacking for several species). The creation of new combinations of sympatric species should be avoided, because of the risk of compromising other weta species through hybridisation, competition, or some other type of interaction. Currently, there are three common methods of translocation (see Sherley 1994 for examples):

- Direct translocation from an existing population to a new one
- Captive breeding and release of offspring into new habitats
- Translocating weta into an enclosure, allowing them to breed, and releasing the offspring at an optimum age and time of year

A combination of these methods can be used where the threatened population is too small to sustain regular harvesting for transfer, or where the ecology of the threatened population is insufficiently known to allow a risk assessment of over-harvesting the parent population. Criteria for transfers and problems inherent in transfers are discussed by Meads (1994) and Sherley (1994).

Species which occur only on the mainland ideally should be translocated to other protected mainland habitats, where management can be carried out for their benefit (e.g., “Mahoenui” giant weta).

Weta are susceptible to predation by introduced mammals, and by other similarly threatened species (tuatara, saddleback, and most other insectivorous species). The introduction of invertebrate species must be considered early in the development of island management programmes. Transfers of threatened

vertebrates also need to address the effects of these animals on weta and other invertebrate fauna.

Objective 6. Establish captive breeding

Explanation: To ensure against extinction of some threatened weta, it may be necessary to breed weta in captivity (particularly for species where only a single population exists). Keeping weta in captivity is technically relatively easy, however, breeding successive generations requires specialised skills and knowledge (Barrett 1991, and see Appendix 5). The methods, objectives, term and requirements for a captive population will be determined through an approved captive management plan. This will require research on husbandry techniques, to enable captive bred animals to be effectively used for the establishment of new populations in the wild.

Progeny from captive breeding programmes may be used to supplement existing populations or to establish new wild populations, particularly through translocation efforts. Captive breeding will also complement research into wild populations of the species, as it can provide essential ecological information for species management that can be difficult to obtain from wild populations.

Objective 7. Prepare contingency plans against threats to the short-term safety of high risk weta species

Explanation: Contingency plans are required for those species which are represented solely (or nearly so), in one population. These populations are at risk from potentially disastrous events such as invasion by rodents, or destruction of habitat by fire. Moors *et al.* (1989) discuss the requirements for rodent contingency plans for island sanctuaries.

Objective 8. Determine the effects of pest control on weta

Explanation: The use of toxins for controlling or eradicating mammalian pests is increasing, with potential for impacts on some threatened weta taxa. It is essential that the risk associated with secondary poisoning of weta (and their native predators) is known. It may be necessary to provide long-term control of mammals where weta are to be managed on mainland refuges. Research is required into the methods and consequences of long-term pest control (e.g., resistance developing in target mammals, bio-accumulation), and into the minimum levels of pest control required to achieve desired population densities of threatened weta species. Toxins in use which are of immediate concern include anticoagulants and monosodiumfluoroacetate (1080 compound).

Objective 9. Conduct research on weta life history, behaviour and habitat requirements

Explanation: Scientific research will provide baseline information required for management and for methods suitable for survey and monitoring. Research will also help to determine habitat requirements, what the effects of predators and habitat modification are on weta, and the biosystematics of known weta and newly discovered populations.

Objective 10. Promote public interest and involvement in weta conservation

Explanation: Generally, invertebrates have a low public profile. The public profile of weta could be enhanced by making more information (in the form of posters and pamphlets) available for schools and the general public. It is also

important to promote the importance of weta conservation during Departmental business planning.

Advocacy will continue to be an essential part of all weta conservation programmes. The enthusiasm and support shown by the King Country community for the Mahoenui weta is a good example of what can be achieved. Display of weta at the National Wildlife Centre, zoos and other institutions is an effective means of advocating weta conservation. Useful advocacy tools could include: the production of a poster which illustrates threatened weta species; weta boxes (or designs with instructions) for erection in or near school grounds; teaching notes and models of weta for schools; and nocturnal houses to be established at new or existing facilities at Seven Oaks (Paraparaumu), Wellington Zoo, Otorohanga Kiwi House, and Nga Manu Sanctuary (Waikanae).

7.2. RESEARCH AND MANAGEMENT TASKS

- Commission research on monitoring and survey methods for some key species, e.g., *Deinacrida heteracantha*, *D. "Mahoenui"*, Middle Island tusked weta.
- Describe the biosystematics of ground weta (*Hemiandrus* spp.), tusked weta, and giant weta (*Deinacrida* spp.). Recommend any new species for inclusion in the recovery plan as necessary.
- Survey the habitats used by *Deinacrida* "Bluff", *D. "Mt Faraday"*, *D. carinata*, and *D. "Mt Cook"*, and determine conservation status of these species.
- Investigate translocation methods, dispersal behaviour and breeding ecology of translocated giant weta (wild captured and captive bred). "Mahoenui" giant weta could be used as a study species since this work is already underway (Sherley 1994). If a captive breeding programme for Middle Island tusked weta is successful, they may also be suitable for this task.
- Undertake research to ensure that vertebrate re-introductions and/or pest eradications on islands or on the mainland do not compromise weta recovery programmes, especially programmes involving the establishment of new weta populations.
- Undertake captive rearing research to develop husbandry techniques for rearing and breeding endangered species of weta. Captive management should complement translocation and ecological studies on these species.

Many of the above topics could be addressed through generic research into the behaviour, physiology, population dynamics and threats (e.g., predation) of weta. Well planned basic research would serve to underpin many of the management options presently pursued with weta (e.g., captive rearing, translocation). For example, the study species could be one of the more common *Deinacrida* taxa.

A diagrammatic representation of a critical path for recovery plans is shown in Figure 1.

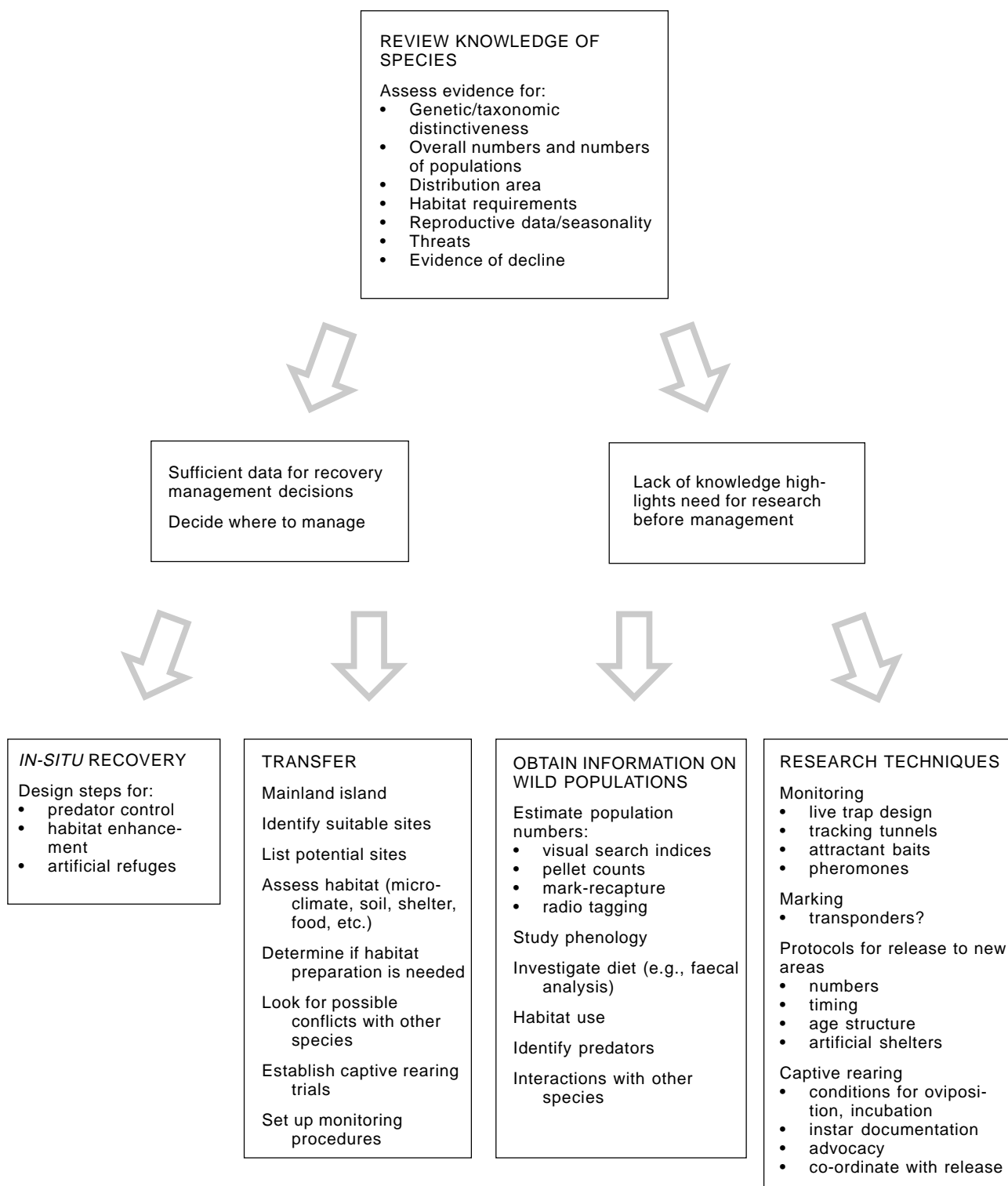


FIGURE 1 A DIAGRAMMATIC REPRESENTATION OF THE SEQUENCE AND THE STEPS TO BE TAKEN WHEN DEVISING WORK PLANS FOR THREATENED WETA.

7.3 RECOVERY GROUP RESPONSIBILITIES

1. Set annual management and research tasks (in priority order) to implement objectives of the Recovery Plan, and make appropriate recommendations to the Department.
2. Assemble new information where relevant, for assessing priorities of the weta recovery plan.
3. Act as a forum for technical recommendations on the direction of the programme, and co-ordinate management, research and publicity tasks.
4. Annually review and report on the progress made toward reaching objectives of the Recovery Plan.

8. Species descriptions

This section summarises the current knowledge of the distribution, abundance, ecology, reasons for decline, and current threats for each species of threatened weta. A brief work plan is described which lists specific tasks required to achieve the objectives for each species. The Recovery Group has listed these tasks in the order in which they should be done. A list of expert contacts is also included. The species are grouped into giant weta (*Deinacrida* spp.), tree weta (*Hemideina* spp.), ground weta (*Hemiandrus* spp.), Middle Island tusked weta (*Motuweta isolata*), and cave weta (Rhaphidophoridae).

8.1 POOR KNIGHTS GIANT WETA (*Deinacrida fallai*)

Conservation status: Currently a category C species (Molloy and Davis 1994) IUCN category VU D2 (World Conservation Monitoring Centre 1998).

Description: The Poor Knights giant weta is a large species, with females measuring up to 73 mm long and weighing 40 g. They are light brown with a line of black markings on the dorsal surface, and black stripes along the flanks. The lower hind legs are dark brown.

Distribution and abundance: This species is restricted to the Poor Knights group of islands. It is common on the two main islands, Tawhiti Rahi and Aorangi. A faecal pellet found on Archway Island was confirmed to be from a giant weta (R. Parrish pers. comm.).

Ecology: *Deinacrida fallai* is primarily arboreal but is frequently seen on the ground. Individuals have a life span of a little over two years and they pass through 10-11 nymphal stages. Egg laying can take place at any time of the year (provided that the ambient temperature is above 10°C), throughout the female's adult life. Eggs are laid in the ground, with between 200 and 300 eggs per clutch. They are probably omnivorous, but mainly rely on vegetation for their nutrition.

Reasons for decline: There is no evidence of a decline in either abundance or distribution of *Deinacrida fallai*. However, the species has never been found alive outside of the Poor Knights Islands. Future information gathered from sub-fossil deposits on the mainland may reveal evidence of a previously wider distribution.

Current threats: The species is preyed upon by a range of indigenous species (e.g., tuatara, lizards and birds). These native predators do not appear to threaten the viability of the weta population. Any future introduction of other insectivorous animals like saddleback could have a deleterious effect, although there are presently no plans to reintroduce such species. Any plans to introduce native species should involve assessments of the possible impacts on giant weta.

The accidental introduction of rodents could seriously reduce or eliminate Poor Knights weta from one or both islands, and would endanger the entire species.

Captive breeding: Richards (1973) kept this species in captivity during her study on their biology. Mike Meads and Paul Barrett (Barrett 1991, 1992) have also successfully bred *Deinacrida fallai* in captivity.

Work plan: A Pest Contingency Plan (especially for rodents) is urgently required for the Poor Knights' Islands; maintain island security at the Poor Knights; investigate the potential for, and feasibility of, increasing the number of populations to four or five by introducing the species to other locations; continue captive breeding for advocacy and research, providing an insurance population as well as assisting in public education.

Contacts:

Mike Meads — Ecological Research Associates of NZ, Upper Hutt.

Richard Parrish, Ray Pierce — Northland Conservancy, DOC

Paul Barrett — Nikau Gardens, Waikanae

References: Richards (1973), Barrett (1991), Barrett (1992)

8.2 WETAPUNGA (*Deinacrida heteracantha*)

Conservation status: Currently a category B species (Molloy and Davis 1994) IUCN category VU D2 (World Conservation Monitoring Centre 1998).

Description: This is the heaviest of the giant weta, with females usually weighing over 40 g when mature, and reaching a length of up to 82 mm. The heaviest recorded weight for a captive female was 71.3 g (Richards 1973). The heaviest adult male kept in captivity was 18 g (Paul Barrett pers. comm.).

Distribution and abundance: Wetapunga were once found in the northern part of the North Island, Great Barrier Island, and Little Barrier Island. The species is now restricted to Little Barrier Island, and adult wetapunga are rarely seen.

Ecology: Wetapunga are nocturnal and arboreal (although it is possible that they are confined to an arboreal habit because of the predation on the ground by kiore), and primarily herbivorous. Predators include kiore, birds and reptiles.

Reasons for decline: The most likely reasons for the disappearance of this species from the Mainland is the introduction of rats. Population declines would have been accelerated through habitat loss and modification. Population numbers on Little Barrier Island also appear to have declined (George Gibbs pers. comm.), probably due to predation by kiore.

Current threats: Continued predation by kiore at night and saddleback by day poses a serious threat to wetapunga. After kiore are eradicated from Little Barrier Island, population trends of wetapunga and of saddleback should be monitored. The accidental introduction of other mammalian pests to Little Barrier Island is a potential threat to the continued survival of this species.

Captive breeding: Mike Meads and Paul Barrett have kept *Deinacrida heteracantha* for conservation and research purposes, and Richards (1973) kept *D. heteracantha* in captivity during a study of their biology. More research on techniques of captive husbandry is required before sufficient numbers could be produced for a translocation programme.

Work plan: Select one or more mammal-free islands for establishment of new populations (the latter work will be contingent on the results of habitat-use research by Drs George Gibbs and Mary McIntyre, Victoria University); establish a captive breeding programme to undertake research on wetapunga life history, and produce animals for the establishment of new populations; assess the risks to wetapunga of toxins used in the eradication of kiore from Little Barrier Island —if the risks to weta are not significant, advocate kiore eradication from the island; investigate the use of artificial refuges/nest boxes where kiore control is not practical; assess the value of Pig Bay, Little Barrier Island, as a refuge for weta following kiore control, and the use of this population as a source of animals for translocations; complete a rodent contingency plan for Little Barrier Island; and determine the range and population size of wetapunga on Little Barrier Island and evaluate whether there are sufficient wetapunga to allow collection for translocation to other islands (e.g., Tiritiri Matangi).

Contacts:

Chris Green — Auckland Conservancy, DOC

Mike Meads — Ecological Research Associates of NZ, Upper Hutt

George Gibbs — Victoria University of Wellington

Paul Barrett — Nikau Gardens, Waikanae

References: Richards (1973), Meads and Ballance (1990), Meads and Notman (1995a, b, and c).

8.3 “MAHOENUI” GIANT WETA (*Deinacrida* n.sp.)

Conservation status: Currently a category C species (Molloy and Davis 1994)

Description: “Mahoenui” weta may be dark mahogany brown, or speckled yellowish brown, and some animals have bright yellow bands. Adult females are between 65–74 mm in length, and adult males are 45–49 mm. Females may weigh up to 15 g and males up to 12 g.

Distribution and abundance: The “Mahoenui” weta is naturally found in two King Country sites, Mahoenui (230 ha) and Otangiwai. Over 200 weta were released at 3 sites on Mahurangi Island in 1993.

Ecology: “Mahoenui” weta are thought to have lived in tawa forest during pre-European times (in epiphytes such as *Collospermum*), but they are now found primarily in gorse bushes. They are nocturnal, arboreal and omnivorous, feeding on vegetation and other insects (see Sherley and Hayes 1993 for further detail).

Reasons for decline: The population has probably declined after loss or modification of habitat, and the introduction of predators. Approximately 100 ha of weta habitat was lost to forestry conversion on private land in November and December 1993.

Current threats: The “Mahoenui” weta habitat is protected (Scientific Reserve, 1992), and has added protection through fire breaks and the Mokau River nearby. There is however, a risk of further loss through destruction or modification of its limited habitat by either deliberate or accidental means. The Otangiwai population is not currently protected.

Captive breeding: “Mahoenui” weta have been bred in captivity for successive generations by Mike Meads (Ecological Associates of NZ pers. comm.) and Chris Winks (Landcare NZ Ltd, pers. comm.). Wellington Zoo is also breeding “Mahoenui” giant weta.

Work plan: Establish additional populations in gorse and gorse/native forest habitats on the mainland and on predator free islands (this should be conducted in accordance with an approved translocation plan); manage the risk of fire to existing habitats including preventing the revegetation of existing firebreaks; continue the production of weta from captive breeding stock, for use in translocations to new populations; re-establish forest habitat in covenanted areas which border the reserve, and prevent the entry of feral and domestic stock; monitor goat numbers in weta habitat at Mahoenui and retain goat population at the historical level of about 200; monitor all populations using a standardised methodology; monitor the effects of biological control agents for gorse (e.g., gorse thrips) which may affect weta habitat; salvage weta where land development, or habitat deterioration is a threat; and liaise with landowners to gain support for ensuring the ongoing survival of the Otangiwai population.

Undertake the research outlined in Sherley and Hayes (1993) including: determine the impact of cattle pugging on weta densities and provide recommendations for management; design release methods for translocated weta, after studying their nocturnal use of habitat and their dispersal behaviour; determine the best release methods for translocated weta which maximise survival and productivity; investigate use of pheromones for monitoring; assess the survival of weta in forest remnants near the reserve and determine methods of habitat management to secure weta in the long-term; continue to survey for weta in the Mahoenui district.

Contacts:

Phil Thomson — Waikato Conservancy, DOC

Paul Barrett — Nikau Gardens, Waikanae

Mike Meads — Ecological Research Associates of NZ, Upper Hutt

References: Barrett (1991), Richards (1994), Sherley and Hayes (1993).

8.4 COOK STRAIT GIANT WETA (*Deinacrida rugosa*)

Conservation status: Currently a category C species (Molloy and Davis 1994, grouped with *D. parva*). IUCN category DD (World Conservation Monitoring Centre 1998).

Description: The Cook Strait weta is light tan to medium brown, with some black markings on the shield. It has five spines on the hind tibia, weighs up to 28 g and can reach 70 mm in length.

Distribution and abundance: *Deinacrida rugosa* is found on five rodent-free islands and two islets in the Cook Strait vicinity; North, South and Middle Trio Islands, Stephens Island, Maud Island, Matiu/Somes Island, and Mana Island. This weta is abundant on Mana Island, and healthy populations are also present on

Stephens and Middle Trio Island. The population on Maud Island was introduced in 1976, and is increasing (Meads and Notman 1992a). *D. rugosa* was introduced to Matiu/Somes Island in 1996.

Ecology: The Cook Strait weta prefers dense grassland and low growing shrubs in open situations. On Mana Island, they now occur in rank grass and shrubland including tauhinu (*Cassinia leptophylla*). Predators include reptiles and birds.

Reasons for decline: Although formerly found on the mainland (type locality near Wanganui) and Kapiti Island, this species is now confined to offshore island habitats due to the introduction of predators and loss of habitat. A dramatic increase in numbers of weta on Mana Island were reported after the eradication of mice (Newman 1994).

Current threats: Accidental introductions of mammalian predators to an island pose a continual threat to the Cook Strait weta populations. Future vertebrate introductions to Mana Island need to consider the possible impacts on giant weta. Other island restoration activities may also affect weta numbers including reforestation (assuming the weta is a shrubland/grassland species).

Captive breeding: This species has been successfully bred in captivity by Paul Barrett and Mike Meads.

Work plan: Maintain island security through the implementation of pest contingency plans (especially rodents); continue research to increase knowledge of *Deinacrida* spp. behaviour; continue to use this species for developing giant weta survey and monitoring techniques (e.g., use of radio-tagging); monitor distribution and abundance of weta populations on offshore islands; and undertake biosystematic research to distinguish *D. rugosa* from *D. parva*.

Contacts:

Colin Miskelly, Raewyn Empson — Wellington Conservancy, DOC
Ian Millar, Mike Aviss, Brian Paton — Nelson/Marlborough Conservancy, DOC
Mary MacIntyre, George Gibbs — Victoria University of Wellington
Mike Meads — Ecological Research Associates of NZ, Upper Hutt

References: Meads and Moller (1978), Beauchamp (1990), Meads and Notman (1992a), McIntyre (1995), Newman (1994).

8.5 NELSON ALPINE GIANT WETA (*Deinacrida tibiospina*)

Conservation status: Currently a category C species (Molloy and Davis 1994). IUCN category NE (World Conservation Monitoring Centre 1998).

Description: This weta is the smallest known species of *Deinacrida*. It weighs about 7 g and females are up to 40 mm in length. Adults are uniform pale or dark brown and have a squat, compressed appearance. The hind femurs have very spiny upper surfaces.

Distribution and abundance: The Nelson alpine weta inhabits sub-alpine tussock and herbfields, and occurs in very low densities within the eastern and central areas of North West Nelson Forest Park. It is currently known from

thirteen widely scattered localities at or above the bushline (Meads 1989a). It appears to be rare throughout its known range.

Ecology: During the day it hides in or under the bases of tussock, thick clumps of *Astelia*, or other plant species.

Reason for decline: It is not known why this species is rare. They may have always been in small numbers throughout their range. Population size may be limited by predators, but there is no direct evidence of this at present, and rats are relatively rare at these elevations.

Current threats: There is potential for Nelson weta to be preyed on by introduced mammals, should these predators penetrate above the bushline. If the Nelson alpine weta naturally occurs at low densities, increased predation from introduced species may place the population at risk.

Captive breeding: A single generation has been successfully bred in captivity by Mike Meads.

Work plan: Undertake surveys of the distribution and abundance of *Deinacrida tibiospina* to clarify their conservation status; monitor several population for effects of predation; undertake research into habitat use and the life cycle of *D. tibiospina*.

Contacts:

Mike Meads — Ecological Research Associates of NZ, Upper Hutt

Ian Millar — Nelson/Marlborough Conservancy, DOC

References: Meads (1989a)

8.6 KAIKOURA GIANT WETA (*Deinacrida parva*)

Conservation status: Currently a category C species (Molloy and Davis 1994, grouped with *D. rugosa*). IUCN category DD (World Conservation Monitoring Centre 1998).

Description: This species of weta is of small to medium size. *Deinacrida parva* is difficult to differentiate from *D. rugosa* at the species level, either by morphology or allozyme gel-electrophoresis analysis (Gibbs and Richards 1994). *D. parva* can be identified by the six spines on the rear tibia, and the pink or red edging on the edge of the thoracic shield. The taxonomic status of *D. parva* and *D. rugosa* is currently being investigated by William Cameron (Victoria University of Wellington). *D. parva* is currently treated as a separate entity for conservation purposes.

Distribution and abundance: Kaikoura weta have been reported from 150 to 1500 m above sea level, in scattered locations ranging from South Marlborough to Hanmer Springs. *Deinacrida parva* is common in parts of the Hapuku and Kowhai catchments near Kaikoura. Populations appear to have declined in some areas to a few individuals.

Ecology: This species is most commonly seen on river flats and scrub margins along forest edges. It is also known to occur on bluffs, in screes, and on stony ground under forest cover. These animals survive under large logs after their forest cover has been felled or burned. Massive die-offs have occurred in larger

populations adjacent to rivers (e.g., in the Kowhai and Hapuku catchments). The die-offs may be associated with a Gordian worm parasite (Meads 1989b, Sherley pers. obs.).

Reasons for decline: Habitat clearance and predation is likely to be significant, especially in lowland areas. It is probable that its range has reduced following human occupation. Predation by rats and other predators is thought to have a significant impact on weta in lower altitude sites. Die-offs associated with a Gordian worm parasite may also be a factor.

Current threats: The species appears to be secure in at least the Kowhai and Hapuku catchments, provided that no major irruptions of predators occur. A number of the populations recorded in earlier times are unlikely to survive in the long-term because of habitat modification. Other weta populations may also be threatened by predators. A Gordian worm parasite may also be a threat.

Captive breeding: *Deinacrida parva* has been successfully bred in captivity (Mike Meads pers. comm.).

Work plan: Survey the distribution and abundance of Kaikoura weta, concentrating on areas away from known populations, and on populations for which data are scarce; establish a monitoring programme for effect of rats on populations in the north branch of the Hapuku River and Kowhai River (upper catchment); and investigate the impact of the Gordian worm parasite on *D. parva* populations.

Contacts:

Mike Meads — Ecological Research Associates of NZ, Upper Hutt
Faith Barber, Ian Millar, Bill Cash — Nelson/Marlborough Conservancy, DOC
George Gibbs — Victoria University of Wellington

References: Meads (1989b, 1990), Whitaker (1991), Gibbs and Richards (1994).

8.7 “BLUFF” (= “MT SOMERS”) GIANT WETA (*Deinacrida* n. sp.)

Conservation status: Currently a category B species (Molloy and Davis 1994).

Description: This weta is an undescribed medium-sized species of *Deinacrida* with exceptionally long slender legs. Their coloration is striking, being dark grey to black on the back, with a reddish wash. The rear of each body segment is edged with white or pale grey which becomes grey and orange on the sides. The thoracic shield is greyish and is tinged with orange. The legs are black and white above, and the femurs are bright orange and black on the underside.

Distribution and abundance: The species is known only from a few widespread sites in the Seaward and Inland Kaikoura Ranges (Meads and Notman 1991), and the Raglan Range area of the upper Wairau River (George Gibbs pers. comm.). Their distribution is likely to be limited by the availability of suitable habitats, therefore some populations may be quite small and isolated. The conservation status of this species is unknown, but it is probably rare, with a restricted distribution in isolated pockets (Sherley 1989).

A giant weta species known from only one sub-adult specimen collected in 1957 from Mt Somers by Mr Val Hunt (preserved in spirits), was thought to be a separate species from the Bluff weta until recently. Surveys by Dr George Gibbs (Victoria University) and Department of Conservation field staff from Canterbury Conservancy have found more specimens from cliffs in the area. These animals appear similar to the “Bluff” weta described above. Genetic research has since shown that the “Mt Somers” (or “mid Canterbury giant weta”) and the “Bluff” weta of the Seaward and Inland Kaikoura Ranges are the same species. It should be noted that there are no official common names for these species as yet.

Ecology: This weta has only been found on stable, deeply-fissured hard-rock outcrops above the treeline (about 1,000 m a.s.l.). These localities are often small and sparsely scattered amongst the usual scree-forming rock in these ranges. The species seeks refuge in rock cracks during the day, and may be sympatric with *Deinacrida connectens* and *D. parva* (e.g., Northern branch of the Hapuku River, Seaward Kaikoura Range).

Reasons for decline: The limited distribution of this weta may be due to its habitat preferences, which appear to be very specific. It is unknown whether its former distribution was wider than at present.

Current threats: No threats have been identified for this species. Small populations may be threatened by catastrophic events such as fire and rodent invasions.

Captive breeding: A male and a female weta were taken into captivity by Mike Meads in 1991, and they form the nucleus of a breeding colony. Offspring have been produced from this colony (Mike Meads pers. comm.).

Work plan: Survey the distribution and abundance of “Bluff” weta; determine whether rats are present in the high-altitude habitats of the Hapuku catchment, the Kahutara Saddle, and Mt Somers areas; if present, establish a monitoring programme to determine the effect of rats on weta populations; formally describe the taxonomic status of the species.

Contacts:

Faith Barber, Ian Millar — Nelson/Marlborough Conservancy, DOC

Euan Kennedy — Canterbury Conservancy, DOC

Mike Meads — Ecological Research Associates of NZ, Upper Hutt

George Gibbs — Victoria University of Wellington

References: Sherley (1989), Whitaker (1991), Meads and Notman (1991), Gibbs and Richards (1994)

8.8 “MT COOK” GIANT WETA (*Deinacrida* n.s.p.)

Conservation status: Currently a category I species (Molloy and Davis 1994).

Description: This giant weta species is of medium size, and has a smooth texture with rich brown colours on all upper surfaces (antennae, head, thoracic shield, body segments and femur). The underside of the body is very pale (almost white), and the spiny parts of the legs are very pale brown.

Distribution and abundance: The “Mt Cook” weta occurs near the tops of the Southern Alps and in western areas which include Mt Alexander, Prices Basin

(head of the Whitcombe River), Mt Cook, Mt Aspiring (head of the Matukituki River) and the Homer Tunnel (Mike Meads pers. comm.). The distribution is patchy but common at favorable sites. The “Mt Cook” weta is found in snow-tussock and tussock/sub alpine shrubland communities where there is plenty of loose rock for cover. They occur in high rainfall mountain basins at an altitude of 700–1400 m.

Ecology: Currently unknown.

Reasons for decline: There is no evidence to suggest that this weta species is in decline, or under any threat, and it appears to be widespread and stable. Up until 1991, the weta was known from relatively few specimens. This was mainly because of the inaccessibility of its habitats and a low search effort. The “Mt Cook” weta is included here as its taxonomic status is unclear, and weta currently considered to be “Mt Cook” weta may, in fact, be several species.

Current threats: Unknown.

Captive breeding: Two pairs are held in captivity (Mike Meads pers. comm.) and eggs have been produced from these animals.

Work plan: Undertake a quantitative survey of the distribution of the “Mt Cook” weta (including alpine areas on the West Coast); and complete a systematic study of the “Mt Cook” weta.

Contacts:

George Gibbs — Victoria University of Wellington

Peter Johns — Canterbury University, Christchurch

References: Gibbs and Richards (1994), Meads and Notman (1995c)

8.9 “MT FARADAY” GIANT WETA (*Deinacrida* n.s.p.)

Conservation status: Currently a category B species (listed as *D. “talpa”* in Molloy and Davis 1994).

Description: The “Mt Faraday” weta is known only from a few specimens. These animals had a chocolate brown upper body with a grey wash on the lower body. They are of medium body size. This weta is similar in appearance and genetic characteristics to the “Mt Cook” giant weta, but it is darker in colour. The hind tibial spines are also much stronger than that of the “Mt Cook” weta.

Distribution and abundance: The species has been found above the bushline (800–1400 m) on Mt Faraday (Paparoa Range). Population size appears to be small. An attempt to locate the species on the Victoria Range was unsuccessful (George Gibbs pers. comm.).

Ecology: The ecology of this species is not well known. It has been found in burrows under tussock and boulders. This habit is unusual for a giant weta, because all other species live above the ground, generally in woody vegetation.

Reasons for decline: It is not known whether this species has declined.

Captive breeding: At least two pairs of these weta have been kept in captivity by Mike Meads. They have not produced eggs.

Work plan: Undertake surveys in the Paparoa Range to determine distribution and abundance; and formally describe the “Mt Faraday” weta, and compare with “Mt Cook” weta.

Contacts:

George Gibbs — Victoria University of Wellington

Mike Meads — Ecological Research Associates of NZ, Upper Hutt

References: Meads and Notman (1995b), Meads and Notman (1995c)

8.10 HEREKOPARE (OR FOVEAUX STRAIT) GIANT WETA (*Deinacrida carinata*)

Conservation status: Currently a category C species (Molloy and Davis 1994), IUCN category NE (World Conservation Monitoring Centre 1998).

Description: *D. carinata* is one of the smallest species of *Deinacrida*, with adult females weighing about 6 g and males about 2 g (Meads and Notman 1995b). It is a dull brown-black colour, with no characteristic markings.

Distribution and abundance: This weta is found on Herekopare Island (off Halfmoon Bay, Stewart Island). Herekopare is a muttonbird island and access by non-Rakiura Maori is difficult to obtain. The population size of *Deinacrida carinata* on Herekopare Island is not known. Its presence however, has been confirmed by a Stewart Island muttonbirdier (Philip Smith). The species was recorded on Pig Island in Foveaux Strait (off Colac Bay) in 1990, and this appears to be a large, viable population. It is also present on Kundy Island (southwest of Stewart Island).

Ecology: This species co-exists with introduced wekas on both Herekopare Island and Pig Island. It has survived in the presence of cats and goats on Herekopare Island in the past. Illegal introduction of weka onto Pig Island in the 1960's has probably resulted in a lower weta population density than would otherwise have occurred. The vegetation of Herekopare Island is quite different from that of Pig Island. The former consists of shrub species, and the latter is dominated by *Carex*, sedge, and some woody shrubs.

Reasons for decline: The former range of this species is not known. It is assumed that introduced predators (cats, weka) have had an impact on distribution of Herekopare weta.

Current threats: Weka possibly reduce the population density of these weta. Introductions or invasions of rodents are also a threat to the long term survival of this species.

Captive breeding: Two adult pairs and a pair of nymphs were collected by Mike Meads in March 1993, for observation and captive breeding. The adult females laid eggs before dying in captivity, but these failed to hatch.

Work plan: Survey population numbers to determine the status of giant weta on Herekopare Island, Kundy Island, and rodent-free islands in the Foveaux Strait/Stewart Island region; investigate the potential introduction of weta to Codfish Island once kiore are eradicated from the island; look at options for removal or control of weka on Pig Island, in consultation with iwi and other groups; and monitor the weta population during and after weka removal or control.

Contacts:

Andy Roberts, Pete McClelland — Southland Conservancy, DOC
Mike Meads — Ecological Research Associates of NZ, Upper Hutt
Peter Notman — NIWA, Greta Point, Wellington

Reference: Meads and Notman (1995b)

8.11 MIDDLE ISLAND TUSKED WETA (*Motuweta isolata*)

Conservation status: Currently a category A species (Molloy and Davis 1994).

Description: The Middle Island tusked weta is large-bodied and weighs up to 26 g in the field (both sexes) and 28 g in captivity, measuring 80–100 mm in length (MacIntyre pers. comm.). Weight of adult males may vary seasonally, from 8.6–28 g. Some males have an enlarged head with prominent ridged tusks projecting forward from the base of the mandible. In adults, the left tusk overlaps the right, and ridges behind the tips of the tusks form stridulatory pegs. In juveniles, the tusks are smooth, symmetrical and non-overlapping. Tusks may be used in sparring with other males and possibly for stridulation. The female is more cryptic, lacking tusks and the large head of the male. Adults have a lightly tanned cuticle, with a red-brown background and pale underside. Dark brown patches occur on the thoracic shield, and dorsal surfaces of the abdominal tergites, and juveniles are darker in colour than adults.

Distribution and abundance: The Middle Island tusked weta is restricted to Middle Island (10 ha) in the Mercury group. Ninety-four adults were captured during four expeditions in 1993 (47 females and 50 males, including 3 recaptures), in an area of approximately 0.18 ha, giving an extrapolated adult density of 532 per ha, although most were found in an area of less than 0.1 ha. “Good weta patches” comprised only 0.2 ha (Mary McIntyre pers. comm.), with only three of these properly surveyed.

Ecology: Tusked weta are known to feed in the canopy at night, and shelter during the day in short sealed burrows under the leaf litter. The burrows are often located near the entrance of bird or tuatara burrows. Captive studies indicate that these weta are largely insectivorous, feeding on a variety of small invertebrates.

Reasons for decline: Middle Island tusked weta are thought to have been present on all of the larger islands of the Mercury group until the arrival of humans to New Zealand. The present distribution of this weta is most likely related to the distribution of rats—Middle Island is the largest of the rat-free islands in the Mercury Group.

Current threats: The remnant population is vulnerable as it is confined to a small area on a single island. A rodent invasion, violent storm or fire could wipe out the species. Introductions of birds could create further predation pressure for the weta population. Although lizard species probably prey on tusked weta, they are not considered to be a threat as most lizard species found in the region already occur on Middle Island.

Captive breeding: Tusked weta have been held for long periods in captivity, but eggs laid in captivity have hatched only once and few have developed into adults (Chris Winks pers. comm.).

Work plan: Confirm the presence/absence of tusked weta on Green and Alderman Islands, because if present this will reduce the urgency of recovery action; develop a captive breeding and re-introduction programme; investigate the feasibility of harvesting nymphs from Middle Island for translocation to other sites (approximately 30 per year for 4 years); establish at least one other population of tusked weta on a kiore-free island in the Mercury group and maintain the Middle Island population; conduct research on population status and habitat requirements of the species to provide management information for translocation efforts (e.g., the impacts of harvesting the wild population on population dynamics); and evaluate the potential for translocation to a protected island environment.

Contacts:

Mike Meads — Ecological Research Associates of NZ, Upper Hutt

Phil Thomson — Waikato Conservancy, DOC

Mary McIntyre — Victoria University of Wellington

References: Gibbs (1994)

8.12 NORTHLAND TUSKED WETA (*Hemiandrus monstrosus*)

Conservation status: Currently a category C species (Molloy and Davis 1994).

Description: *H. monstrosus* is a small bodied weta, 25–32 mm in length. Adult males have protruding tusks at the base of their mandibles which extend forward and cross each other. They are reddish brown in colour, with yellow dorsal stripes. There are small spines on the hind tibia. There is however, some debate as to whether this species should be in the genus *Hemiandrus*.

Distribution and abundance: This species is only known from north of a line between Waipoua and Whananaki. The first specimen was found at Orokawa Bay in the Bay of Islands in 1948, and the species was described from one individual found at Cape Reinga in 1950. Most subsequent sightings have come from the Hokianga region. Most records are of single animals which has given little indication of their abundance. Several sightings are reported from Pakanae Valley, Opononi and Kohukohu. Since 1990, single animals have been found at Maungapika (Te Pahi), Whareana (Te Pahi), Whananaki, Kaitaia and Puketi Forest.

Ecology: Very little is known about the ecology of this species. Most specimens have been located inside manuka and kanuka holes. One weta was located in the stem of a *Muehlenbeckia* vine growing on totara. The Cape Reinga specimen was located under a log. The preferred habitat of this species is not known, although Bellingham (1991) reports that it is confined to trees, when found in mixed manuka (*Leptospermum scoparium*) and broad-leaved scrub.

Reasons for decline: There is no evidence of a decline and little information on past or present abundance and distribution. Loss of habitat through forest

clearance and the introduction of exotic predators has probably reduced both the distribution and abundance of the species.

Current threats: Due to a lack of knowledge about the species, the current threats are unknown. However, further loss of habitat would certainly reduce their distribution and abundance.

Captive breeding: Attempts to breed the species by Jackie Davidson, Graeme Ramsay and Chris Winks have been unsuccessful.

Work plan: Include the species in further general biosystematic research of tusked weta; determine the distribution and abundance, and monitor population trends; and investigate the habitat requirements and biology of the species through captive and field studies.

Contacts:

George Gibbs — Victoria University of Wellington

Mike Meads — Ecological Research Associates of NZ, Upper Hutt

Richard Parrish, Ray Pierce — Northland Conservancy, DOC

Mark Bellingham — Private consultant

Paul Barrett — Nikau Gardens, Waikanae

Reference: Bellingham (1991)

8.13 CENTRAL OTAGO GROUND WETA (*Hemiandrus* sp.)

Conservation status: Currently a category A species (Molloy and Davis 1994)

Description: The Central Otago ground weta is similar in morphology to the Tekapo ground weta (van Wyngaarden 1995), but it is distinguished by the female genitalia. In this species the ovipositor of the female is relatively short, compared with other members of the genus. It has a large body size compared with limb length. Coloration is dark on the upper surface with wide bands alternating with lighter thin bands, and the head capsule is brown and cream.

Distribution and abundance: This weta is common only in the Cromwell Chafer Beetle Reserve in Central Otago, and in Alexandra (Flat Top Hill Conservation Area).

Ecology: The Central Otago ground weta shelters in sealed burrows that are dug into loam soils of river flats. They are omnivorous, although feed primarily on plant matter during some seasons. The whole life cycle revolves around the burrow where females also lay their eggs. Both sexes may survive for two years and go through nine or ten instars to reach maturity.

Reasons for decline: Reasons for decline of the Central Otago ground weta include habitat modification through hydro-electric power generation schemes, modification of vegetation by rabbits, forestry and the development of orchards (van Wyngaarden 1995). There is little information on past distribution and abundance. It is assumed that their present restricted distribution is evidence that a decline has occurred.

Current threats: Rabbits and habitat modification pose continued threats to the long-term survival of this species. van Wyngaarden (1995) reports that cats, hedgehogs, and little owls may also prey on this weta species.

Captive breeding: No attempts have been made to breed the species in captivity.

Work plan: Survey to determine the distribution and status of the species; include the species in any other research into the biosystematics of ground weta generally; determine the habitat requirements and general biology of the species, and establish appropriate survey techniques (through research on wild and captive populations).

Contacts:

Bruce McKinley — Otago Conservancy, DOC

Peter Johns, Frans van Wyngaarden — Canterbury University, Christchurch

References: van Wyngaarden (1995)

8.14 BANKS PENINSULA TREE WETA (*Hemideina ricta*)

Conservation status: Currently a category B species (Molloy and Davis, 1994)

Description: *Hemideina ricta* is a uniform red-brown and is similar in size and shape to *H. femorata*, but it lacks the same striking bands. There is some sexual dimorphism (macrocephaly) but not as pronounced as in its congeners.

Distribution and abundance: The distribution of *Hemideina ricta* on Banks Peninsula has been described in detail by Brown and Townsend (1994), particularly in relation to *H. femorata*. *H. ricta* was found mainly in the southeastern (seaward) quarter of the peninsula at high altitudes and was common.

Ecology: The ecology of this weta has been described in an unpublished M.Sc. thesis (Townsend 1995). Its habitat includes cavities under the bark of totara or other trees, or in galleries initiated by the larvae of Coleoptera and Lepidoptera.

Reasons for decline: The distribution of *Hemideina ricta* has probably diminished after clearing of forest and shrubland for farming. Predation by rodents may also have been a significant factor in their decline.

Current threats: Current threats include loss of habitat through fire and land clearance, and rodent predation.

Captive breeding: Three adults (1 male and 2 females) have been held at Wellington Zoo and additional individuals held at Massey University Department of Ecology. No breeding has been reported from either location.

Work plan: Determine the protection status of known weta habitat and seek appropriate protection through the range of options available (e.g., covenanting, etc.); determine whether habitat management or predator control is required to improve existing populations of *H. ricta* (based on Brown and Townsend 1994); locate suitable habitat, with appropriate protection status, for the long-term maintenance of new populations.

Contacts:

Euan Kennedy — Canterbury Conservancy, DOC
Peter Johns — Canterbury University, Christchurch
Paul Barrett — Nikau Gardens, Waikanae
Ian Stringer — Massey University, Palmerston North

References: Field (1993), Morgan-Richards (1995), Richards (1995), Townsend (1995), Brown and Townsend (1994).

8.15 POOR KNIGHTS CAVE WETA (*Gymnoplectron giganteum*)

Conservation status: Currently a category B species (Molloy and Davis 1994).

Description: This species is the largest of the cave weta, spanning 450 mm in length from the tip of its antenna to the distal end of its rear legs. The body is only about 50 mm long with blackish “plates” on the dorsal surface, interspersed with white stripes.

Distribution and abundance: The Poor Knights cave weta occurs on Tawhiti Rahi and Aorangi Islands (R. Parrish pers. comm.). No data is available on their abundance. Paul Barrett (pers. comm.) reported finding 3 males (including one nymph) on tree trunks during one visit to Tawhiti Rahi.

Ecology: Few observations have been made of the species’ ecology. They have been located sheltering in dark crevices, caves, and rotten logs. They are probably omnivorous and have been observed feeding on lichens, fungi, and pohutukawa flowers.

Reasons for decline: There is no evidence of decline in this species, but it is an island endemic and therefore its distribution is quite limited.

Current threats: The species is probably preyed on by a range of indigenous birds, lizards and tuatara, but this is unlikely to be a threat to population survival. The introduction of other animals (e.g., rodents from boats) could seriously reduce numbers or result in their extinction.

Captive breeding: This species has not yet been bred in captivity (Mike Meads pers. comm.). Congenerics (*Gymnoplectron edwardsii* and *G. longipes*) have been successfully kept in captivity by Paul Barrett.

Work plan: A Pest Contingency Plan (especially for rodents) is urgently required for the Poor Knights Islands; survey to confirm the presence and abundance of this species on other islands in the Poor Knights group.

Contacts:

Richard Parrish, Ray Pierce — Northland Conservancy, DOC
Paul Barrett — Nikau Gardens, Waikanae
Mike Meads — Ecological Research Associates of NZ, Upper Hutt

References: Richards (1962)

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Appendix 1

“RAUKUMARA” TUSKED WETA (ANOSTOMATIDAE n.s.p.)

Conservation status: Currently considered to be secure in the medium term.

Description: The “Raukumara” tusked weta is genetically distinct from other weta taxa and will probably be grouped together with *Hemiandrus monstrosus* and the Middle Island tusked weta, into their own taxon. Only males have tusks, which are 3.8–9.0 mm long and project from the mandibles. The tusks curve horizontally forward and inwards, and sometimes cross. The tibiae are relatively thin and lack the heavy spines of tree weta (the species most likely to be confused with the “Raukumara” weta). The long hind legs have heavy muscular femurs, which appear as obvious parallel thin black lines. There are four long moveable spines at the outer end of the rear tibia. Some weta of this species have a unique brightly coloured orange-red “saddle” mark on the plate behind the head (pronotum). This saddle mark is absent in the rich reddish-brown adults.

Characteristics which differentiate “Raukumara” weta (including females and juveniles) from ground and cave weta are: tympanic membranes (“ears”) on each side of the fore legs or tibia; and absence of a distinctive forward facing spine on the front legs below the ears (this spine is present in ground weta only). Antennae of “Raukumara” weta are about twice as long as the body. The ocelli (simple eyes) are located between the antennae and they are clearly seen as yellow spots in torch light. The compound eyes are black. The body has a hunched appearance but it is of larger proportion relative to the legs than is the body of a cave weta. The cuticle has a smooth dull appearance when dry, and is shiny when wet. Sensory “spines” (or cerci) are 5–6 mm in length, turn upward and occur as pairs from the posterior of the animal.

Distribution and abundance: This species has been found in six stream localities over a 90 km area in the ranges behind the Bay of Plenty. They are found in the Raukumara Range from 220 m ASL (Mangakirikiri and lower Mangatutara Huts) to about 400 m (no known upper limit). The species also occurs in the Ikawhenua Range from 380 to 500 m a.s.l. and has been found at 740 m in hard beech forest near Moutohora (Uretawa block). “Raukumara” weta are only known to occur close (0–3 m) to streams in podocarp-broadleaf forest which is dominated by tawa, kamahi and podocarp mixtures.

Ecology: Adults appear to mate, and females to lay eggs at any time of the year. Their life cycle is probably at least 2 years long. Egg-laying has been observed in silt, 2 m above a stream bed at a locality which is west of the lower Mangatutara Hut. The species is probably carnivorous.

Reasons for decline: It is not known if this weta has declined in recent times, although its distribution is assumed to have diminished through loss of habitat by deforestation.

Current threats: Purple buddleia (*Buddleia davidii*) and Himalayan fairy grass (*Miscanthus nepalensis*) are invading their stream habitats, and may result in overgrowth of vegetation in the open stream beds favoured by the weta. The weta is probably eaten by predatory mammals. It's relatively wide distribution and ability to survive in reasonable numbers indicates that it may not be threatened.

Work plan: Continue to survey and establish the limits of tusked weta range in the Bay of Plenty; examine the effect of purple buddleia and Himalayan fairy grass, on weta dynamics; include the Raukumara Ranges tusked weta in the review of the biosystematics of the tusked weta in New Zealand.

Contacts:

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References: None known

Appendix 2

SPECIES REQUIRING FURTHER INFORMATION FOR INCLUSION IN FUTURE RECOVERY PLANS

SPECIES	KNOWN INFORMATION
<i>Hemiandrus</i> “Mochau”	Orange/brown body, light coloured underparts; found in mature forest near northern Mt. Mochau, Coromandel Range. <i>Contact:</i> George Gibbs (Victoria University of Wellington).
<i>Hemiandrus</i> “Kapiti Island”	Known only from Kapiti Island, possibly an endemic. <i>Contact:</i> Lisa Sinclair (DOC).
<i>Hemiandrus</i> “Haast Range”	Known from the Haast Range - Lake Greaney area at the top of Tuning Fork Stream. There is confusion about the genus—this large bodied weta may be a <i>Zelandrosandrus</i> species. <i>Contact:</i> Mike Meads (Ecological Research Associates of NZ) and Peter Johns (Canterbury University)
<i>Hemideina trewicki</i>	Distribution within northern and inland Hawkes Bay. Apparently similar to other tree weta, allopatric with congenics. <i>Contact:</i> Steve Trewick (c/- DOC)
<i>Hemiandrus</i> “Cape Campbell”	Distribution on Cape Campbell farmland (Marlborough). <i>Contact:</i> Peter Johns (Canterbury University)
<i>Hemiandrus</i> “Cromwell”	Found in Cromwell chafer beetle reserve. <i>Contact:</i> Peter Johns (Canterbury University)
<i>Hemiandrus</i> “Longwood Range”	Found in Longwood range, Fiordland. <i>Contact:</i> Peter Johns (Canterbury University)
<i>Hemiandrus</i> “Rocklands”	Great Moss swamp, Otago <i>Contact:</i> Peter Johns (Canterbury University)
<i>Hemiandrus</i> “Tapuae-o-Uenuku”	Mt. Tapuae-o-Uenuku, Northern Marlborough. <i>Contact:</i> Peter Johns (Canterbury University).
<i>Hemiandrus</i> “Timaru”	Timaru township <i>Contact:</i> Peter Johns (Canterbury University).
<i>Hemiandrus</i> “Waipoua”	Waipoua State Forest <i>Contact:</i> Peter Johns (Canterbury University).

Note: The information required includes distribution, and/or systematics, and/or conservation status (density, threats, etc.).

Appendix 3

SURVEY AND MONITORING

Survey

The goal of any survey programme must be to determine the range and/or abundance of a species. Quantifiable and repeatable survey techniques for weta are not yet available. Survey relies on the observer knowing what habitat might harbour the weta, knowing how to search for the weta, and chance factors for success in finding specimens. The latter is especially true for populations occurring at low densities. Experienced workers develop an ‘eye’ for a species and tend to be more successful than novices.

Methods are often species-specific, as the search technique will depend on the behavior and habitat-use of the species in question. Some methods used for estimating abundance include number of hours searched per weta found, or some other measure of search effort such as number of rocks, logs, etc., turned over per animal found.

Monitoring

Invertebrate populations are very changeable, and a single population can vary from being rare to abundant at stages throughout its life cycle. It is necessary that field workers understand the behavior of invertebrates, and that methods used to monitor vertebrates may not be directly applicable. The reproductive cycle, generation time, and seasonal abundance of a weta species must be considered when designing a monitoring programme.

Techniques for monitoring populations in an unambiguous and repeatable way include the provision of artificial refuges (where weta can be easily counted) and/or use of attractive pheromone baits. Artificial refuges can be simply made by placing cardboard over recesses in trees. For long-term monitoring, purpose built boxes can be used.

Weta box design

The weta box illustrated in Figure A3.1 is made of six pieces of wood, or, if a router is employed, then the

FIGURE A3.1 GREG SHERLEY DESIGNED THIS WETA BOX IN 1992 (MODIFIED FROM A DESIGN BY RON ORDISH, OF THE NATIONAL MUSEUM OF NEW ZEALAND).

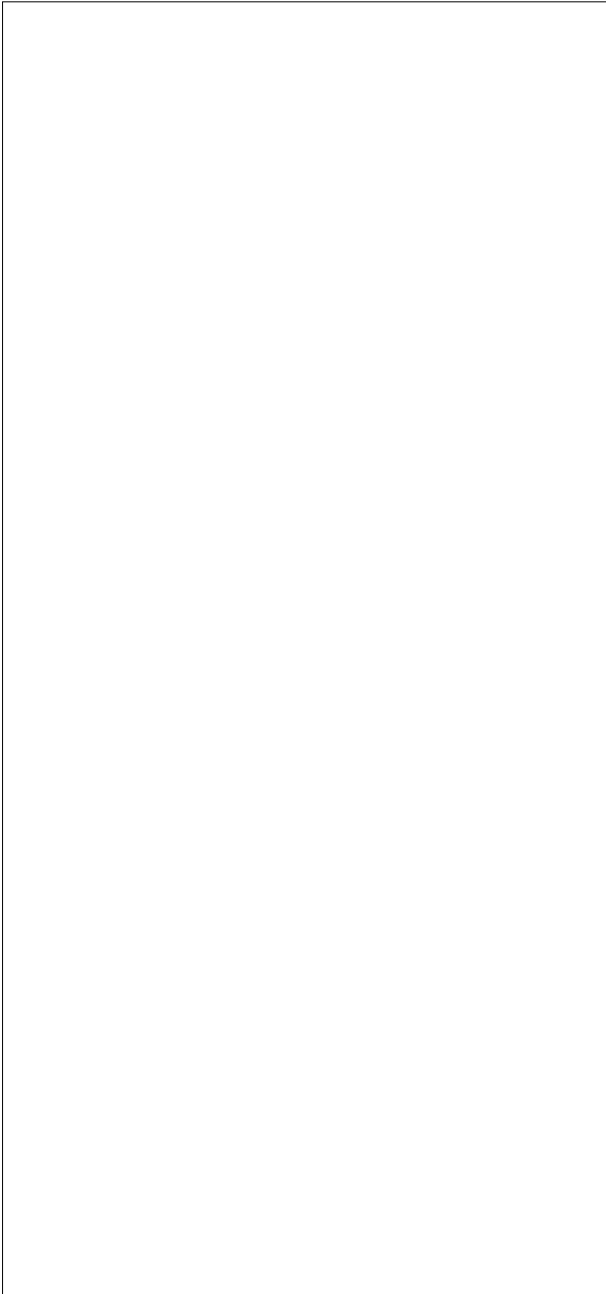


FIGURE A3.2. THE WETA "CONDOMINIUM"
CURRENTLY BEING USED BY DOC.

box can be made from two pieces. In either case, a small square of formica serves as a reliable waterproof top. The wooden box should be open-ended, with a hole near the top, and exit holes in the bottom. It should be fitted with a glass or perspex cover which lies immediately beneath a hinged wooden cover. This second cover is extremely useful in preventing a mass exodus when the box is opened for inspection. It is useful to have a drawing pin fastened to the wooden medial partition, where it can overlap the glass/perspex and prevent it falling out. Untreated wood should be used, as treated wood can be poisonous to insects. The box is stained dark mahogany which makes it less conspicuous and, therefore, less likely to be interfered with. Boxes are also varnished to increase their life span.

Other designs for monitoring boxes have a continuous medial division which provides accommodation for a main, and several smaller colonies. Figure A3.2 is the standard weta "condominium" currently being used by DOC, although there are a number of alternative designs available.

Placement

Ideally, the box should be placed on a food tree so that it leans against the trunk and will not be affected by wind. It should be suspended so that it can be removed with a minimum of vibration. The cover can then be gently and slowly opened. Monthly counting of specimens has proven to be adequate for *Hemideina crassidens*. It is best done in the morning, so that there is no disturbance during their emergence immediately before dusk. Low temperatures also reduce the immediate risk of the weta abandoning a box.

If weta are being transferred from a tree into a box, then this can sometimes be achieved by fastening the box about 4 cm above the exit hole in the tree. It may

take some weeks for the transfer to occur, depending to some extent on the suitability of the natural tunnel.

Recording information

As with any specimen that is collected, there is a minimum amount of information which needs to be recorded. Unless the following information is recorded, any insects collected are of little use for further scientific study.

Essential data includes:

- Where — locality, as precise as possible
- When — the date found
- Who — the name of the collector

- On what — plant species, or substrate, such as rotten wood, or other habitat type
- How collected — method used to collect the insect, for example, what sort of trapping technique (if one was used), trap period.

If you suspect that the insect is a threatened species, then it should be kept alive while you make enquiries to have it identified. Consider taking a close-up photograph then releasing at a marked release site.

For further details refer to Green, C. 1996. Survey and monitoring techniques for insects. *Ecological management* 4: 73-90. Department of Conservation, Wellington.

Information that would also be of use includes:

- Weather conditions
- Number of searchers
- Experience of searchers
- Hours of searching

Appendix 4

Collection guidelines for weta

1. Any removal of weta must be shown to have a conservation benefit for the population concerned and must not increase its vulnerability to decline. It is essential to examine the objective for animal removal, and not simply the maximum number which may be taken. Therefore the following points need to be considered before collection of weta:

- The reason for removal of the animals; i.e., for direct transfer, or captive rearing, or data collection (e.g., genetic research).
- The status of the species and the population from which the animals are removed; (i.e., its area, uniqueness, density, security).

2. The following characteristics of invertebrate populations are relevant to assessing the impacts of collection on weta before it occurs:

- Early instars have the highest mortality rate
- Most species are polygamous
- Adults normally survive for only a single breeding season
- There is normally an excess of males in a population
- Populations normally undergo marked fluctuations, either randomly (weather-related) or cyclic (predator/disease related)
- A special consideration in relation to weta is their 2-year life cycle (except for some *Hemideina* sp.). This results in two distinct or overlapping age-classes present at any one time.

3. The most significant features related to weta collection are that most natural mortality occurs in the early life stages, and that each generation of adults will normally reproduce only once before dying. From these features, we can rank individuals in a population according to their importance for long-term population viability in the wild:

- Greatest importance: adult females and males
- Least importance: juveniles
- There are probably no cases where collection by humans has extinguished an insect population (G. Gibbs pers. comm.). Most weta will always have a much higher proportion of small and hidden individuals in the population, than the larger ones which are collected.

4. Ease of location is the only measure of population numbers that is presently available. It does allow for season to season fluctuations. Based on this measure, collection for:

- Direct transfer should only occur when surveys indicate a large donor population (e.g., >500). In this case a cohort of 50 individuals of mixed sexes and ages would be appropriate.

- Captive rearing should involve only immatures when population numbers are very low. A 'search' ratio of 1:5 is suggested as a baseline for collection (i.e., if a search produced 20 individuals, 4 juveniles could be taken to establish a breeding group). Removal of adults for captive breeding requires a more conservative ratio (e.g., 1:10 if adult females are being collected). Reproductive success is greater for cage-reared immatures than wild collected adults.
- Ecological research does not present a problem where only one or two individuals are required. If there is no special requirement for females, then only males should be taken.

For information on legislation applying to collecting see:

Stephens, T. 20 June 1996. Collecting plant or animal or soil samples — What legislation applies.

Issue of permits should be in accordance with guidelines promulgated in:

Edmonds, A. 12 June 1995. Issue of permits to collect flora/fauna.

Copies of these documents can be obtained from Chris Hickford, Senior Technical Support Officer, Southern Regional Office, Department of Conservation, PO Box 13-049, Christchurch.

Appendix 5

CAPTIVE MAINTENANCE AND BREEDING

The following is taken from the introduction to Paul Barrett's book "Keeping Weta in Captivity" (see Barrett 1991 in the reference list).

"In general [weta are kept] in large containers — reptile cages, aquaria, miscellaneous wooden containers, and so on. All are satisfactory as long as they give plenty of space for the weta, ventilation, and have at least one glass side for observation. To ensure adequate ventilation I employ metallic rather than plastic gauze because weta sometimes chew their way through the latter and escape. The lids and ventilation gauze should be tight-fitting and escape-proof. If wood is used it should be untreated as treated wood is impregnated with arsenic or boron and other substances poisonous to insects. Weta containers must not be exposed to sunlight when in use as the ultraviolet light, raised temperature and consequent higher humidity can be fatal to weta. I always place clean soil, sand, leaf-litter, and so on, on the floor of the container so that the weta's natural environment is replicated as closely as possible. Moisture can then be absorbed and egg-laying sites are present. I provide additional other materials for shelter and so on as appropriate to meet the special needs of each species.

"Climbing material is important for *Hemideina* and *Hemiandrus* weta as well as some *Deinacrida* and the cave weta, as all of these prefer to shelter off the ground. The setting up of an assortment of branches and other climbing materials is also important in providing sites for the ecdysis or moulting of weta nymphs.

"I made shelters for the tree weta by drilling galleries in logs and by using New Zealand flax flower stems. Giant weta were provided with bark shelters which they used readily as did the cave weta also."

Further details on feeding and other care can be found in Barrett (1991).

