Research into the status and distribution of Chatham Islands endangered invertebrates

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R. M. Emberson, J. W. Early, J. W. M. Marris, P. Syrett

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Abstract

Examination of public collections in New Zealand has established the former distribution of three protected beetle species, the Chatham Islands click beetle (*Amychus candezei* Pascoe), the coxella weevil (*Hadramphus spinipennis* Broun), and the Pitt Island longhorn beetle (*Xylotoles costatus* Pascoe). It has shown that there has been a significant contraction in the distribution of all species to the outer predator-free islands of the Chathams group.

A field expedition in November and December 1992 was successful in locating all three species and extending the known distribution of *A. candezei* to Mangere Island. However, only a single specimen of *X. costatus* was found.

One of the main findings of the expedition was the contrast in diversity and abundance of the ground-dwelling insect fauna between the predator-free islands and Chatham and Pitt Islands. This demonstrates what has already been lost from the larger islands of the group and the extent of the problem facing the Pitt Island restoration project.

1. Introduction

Three species of beetles from the Chatham Islands are listed in the Seventh Schedule of the Wildlife Amendment Act 1980. The species are:

Amychus candezei Pascoe, Chatham Islands click beetle

Hadramphus spinipennis Broun, coxella weevil

Xylotoles costatus Pascoe, Pitt Island longhorn

The species were listed because they were thought to be rare, vulnerable or possibly extinct (Ramsay *et al.* 1988) and were worthy of protection

The same species were listed by Hughey (1990) in a discussion paper identifying important research topics on terrestrial invertebrates within the Canterbury conservancy, in which surveys for two of the species were said to be urgent or extremely urgent. In a paper setting priorities for conservation, Molloy and Davis (1992) identified *H. spinipennis* as being in the highest priority category, whilst *A. candezei* was of lower priority. *X. costatus* was listed as not having been sighted for a number of years, but might still exist.

There was very little recent reliable information on any of the three beetle species. The Pitt Island longhorn was only known from one recent specimen, from Rangatira, whilst the other two species had recently been collected only from outlying islands, where limited populations might be vulnerable to extinction. A small population of the Chatham Islands click beetle had been reported from the main Chatham Island in 1967, but there was no information on its survival to the present in that locality.

There was little reliable biological information on any of the species, apart from the host plant of the coxella weevil. Available information was completely

insufficient for formulating a management strategy to ensure the survival of these species in the long term.

Lincoln University first became involved with these beetles through a visit to Pitt Island by four entomologists from the Department of Entomology, Lincoln University, and MAF Tech, Invermay, in January 1990. The visit was funded in part by a research grant to Lincoln University from DoC, Canterbury Conservancy. This grant was for a survey to locate the Pitt Island longhorn on Pitt Island.

The survey was unsuccessful in its prime objective, but did establish a valuable working relationship with the DoC conservancy staff and the beginnings of a working knowledge of the Chatham Island insect fauna (Early *et al*. 1991).

In October 1990, Lincoln University was awarded a two-year contract, subsequently extended, to undertake a survey of all three listed Chatham Islands beetles. The objectives of the contract were to:

1. develop a report on the distribution, status, habitat requirements and threats to the survival of each species;
2. write a manual for each species as appropriate, for DoC field staff, with aids to identification, suggested protection measures for each known population and suggestions for simple population monitoring.

The research reported here meets these objectives.

2. Literature review

Amychus candezei (Appendix Fig. 1) was described by Pascoe (1877) from specimens sent to him by H. H. Travers. This species was long confused in the literature with a closely similar click beetle, named *Psorochroa granulata* by Broun (1886), from the Brothers Islands in Cook Strait. The two were synonymised by Hudson (1934), and the name *Amychus candezei* was then applied to the Cook Strait islands populations by Hudson (1934), Sharrell (1971) and perhaps other authors. In fact, the two species, though similar, are quite distinct, with *Amychus candezei* Pascoe being confined to islands in the Chathams group, and the larger *Amychus granulatus* (Broun), as it is now known, to small islands in Cook Strait. Both species were judged to be rare/vulnerable (Ramsay *et al*. 1988) and are listed in the Seventh Schedule to the Wildlife Amendment Act.

Species of *Amychus* are unusual among New Zealand click beetles (family Elateridae) in being entirely flightless. Almost nothing is known of their biology, but larvae are almost certainly soil-dwelling while adults are frequently found on the soil surface, under logs, rocks or debris.

The combination of flightlessness, relatively large size (15–18 mm in *A. candezei*), and ground living, makes beetles very vulnerable to predation from introduced mammals and perhaps weka. The result is that all known surviving populations of both species of *Amychus* are confined to predator-free offshore islands.

Hadramphus spinipennis (Appendix Fig. 2), was described by Broun (1910) from specimens collected by Thomas Hall in 1906–1907, on Pitt Island, where he worked as a musterer. *H. spinipennis* belongs to a small genus of large, flightless weevils (family Curculionidae; subfamily Molytinae), recent species of which are all listed on the Seventh Schedule to the Wildlife Amendment Act. Two species, *H. spinipennis* from the Chathams and *H. tuberculata* from Banks Peninsula and the Canterbury foothills, feed on species of *Aciphylla* or speargrasses (family Apiaceae) (Appendix Figs 3–8), whilst *H. stilbocarpae*, from islets around Stewart Island and on the Snares Islands, feeds on *Stilbocarpa* (family Araliaceae). A separate population of *H. stilbocarpae* from islands in Dusky Sound is reported to feed on *Anisotome* (family Apiaceae). A fourth species of *Hadramphus* has recently been discovered in sub-fossil cave deposits around Karamea (Johns, pers. comm.). The genus *Hadramphus* is very closely related to *Lyperobius* Pascoe (Craw, pers. comm.), another genus of large flightless weevils that feeds on *Aciphylla* and *Anisotome* species, and to *Karocolens* Kuschel, which feeds on *Pittosporum* species (family Pittosporaceae). All extant lowland species of these three genera are rare, vulnerable or endangered, or have very limited distributions, largely on predator-free islands.

Recent records of *H. spinipennis* are all from the predator-free outlying islands of the Chathams group; Rangatira and Mangere Island (Young 1989), though the weevil obviously occurred on Pitt Island early this century. *H. spinipennis* is apparently confined to *Aciphylla dieffenbachii*, itself a rare plant, now mostly found on Mangere Island, although there are small populations on Rangatira Island and in places inaccessible to livestock on Pitt and Chatham Islands. Both adults and larvae of *H. spinipennis* feed on *Aciphylla,* with the adults feeding on the foliage and flowers and the larvae probably feeding mainly in the root crown, but also sometimes on the foliage and in the leaf petioles.

On Mangere, *Aciphylla* tends to have a patchy distribution, and patches sometimes die out or disappear (Young 1989). It is not known what effect this has on the weevils.

Xylotoles costatus (Appendix Fig. 9a) was also described by Pascoe (1875) from specimens sent to him by Travers from Pitt Island. The type specimen is now in the Natural History Museum in London, and was examined by one of us (R.M. Emberson) in 1989. *Xylotoles* is a medium-sized genus of longhorn beetles (family Cerambycidae; subfamily Lamiinae). Most species of *Xylotoles* are thought to be non-host specific, feeding as larvae on dead twigs. All older records of *X. costatus*, where a locality is specified, were collected from Pitt Island, and none was collected after about 1910 until John Dugdale (formerly Entomology Division, DSIR, now Manaaki Whenua-Landcare Research Ltd) collected a single specimen on Rangatira in December 1987. There is no available information on the biology of *X. costatus*; none of the older specimens even has habitat information. The specimen found by Dugdale was collected by beating a dead ngaio (*Myoporum laetum)* branch caught up in a tangle of *Muehlenbeckia*.

By analogy with other species of *Xylotoles*, larvae of the Pitt Island longhorn are likely to be relatively non-specific feeders on dead branches. Early *et al.* (1991) reported on efforts to find *X. costatus* on Pitt Island in January 1990,

which proved unsuccessful. It is worth noting, however, that adults of the smaller but similar species, *X. traversii* (Appendix Fig. 9b), were easily collected, a total of 46 being found in 12 days from a wide variety of woody hosts. Larvae of this species were also located. The ease with which *X. traversii* could be collected, combined with the dearth of *X. costatus*, suggests that the latter is either rare or extinct on Pitt Island, or that it has much more specialised habits than *X. traversii.*

3. Methods

The research proposal envisaged two distinct phases to this programme:

1. Collection of published information and information associated with specimens of the nominated species in public collections.
2. Mounting an expedition to Chatham, Pitt, Rangatira and Mangere Islands to search for, locate and study the three species of beetles.

3.1 SPECIMENS IN COLLECTIONS

The main public collections of insects are:

New Zealand Arthropod Collection, Auckland (NZAC)

Museum of New Zealand, Wellington (MONZ)

Auckland Institute and Museum, Auckland (AMNZ)

Canterbury Museum, Christchurch (CMNZ)

All were visited, and the label data on all specimens of the three species were recorded. This information was useful in planning the timing of the expedition and provides a database of the known distribution and seasonal occurrence of the species.

3.2 LINCOLN UNIVERSITY CHATHAM ISLANDS EXPEDITION, 1992

Expedition members:

Mr J.W. Early, Curator of Entomology, Auckland Museum

Dr R.M. Emberson, Department of Entomology & Animal Ecology, Lincoln University

Mr J.W.M. Marris, Department of Entomology & Animal Ecology, Lincoln University

Ms P. Syrett, Manaaki Whenua-Landcare Research NZ Ltd.

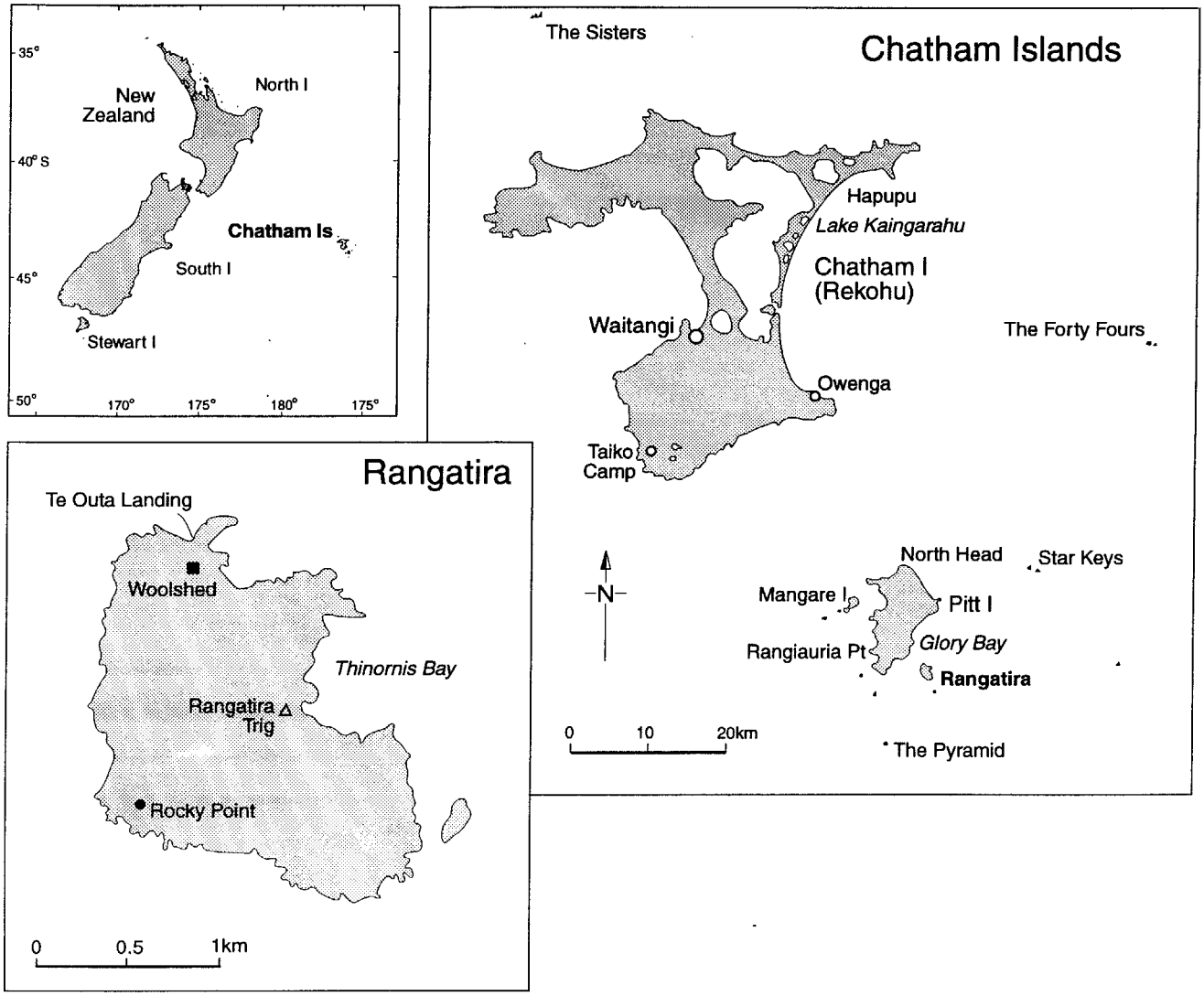

FIGURE 1: MAP OF THE CHATHAM ISLANDS, WITH DETAIL-OF RANGATIRA, SHOWING SITES VISITED BY THE LINCOLN UNIVERSITY EXPEDITION, 1992.

a. Itinerary and activities

Sites visited are shown in Fig. 1.

21 November: Christchurch-Chatham Island-Pitt Island (Glory Bay).

22 November: Glory Scenic Reserve - Malaise trap, 6 yellow pan traps, 10 branch traps; *(Dracophyllum, Olearia, Pseuclopanax, Melicytus* and *Coprosma).* Rangiauria Point, hand searching *Aciphylla.*

23 November: North Head - Malaise trap, 5 pan traps, 10 pitfalls, 11 branch traps, *(Corynocarpus, IIebe, Griselinia, Coprosma, Macropiper* and *Myrsine).*

24 November: Glory Bay, but bound, rain and wind.

25 November: Glory Bay, fog and drizzle. Collected in Waipaua Valley.

26 November: Glory Bay, heavy swells, collected locally.

27 November: To Rangatira, tour of island, 2 malaise traps, 39 pitfall traps, 15 branch traps (*Myoporum, Melicytus, Macropiper, Plagianthus, Myrsine* and *Olearia*); night collecting.

28 November: Rangatira, beating, log-turning etc., night collecting.

29 November: Rangatira, more beating and sweeping, night collecting.

30 November: Rangatira, traps and leaf litter collected. RE and PS to Pitt Island; JM and JE to Mangere Island. RE and PS retrieved Glory Scenic Reserve traps, collected leaf litter. JM and JE 19 pitfall traps in "Robin Bush". Night observation of *Hadramphus* on *Aciphylla*.

1 December: RE and PS to North Head to recover traps and collect leaf litter. JM and JE Mangere Island observing *Hadramphus*.

2 December: RE and PS to Chatham Island, then to Hapupu National Historic Reserve to check for *Amychus*, 11 pitfalls, night collecting. JM and JE Mangere Island, more *Hydramphus* on *Aciphylla.*

3 December: RE and PS walk to Lake Kaingarahu, collecting in shore drift, night collecting. JE and JM general collecting and collected pitfalls.

4 December: RE and PS collected pitfalls, mostly destroyed by weka; collected leaf litter, back to Waitangi. JE and JM boat to Owenga and drive to Waitangi.

5 December: To Taiko Camp, general collecting, back to Christchurch.

b. Collecting Activities

The insect collecting was specifically targeted at locating the three nominated species of beetle, but some general insect collecting was also undertaken. Collecting methods chosen were aimed at particular species. Most material is now lodged in the Entomology Museum Lincoln University (LCNZ), with a smaller representation at the Auckland Institute and Museum (AMNZ).

Amychus candezei

As the click beetle is a ground-inhabiting species, pitfall traps and the turning of logs and rocks were the most appropriate collecting methods, combined with night searching on the ground and on tree trunks.

Hadramphus spinipennis

Because of this weevil's association with *Aciphylla dieffenbachii*, activities were confined to examining plants for damage and for weevils on the plants, and plant bases for resting weevils. Night searching for adult weevils on *Aciphylla* flower heads was expected to be particularly useful in locating colonies of the coxella weevil.

Xylotoles costatus

Many longhorn beetles are attracted to the odours given off by cut or broken branches and foliage, so emphasis was placed on using branch traps, which are bunches of short lengths of cut branches up to 60 cm in length, hung up in

trees. These were then beaten at regular intervals so that insects dropped on to a collection tray. Beating the foliage of woody plants, particularly in sunlight, is another well established technique for collecting longhorns. It had been used very successfully on a previous occasion for catching the related *X. traversii*. The only recent collection of the Pitt Island longhorn, in 1987, had also been by beating. All accessible species of woody plants were therefore extensively sampled by beating. Longhorn larvae, pupae and teneral adults were sought by splitting dead wood with a view to retaining the beetles for subsequent rearing.

4. Results and Discussion

4.1 SPECIMENS IN COLLECTIONS

Appendix 7.1 lists the numbers of specimens, locality information, collection date, collectors, and present depository for all specimens of the three beetle species located in the main insect collections in New Zealand. From these data the known distribution at the beginning of this century and in the recent past can be summarised as follows:

Amychus candezei

Early records are unhelpful regarding specific locality, but it is interesting to note that there are no known specimens from Pitt Island, which was extensively sampled for beetles by Thomas Hall between 1906 and 1908 (Watt 1977). More recently there are records from the main Chatham Island, where five specimens were collected from Hapupu in 1967, from Rangatira, 1970, 1984, and 1987, and from the Sisters Islands, 1973 and 1974. In fact, it appears that whenever experienced collectors have looked on Rangatira and the Sisters Islands they have found the click beetle. The Chatham Island record is particularly interesting as it is the only record of any of the three protected species from there or Pitt Island during the last 60 years.

Hadramphus spinipennis

Most of the old specimens in collections have somewhat equivocal locality labels. The species was described from Pitt Island from specimens collected by Hall. One of these specimens remains in NZAC, although not labelled Pitt Island. There could be others in the Natural History Museum, London (BMNH), but this has not been checked. Modern collections include Rangatira (1970) and Mangere Island (1988). There are no recent collections from Pitt Island, where the populations of *Aciphylla* have been severely depleted by grazing.

Xylotoles costatus

This beetle was also first collected from Pitt Island, but the collector was Travers. A number of older specimens exist. Where specific locality data are given, specimens are all from Pitt Island. Apart from the type (examined in BMNH), there are three specimens in NZAC collected by Hall presumably between 1906 and 1908, and a specimen in CMNZ, presumably the one

mentioned by Hutton (1898). The only recent record is the specimen already mentioned, collected by Dugdale on Rangatira in 1987.

4.2 FIELD EXPEDITION, 1992

a. Chatham Island

Two investigators spent two days at Hapupu on the north-east coast of Chatham Island, principally to see if the Chatham Islands click beetle still survived in the area. Eleven pitfall traps were placed in the reserve in two areas, but nearly all of these were destroyed by weka. Intensive collecting was undertaken in the forested areas, concentrating on log turning and night collecting, techniques that were known to be effective in locating *A. candezei* on Rangatira.

No specimens or remains of *A. candezei* were found. In fact the ground-dwelling insect fauna of beetles and weta was very depauperate, for example no specimens of *Dorcus capito* were found. From discussion with participants of the 1967 DSIR visit to Hapupu it appears that *A. candezei* survived at that time under large, very old, fallen logs in a largely grazed-out environment. Our suggestion is that as those logs decayed the habitat available for *Amychus* declined in the face of continuous grazing, until the fencing of the reserve. By this time *Amychus* may have become locally extinct. The area was visited by Dugdale in 1987, and he also failed to collect *Amychus*.

We noted an extremely high population of weka and some pigs in the area, both of which would impact severely on any remaining *Amychus*. However, our impression from a very brief visit to Taiko Camp was that the forest there, although severely disrupted by cattle, was much more intact than at Hapupu and some large ground-dwelling insects were found, including *Dorcus capito*. *A. candezei* might still survive in the less modified areas of the southern Chatham Island plateau.

b. Pitt Island

Activities on Pitt Island again concentrated on the location of the Pitt Island longhorn and to a lesser extent the Chatham Islands click beetle and the coxella weevil. To this end, 10 branch traps were placed in the proposed Glory Scenic Reserve and 11 in lightly grazed forest at North Head. Both of these areas had been identified for further investigation on our previous visit in 1990. Pan traps, pitfall traps and malaise traps were also run in these areas. Limited night collecting was undertaken in the vicinity of the Glory Bay house.

No specimens of any of the three protected species were found, and we have increasing doubts about their survival on Pitt Island.

The combined activities of our 1990 visit to Pitt Island and our more limited, but highly directed collecting in 1992 have led us to doubt the survival of the Pitt Island longhorn on this island. It still remains possible, however, that it could persist in low numbers, as it apparently does on Rangatira. There would appear to be adequate available larval food material, as trees die from the effect of wind and opening of forest margins by stock. Although the Chatham Islands

click beetle has, to our knowledge, never been recorded from Pitt Island, there seems no inherent reason why it should not have been present there. There appears to be extensive suitable habitat that is probably no worse than existed at Hapupu in 1967. If the beetle still survives on Pitt Island, it would be highly vulnerable to pig rooting and predation from other introduced vertebrates.

We again visited Rangiauria Point to inspect the *Aciphylla* plants. Less than 10 plants were found, and no weevil damage was evident. Although the plants were not as severely grazed as in 1990, it was disappointing, nevertheless, to see sheep in the reserve. Without better populations of *A. dieffenbachii,* it is hard to see how the coxella weevil could survive on the island, although we admit that we have not visited the largest coxella populations on Pitt Island.

We were alarmed to see the extent of pig rooting in "protected" areas of Pitt Island. Subjectively, we believe this problem has grown worse since 1990. We also noted how pig "burrows" under fences have allowed access by sheep to protected areas. Without some real control of the pigs, efforts at arthropod and plant conservation on Pitt Island will be entirely negated, and presently vulnerable species, e. g. *Dorcus capito, Mecodema alternans, Catoptes brevicornis,* and various weta, will become increasingly rare or be completely extirpated from the island. We also noted the extreme depauperateness of apterous and brachypterous microhymenoptera (tiny parasitic wasps) that are mainly dependent on litter-inhabiting insects in forest habitats. This lack of microhymenoptera is evidence of severe disruption of the forest ecosystem. We believe this to be largely due to the destruction of forest litter by pigs.

c. Rangatira

Our main objective on Rangatira was to locate further specimens of *Xylotoles costatus* following the collection of a specimen there by Dugdale in 1987 and, if possible, to learn something of its biology and host preferences. Secondary objectives were to investigate the population of *Amychus candezei* and to try to locate the population of *Hadramphus spinipennis* known to exist on the island.

Fifteen branch traps were placed in two sites, one in the clear areas just above the old woolshed and one in pole-sized forest well up the main track. Pitfall traps were also placed at both sites. Two malaise traps and a flight intercept trap were run in the clear areas. The flight intercept trap was removed at night to prevent interception of petrels. Branch traps were constructed using most of the main tree species on the island, in case *X. costatus* is host specific. Concentrated beating of woody plant foliage was undertaken during the day, in sunny areas. Particular attention was paid to ngaio, as the specimen of *X. costatus* collected by Dugdale in 1987 had been beaten from this species.

These techniques yielded numerous *X. traversii* and various other longhorns but no *X. costatus*, leading us to believe that either *X. costatus* is naturally rare on Rangatira or its habitat requirements are completely different from those of *X. traversii* and quite specific.

Our efforts to reach the *Aciphylla dieffenbachii* colony below the cliffs on the west side of Rangitira were unsuccessful because of lack of knowledge of the access route and shortage of time.

Our other main activity was night collecting and limited log turning in an effort to assess the prevalence of *A. candezei*. We found that though *A. candezei* could be found by log turning, its distribution was patchy and totally unpredictable. Also access to suitable logs was severely limited by bird burrows. *Amychus* could, however, be reliably located by searching tree trunks at night, when each observer could expect to find a minimum of three or four in two hours on a mediocre night and possibly as many as 10 on a "good" night. It is probable that warm humid nights, perhaps just after rain, are the best nights for seeing these beetles.

Our night collecting also turned up a single *X. costatus*. It was walking up a *Coprosma chathamica* tree trunk, next to the remains of the old woolshed, which tells us nothing, except that the species still exists on Rangatira.

A single specimen of *H. spinipennis* was also collected near the old woolshed, on the trunk of a *Pseudopanax chathamica*. There are no known colonies of *Aciphylla dieffenbachii* anywhere near, which is very odd. The collection from *Ps. chathamica*, however, may not be completely fortuitious, as one specimen in NZAC was collected from *Ps. chathamica*. *Pseudopanax* belongs to the plant family Araliaceae, which is closely related to the Apiaceae, to which *Aciphylla* belongs; both families belong to the plant order Araliales. It is just possible that these records on *Pseudopanax* are because the weevils were attracted to the plant rather than being attributable to chance. A close relative of *Hadramphus spinipennis, H. stilbocarpae* from Stewart Island and the Snares, has as its host plants *Stilbocarpa* spp., members of the Araliaceae. Both of these interesting collections were made on our one "good" night on Rangatira.

Night collecting on Rangatira gives an idea of what the insect fauna must have been like in many parts of the Chatham Islands and indeed of New Zealand, before the advent of humans and their introduced vertebrate animals. This applies particularly to medium- to large-sized flightless insects, which are now rare over most of New Zealand, and certainly do not occur exposed on the forest floor in the way that they do on Rangatira.

Apart from the three protected species, literally thousands of weta and perhaps hundreds each of cockroaches, stag beetles (*Dorcus capito*), darkling beetles (*Mimopeus pascoei*) and large ground beetles (*Mecodema alternans*) can be seen during an average evening. All that remains in most other places are the cockroaches, the occasional weta and small ground beetles.

d. Mangere Island

The main objective on Mangere Island was to locate and study the *Hadramphus* population. From reports by Young (1989) we knew that the weevil was widespread on the main part of Mangere Island and that some preliminary work had been done on the abundance and distribution of *Aciphylla dieffenbachii,* its only host plant. A disturbing feature of Professor Young's report was the recorded complete disappearance of whole surveyed patches of *Aciphylla*. The plant itself is regarded as vulnerable, and the weevil is potentially endangered, so anything that affects the well-being of the plant is of considerable significance.

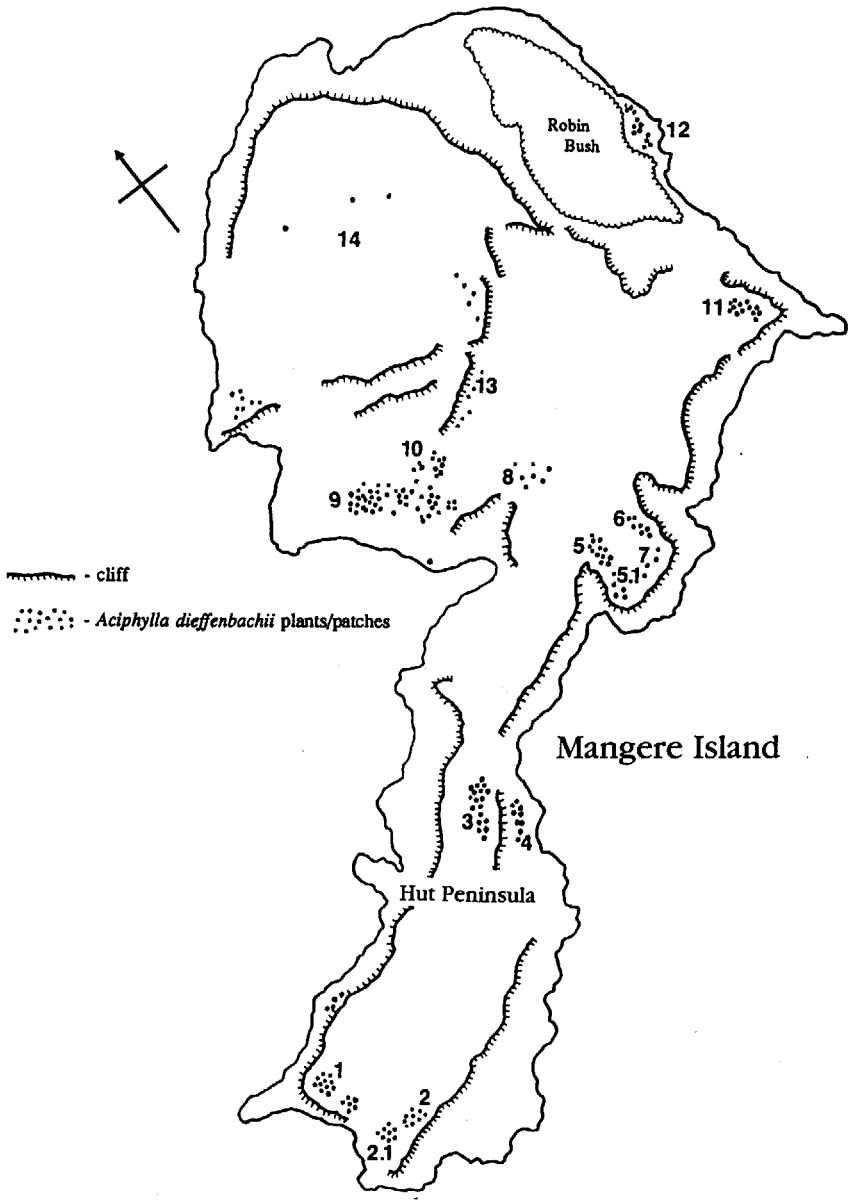

FIGURE 2. DISTRIBUTION OF *ACIPHYLLA DIEFFENBACHII* ON MANGERE ISLAND. (NUMBERS REFER TO A. *DIEFFENBACHII* PATCHES LISTED BY E. C. YOUNG.)

patches had previously existed, a more or less continuous distribution of *A. dieffenbachii* now occurs, i.e. ECY patches 8, 9, 10. Several new areas of the speargrass were found (Fig. 2). Plants in all areas of speargrass either showed damage that could be attributed to *Hadramphus* adults or larvae, or had weevils associated with them. The weevils were usually found in the grass and litter around the plant bases. This applied even to the plants on the Hut Peninsula that were previously thought to be relatively unaffected by the weevils, and to the scattered plants on the summit plateau.

Plant damage consisted of several identifiable types, as described in Appendix 8.3 and illustrated in Appendix Figs 3-8.

Plant damage was sometimes severe. Two small plants, each with a single male flower head, in ECY patch 3, were found that were dying from weevil damage. Stems were almost eaten through and gummy areas at the bases of leaf petioles were rotting. One

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Plant damage was sometimes severe. Two small plants, each with a single male flower head, in ECY patch 3, were found that were dying from weevil damage. Stems were almost eaten through and gummy areas at the bases of leaf petioles were rotting. One of these plants had at least 12 small (up to 1 cm long) larvae associated with it; however, the root crown was still firm and fresh, without apparent weevil damage, and was producing new shoots.

It is plain that larval feeding can cause death of the plant tops, but this may stimulate the plant to produce side shoots. At this time of year the larvae were still small, less than 1 cm in length, compared with an ultimate size of 3–4 cm. As the larvae grow and the plant top dies off, competition for food must become very severe. Under these conditions it is not unreasonable to expect that significant plant death might occur.

Whether weevil-induced plant death is sufficient to explain the observed disappearance of whole patches of *Aciphylla* from the island remains unclear and needs further investigation. It is likely that, later in the season, effects of feeding by larger, later-instar larvae would be sufficiently devastating to kill a number of plants and severely affect some heavily infested patches of plants.

We know from observations that, in some patches, most plants showed signs of weevil damage, but our data are not sufficiently complete to estimate the proportion of plants in a patch affected by weevil larvae. We imagine that *Aciphylla* patches, following devastation and subsequent decline of the local weevil population, could recover quite quickly from seed, and possibly from surviving root crown fragments. This process appears to be happening to ECY patches 5, 6 and 7, which apparently died out between December 1989 and December 1990 (Young, pers. comm.) but were present in December 1992 as a more or less continuous large patch of small plants, including many seedlings but only one flowering plant.

Hadramphus *distribution and numbers*

Signs of *H. spinipennis* could be found all over the island wherever *Aciphylla* grows, even on isolated scattered plants on the summit plateau. Interestingly, Young noted that he was unable to find coxella weevils on the Hut Peninsula in 1989. In 1992 they were numerous on every patch of *Aciphylla*. Perhaps the disappearance of *Aciphylla* patches in other parts of the island recorded at the same time encouraged dispersal of weevils. This evidence once again points to the dispersal powers of the weevil, which may be an important feature of its ecology and survival.

During the day, the most obvious manifestation of the weevil was the feeding damage referred to above, but occasional weevils were also seen on the plant or found resting at plant bases among grass and litter. At night, weevils could readily be seen, along with a variety of other insects, feeding, mating and walking over *Aciphylla* flower heads. Male flower heads, which outnumber female flower heads, were particularly favoured; for example on 30 November 1992 in ECY patch 3, of 96 *H. spinipennis* seen in a period of about an hour by two observers, 87 were on male flower heads, and nine on female flower heads. Distribution was very clumped, with most weevils towards the north-

east of the patch and few or none at the south-west or Hut end of the patch. on No weevils were found on many flower heads, only a single one was observed on a number of others, but 13 weevils were observed on one flower head and 14 on another.

On the same patch the next night, only 48 weevils were seen in about the same time; none were on female flower heads and no more than five on a single male flower head. On the night of 2 December 1992 in ECY patches 1, 2 and 2.1, a total of 222 flower heads were examined and 75 weevils observed, with only six on female plant heads. In surveys of *Aciphylla* patches ECY 1-3, male flower heads outnumbered female flower heads by 225 to 90 (Table 1), but even allowing for this imbalance, male flower heads were clearly favoured over female flower heads.

TABLE 1: *H. SPINNIPENNIS* SEEN AT NIGHT ON MALE AND FEMALE *ACIPHYLLA* FLOWER HEADS, ON 1-2 DECEMBER 1992, HUT PENINSULA, MANGERE ISLAND.

ECY PATCH NO.	MALE FLOWER HEADS	WEEVIL NO.	FEMALE FLOWER HEADS	WEEVIL NO.
1	34	59	11	6
2	62	6	39	0
2.1	52	2	6	0
New patch	11	2	7	0
3	66	48	27	0
Total	255	117	90	6

Comparing figures for 30 November (96 weevils) with 1 December (48 weevils) in the same *Aciphylla* patch it is apparent that, as noted previously, the "quality" of the night has a major impact on the number of weevils seen. The weather on 30 November consisted of moderate westerly winds with light showers, but the wind dropped in the later afternoon so the evening was relatively warm and humid. The evening of 1 December was cold with a moderate southerly wind blowing.

Discussion of Hadramphus *observations*

It is clear that, where the terrain is suitable, *H. spinipennis* can be most easily surveyed by observing and counting weevils on *Aciphylla* flower heads at night. Not too much reliance should be placed on the actual counts, because of the difficulty of standardising the weather conditions. From our counts alone, however, it is evident that the population of *Hadramphus* on Mangere Island must be substantial. One hundred and seventy one adults were counted on two nights in two discrete areas, which were not the largest areas of *Aciphylla* or the areas showing the heaviest *Hadramphus* feeding damage. Because of the patchy distribution, a reliable estimate of the actual weevil population could

only be made using other more sophisticated techniques, such as mark/recapture.

For survey and monitoring purposes a good assessment of the weevil population could be obtained by counting the weevils at night on samples of 50–100 male flower heads in late November–early December while flower heads were in good condition, preferably on warm humid evenings.

In areas where night survey is impracticable, a reliable estimate of the presence or absence of *Hadramphus* could be made from the diagnostic feeding damage of adults and larvae, together with searches for resting adults around the bases of plants.

It seems likely that *H. spinipennis* is responsible for some death of *Aciphylla* plants on Mangere Island. The extent of this and its effect on the long-term population dynamics of *A. dieffenbachii* need to be established and monitored. At present the *Aciphylla* population seems to be healthy and perhaps even spreading, but the impact of future planned and natural successional vegetation changes on the island might well alter the balance between *H. spinipennis* and its host plant to the detriment of both of them.

Other observations on Mangere Island

Although the area of bush remaining on Mangere Island is small and difficult to penetrate, and no night collecting was done in it, it appeared to retain some of the impressive entomological features seen on Rangatira, particularly the large diversity of ground-inhabiting insects. *Dorcus capito*, the Chatham Islands stag beetle, was numerous and two *Amychus candezei* were collected in pitfall traps. This latter is apparently a new island record for the species, and thus very encouraging for their long-term survival, in view of the apparent demise of the species at Hapupu on the main Chatham Island.

5. Conclusions

5.1 *AMYCHAS CANDEZEI*, CHATHAM ISLANDS CLICK BEETLE

This beetle is known from historical collections to have been present on at least Chatham Island, Rangatira, and Middle and Big Sister Islands. Whenever experienced collectors have searched for it, the beetle has always been found on the outer islands. However, it has not been collected on the main Chatham Island since 1967 and our searching at Hapupu, its last known locality there, using techniques successfully applied on Rangatira, failed to relocate it. The habitat at Hapupu is very severely modified and we can only conclude it probably no longer exists there. A newly discovered population of *A. candezei* was located in the "Robin Bush" on Mangere Island.

Further searches for the species should be made in other suitable localities on Chatham Island. Brief observations at Taiko Camp suggest that the habitat

there might be more suitable than at Hapupu. We understand that snipe have recently established on Star Keys, which could indicate that there might be suitable leaf litter habitat for *Amychus* there as well. Our conclusion is that, with at least four distinct populations in existence, *Amychus* is at present not seriously threatened. The Sisters Islands populations should be checked, since we understand that the vegetation on these islands has suffered from a series of dry years and increased seabird populations. These perturbations could affect the viability of the click beetle populations, which might necessitate a reassessment of the conservation status of the species.

5.2 *HADRAMPHUS SPINIPENNIS*, COXELLA WEEVIL

Historically the coxella weevil is known from Pitt Island, Rangatira and Mangere Islands. The last positively established collection from Pitt Island was by T. Hall in 1906–1908. Recent searches of *Aciphylla dieffenbachii*, particularly at Rangiauria Point on Pitt Island in 1990 and 1992, failed to reveal any weevils or feeding damage. We feel that it is unlikely that a weevil of this size would have escaped attention for 85 years, so we reluctantly conclude it may be extinct from Pitt Island. There is known to be a small population of *Hadramphus* on Rangatira. Fourteen were collected in 1970 and others have been seen since, on *Aciphylla* below the summit cliffs. Young (1989) reported that the largest clumps of *Aciphylla* had entirely disappeared, but *Aciphylla* could be seen clearly with binoculars in November 1992 in this locality. A single weevil was found in Woolshed Bush, not far from the old woolshed, on a *Pseudopanax* tree at night, a long distance from the nearest known *Aciphylla*, demonstrating their powers of dispersal.

It may be that the strong return to woody vegetation on Rangatira over the past 25 years has disadvantaged both *Aciphylla* and the coxella weevil. There remain, however, substantial populations of *Aciphylla* and *Hadramphus* on Mangere Island. Other outlying islands that have populations of *Aciphylla*, i.e. Western Nugget in the Murumurus (Tennyson *et al*. 1993), should also be searched for *H. spinipennis*.

Efforts should be made to establish the role of *Hadramphus*, if any, in the reported (Young 1989) disappearance of patches of *Aciphylla* and the dynamics of the inter-relationship.

With only two known populations, one of which appears precarious, the long-term survival of *Hadramphus* remains significantly threatened. Efforts should be made to establish a third viable population, perhaps on Pitt Island as part of the planned restoration programme. A prerequisite for this would be the establishment of a substantial *Aciphylla* population, which cannot take place without total control of sheep, pigs and cattle. The effects of mice, cats and weka on adult and larval *Hadramphus* are unknown and may need investigation.

5.3 *XYLOTOLES COSTATUS*, PITT ISLAND LONGHORN

This beetle is known from historic collections on Pitt Island, with the most recent positively dated collection being 1906–1908. Other undated specimens exist, but these are probably even older. Collections on Pitt Island over the last 25 years have failed to find this species. Our own visits in 1990 and 1992 were specifically targeted at finding *Xylotoles costatus* and used well known longhorn collecting techniques that were successful in collecting many specimens of the closely related *Xylotoles traversii*. We are forced to conclude that the chances of rediscovering *X. costatus* on Pitt Island are small.

A specimen of the Pitt Island longhorn was, unknowingly, collected by John Dugdale in 1987 from Rangatira. During our study we found another specimen next to the old woolshed in November 1992, which proves that the species still survives.

Unfortunately the circumstances in which both of these specimens were found, in a tangle of *Muehlenbeckia* and dead ngaio, and on a *Coprosma chathamica* trunk at night, reveal nothing useful about its habitat requirements. It has been assumed that, in common with other species of *Xylotoles, X. costatus* is a non-specific feeder on dead wood, with the larvae developing in dead twigs and small branches, but its scarcity, compared with the ubiquitousness of *X. traversii*, suggests it may be much more specialised in its requirements. All that we can say is that it survives, possibly at a low level, on Rangatira. It should be a priority of further work, but as this longhorn is so rarely encountered and can only be identified in the field with difficulty, efforts will need to be very precisely targeted.

We suggest a detailed study of the biology of other species of *Xylotoles* and related genera, which could be largely literature-based, to establish the likely limits of its behaviour and biology. Subsequently, a visit or series of visits to Rangatira, by experienced personnel, should specifically endeavour to locate beetles and their larvae in the field. We believe monitoring or casual observation is unlikely to give indications of the population size or threats to the survival of *X. costatus* until the precise habitat requirements are established.

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7. Appendices

7.1 RECORDS OF CHATHAM ISLANDS PROTECTED BEETLES IN PUBLIC COLLECTIONS

Amychus candezei Pascoe

*NZAC	1	"68" ex Brookes colln., no locality
CMNZ	1	Hutton colln., no locality
CMNZ	1	Chat. Is., Hutton colln.
NZAC	5	Hapupu, Chatham Is., 1.iii.1967, G.W. Ramsay, under logs
AMNZ	1	South East I., 27.xii. 1937, E.G. Turbott
NZAC	6	South East Island, 4–12 Nov. 1970, J.I. Townsend, under logs and on trees at night
NZAC	3	South East Island, 7–11 Dec. 1984, G.W. Gibbs
NZAC	3	South East Island, 1–14 Dec. 1987, J.S. Dugdale
AMNZ	3	South East Island, 10–30 m, near old Woolshed, 27-28.xi. 1992, J.W. Early, in dead logs and on dead *Olearia traversii* at night
LCNZ	6	Rangitira, 27–30.xi. 1992, J.W. Early, R.M. Emberson, P. Syrett, under logs, on trees, under *Melycytus* bark, in pitfall trap
LCNZ	2	Robin Bush, Mangere I., 30.xi.-3.xii. 1992. J.W. Early, J.W.M. Marris, in pitfall traps
NZAC	1	The Sisters, 12 Feb. 1974. A. Wright, under ice plant
NZAC	2	Mid Sisters I., 29.xi. 1973 . A Wright, A. Whittaker, fern litter, under rock
NZAC	1	Main Dome, Mid Sisters I., 24.xi. 1973. A. Whitaker, litter
NZAC	1	Big Sister, 11 Nov. 1973. R. Morris, under stone

Hadramphus spinipennis Broun

*NZAC	1	"78" ex A.E. Brookes colln., compared with type Kuschel,1964
*NZAC	1	"78" Chatham Islands, T. Hall
NZAC	1	no original labels, modern label reads "Chatham Is., Pitt Island 1900?"
NZAC	14	South East Is., 8–11 Nov. 1970. J.I. Townsend, R.H. Taylor and D.V. Merton, on coxella at night, one on *Pseudopanax* trunk
LCNZ	1	Rangatira, 29.xi. 1992, R.M. Emberson, *Pseudopanax chathamica* trunk at night
NZAC	6	Mangere Is., 16-21 Dec. 1988, on *Aciphylla dieffenbachii*

LCNZ	4	Mangere I., 2.xii. 1992, J.W.M. Marris, on *Aciphylla dieffenbachii* flowers at night
AMNZ	4	Hut Peninsula, Mangere I., J.W. Early, on *Aciphylla dieffenbachii* flowers at night

***Xylotoles costatus* Pascoe**

NZAC		No locality labels
BMNH	1	Pitt Island, Travers
CMNZ	1	Pitt Is., Wakefield
NZAC	1	Rangatiria Is., 1–14 Dec. 1987, J.S. Dugdale
LCNC	1	Rangatira, 29.xi. 1992, R.M. Emberson, on *Coprosma chathamica* trunk at night

* The numbers "68" and "78" on early specimens are T. Broun's identification numbers for *Amychus candezei* and *Hadramphus spinipennis,* respectively (Broun, 1910).

7.2 MANUAL FOR IDENTIFICATION AND MONITORING OF *AMYCHUS CANDEZEI,* CHATHAM ISLANDS CLICK BEETLE

The Chatham Islands click beetle, *Amychus candezei*, is a large (13–19 mm long), broad, rough surfaced click beetle (Appendix Fig. 1). Its larvae live in soil and leaf litter, probably growing to about 40 mm in length and having the appearance of large mealworms. The adults rest among leaf litter or under rocks and logs during the day but tend to come out and crawl around on the surface at night, when they can often be seen walking up tree trunks or on fallen logs and other debris. Although they can be found during the day by turning logs, the best and least intrusive way of observing them is by night searching of tree trunks alongside tracks, with a head torch. In areas lacking trees they should be visible on bare ground at night, or may be found by turning rocks and debris during the day.

There are thought to be at least four discrete populations of the Chatham Island click beetle, on Rangatira, Mangere, Middle Sister and Big Sister. Historically, the species also occurred on Chatham Island, with the last known sighting in 1967 at Hapupu, where it was found under large rotten logs in grazed-out kopi forest. It appears that this population did not survive until the fencing of Hapupu. They may have been finished-off by pigs or wekas, both of which are numerous in the area today. Other populations of the click beetle may still survive on Chatham Island, where better habitat remains. The tangled forest behind Taiko Camp would be a possibility. Perhaps efforts could be made to search for them on tree trunks at night, in conjunction with work at Taiko.

The Rangatira population remains healthy. On an average evening in summer an observer can expect to see 3 or 4 of these beetles on tree trunks in a two hour period after dark. Sometimes the number may be 8 or 10 individuals in the same length of time. It is not known what precisely controls this variation, but

warm, still, humid evenings, perhaps just after rain, are likely to be the most rewarding for searching. These same conditions seem to benefit other insects, so more of them will be about as well. We found a useful comparison could be made between the number of click beetles seen and the number of Chatham Island stag beetles, *Dorcus capito*, observed on the ground and on logs and tree trunks. Roughly twice as many stag beetles may be seen as click beetles. The stag beetles are more conspicuous and may provide a useful check on observer bias. However, care needs to be taken not to confuse the shiny stag beetles with the slightly smaller, matt black darkling beetle, *Mimopeus pascoei*, which is also very common on the ground at night.

The population on Mangere is newly discovered. Two specimens were collected in pitfall traps in "Robin Bush" in December 1992. It would be interesting to know whether the species is restricted to Robin Bush, or is more widely distributed on the island and also how numerous it is in Robin Bush. Night observation could reveal whether it is as numerous as on Rangatira.

There are specimens of *Amychus candezei* in collections from both Middle and Big Sister Islands. These beetles were collected in 1973 and 1974. It would be extremely helpful to know the present status of these populations. There have apparently been a series of dry years on the Sisters Islands combined with some increase in the seabird populations. The impact of these changes on the vegetation may have been such as to affect the populations of *Amychus* on these islands. Since the Sisters Islands hold half of the known discrete populations of *A. candezei*, the long-term survival of the species would be threatened by their demise.

Urgent steps should be taken to ensure that both of these populations remain viable. Studies could begin with night surveys, to be undertaken by visiting seabird workers, perhaps combined with some careful rock turning and replacement. A close relative, Cook Strait click beetle, used to be observable by these methods on North Brother Island in Cook Strait, which also lacks tall woody vegetation.

The possibility of further populations of *Amychus candezei* being found remains good. Searches could profitably be mounted on Little Mangere, Star Keys and perhaps other small islands including the Forty Fours, the Pyramid, the Murumurus and other stacks that have at least some vegetation. DoC and other workers visiting these islands in the course of other duties and research might be asked to invest a little time in looking for these beetles.

If observers are in doubt as to the identity of possible specimens of *Amychus*, photographs should be taken with a macrolens, or single voucher specimens, which could probably be removed without harm to the population, should be collected. These may be sent to the Department of Entomology and Animal Ecology at Lincoln University for confirmation of identification.

7.3 MANUAL FOR IDENTIFICATION AND MONITORING OF *HADRAMPHUS SPINIPENNIS*, COXELLA WEEVIL

The coxella weevil, *Hadramphus spinipennis*, is a large stout, knobbly-backed weevil (Appendix Fig. 2) that feeds on coxella, *Aciphylla dieffenbechii*. Because of its large size (20–25 mm in length) it cannot be confused with any other species of weevil or beetle occurring on the Chatham Islands.

Both adults and larvae feed on coxella, and this is its only known food plant. Adults and larvae produce characteristic feeding damage on coxella (Appendix Figs 3–8). Recognition of the feeding damage is an important aid in location of beetle colonies. This feeding damage is divided into four main types.

1. Adult feeding on leaf tips, blades and petioles. This varies from mild grazing with white gum production, to large areas eaten out of petioles (Appendix Fig. 3–4).

2. Adult flower feeding. Male flowers are clearly favoured. Male flower stalks are sometimes eaten almost through, causing tips to bend and die. Female flowers and green seeds are also eaten, usually only partially, but in extreme cases so that only a few seeds remain out of an umbrel (Appendix Fig. 5).

3. Larval feeding on leaves and petioles. Sometimes leaf tips are gummed together with sticky brown gum enclosing a small larva. On other occasions leaf fronds can be found dying, with a gum deposit near the base of the leaf blade, in which case a larva can be found inside the petiole (Appendix Figs 6–7).

4. Larval feeding in plant crowns amongst rotting leaf bases. In these cases, if several larvae are present, the whole plant top may die (Appendix Fig. 8).

Other ways of checking for the presence of coxella weevils include looking for the adult weevils on the plant tops, and searching round the bases of the host plant, as adults can often be found here, resting during the day. Best of all is night searching for the weevils with a headlamp, particularly when the plants are in flower. Adult weevils seem to be strongly attracted to the male flower of coxella for feeding and mating, and can readily be seen on them with a spotlight.

An indication of the number of weevils in an area can be gained by counting the number of weevils present on 50 male flowers of coxella, just after dark in November or December. Our data suggest that up to 30 or 40 weevils might be seen in a healthy population, with perhaps as many as 75 on a really good, warm, humid night.

It is probable that at high populations the weevils can cause significant damage to coxella plants. Individual plants may be killed and possibly whole patches of the plant devastated. Professor Euan Young of Auckland University has recorded the disappearance of patches of coxella that he had previously surveyed. It is not known if the weevils are responsible for this disappearance, but it seems possible. Records of coxella disappearance would be most useful,

particularly if combined with observation of weevil abundance and obvious signs of weevil-induced damage.

It is also not known what effect the disappearance of patches of coxella has on weevil populations. It seems likely that adult weevils may be able to walk considerable distances in search of new host plants. Observations on coxella weevils away from their host plants would be most interesting, and might include information such as distance to nearest coxella plant, what the weevil was doing when seen, and particularly observations on feeding on plants other than coxella.

The coxella weevil is currently known from two populations; a substantial one on Mangere Island, and a smaller one on Rangatira. Historically, the weevils used to occur on Pitt Island, but have not been seen there since early this century. Rediscovery of the weevil on Pitt Island would be a significant bonus and greatly improve its chances of long-term survival.

The possibility exists of further populations of the coxella weevil being discovered. Coxella evidently exists on some of the smaller offshore islands and stacks, for example the Murumurus and perhaps in other places. Careful searches for weevils or weevil damage, as described above, could be rewarded with the discovery of a new population of the weevil.

If a project is developed to protect and restore the southern end of Pitt Island, consideration should be given to making provision for coxella and the coxella weevil. This would require complete control of all grazing animals, because coxella is a highly favoured food plant for sheep or cattle. The effect of mice and perhaps of cats and weka on coxella weevil adults and larvae would also need to be investigated.

7.4 MANUAL FOR IDENTIFICATION AND MONITORING OF *XYLOTOLES COSTATUS*, PITT ISLAND LONGHORN

The Pitt Island longhorn, *Xylotoles costatus*, is a medium-sized (17–20 mm long) beetle (Appendix Fig. 9a). It is the largest of a number of species of longhorn beetles (family Cerambycidae) that occur on the Chatham Islands. Beetles of this family can generally be recognised by their elongate shape and long antennae, which are normally at least three quarters of the length of the beetle and sometimes even longer.

Positive field identification of the Pitt Island longhorn is difficult because of the presence on the Chatham Islands of another very similar species of longhorn, *Xylotoles traversii*. Both species of *Xylotoles* are blackish with a variable green-bronze sheen. In the few specimens of the Pitt Island longhorn seen, the bronzy colour was more evident than in *X. traversii*. Both species of *Xylotoles* have ridges or costae on their elytra, or wing cases, these being much more pronounced in the Pitt Island longhorn than in *X. traversii*.

Appendix Fig. 9b is a picture of the original type specimens of both species in the Natural History Museum in London. It can be seen from this that the most

obvious difference between the two species is in size. The size of *X. traversii* is however, very variable, from 6 to 14 mm in length in our collections. The few specimens of the Pitt Island longhorn we have seen vary from 17 to 20 mm in length, but smaller specimens that overlap the size range of *X. traversii* could occur.

Other useful differences for distinguishing between the two species are the slightly raised area between the inner ridges on each wing case and the somewhat more spatulate or rounded tips to the wing cases in the Pitt Island longhorn. But these differences are quite subtle and not readily appreciated without direct comparison between the two species.

The best that can be said is that any specimen of *Xylotoles* from the Chatham Islands over 16 mm in length is likely to be a Pitt Island longhorn.

Until recently the Pitt Island longhorn was only known from specimens collected late last century and early this century on Pitt Island. Then in 1987 a specimen was collected from a dead branch of ngaio caught up in a tangle of *Muehlenbeckia* on Rangatira. In 1992, a second specimen was found, by us, on Rangatira walking up a *Coprosma* tree at night.

Repeated efforts by ourselves and by entomologists from the old DSIR Entomology Division over a period of 25 years to re-collect the Pitt Island longhorn from Pitt Island have been unsuccessful. It could be extinct there or present in such low numbers as to be hard to find, or possibly it is in a habitat that has not been adequately sampled.

Most species of *Xylotoles* are thought to be feeders on dead twigs and branches as larvae and there would certainly be plenty of this material on Pitt Island. Being larger than the other species of *Xylotoles,* larvae of the Pitt Island longhorn might be expected to feed on woody material of a larger diameter than other species such as *X. traversii*. This might not be a problem on Pitt Island, but could go some way to explaining its apparent rarity on Rangatira. Most of the forest on Rangatira is relatively recent, and if the larvae needed large dead branches or large rotten logs, larval food could be a limiting factor for the population.

The Pitt Island longhorn is flightless, and the adults may spend a large part of their time on the ground, which would make them vulnerable to mouse predation on Pitt Island.

A priority for conservation of the Pitt Island longhorn is to establish its precise habitat requirements. This must involve determining its larval food requirements. Only when this has been achieved is real progress towards its long-term conservation likely.

Further searches for the species on Pitt Island could still be worthwhile. Since it is now known to occur elsewhere, i.e. on Rangatira, it could also be present on Mangere and possibly Little Mangere. Searches on these two islands would be most valuable. Really good photographs and measurements could be used to document its presence in any of these places.

The best way of finding adult longhorn beetles is by beating woody vegetation on to a tray and by using branch traps. Branch traps are bunches of freshly cut branches, up to about 60 cm in length, hung up in trees. These dying branches

give off various plant odours that are attractive to longhorn beetles. The branch traps can be beaten at regular intervals on to a tray and the longhorns collected or released back on to the tree. Recently dead or dying large branches are similarly attractive. Using these techniques, we were able to collect large numbers of *X. traversii* and a variety of other species of longhorns of Chatham, Pitt, Rangatira and Mangere Islands, but unfortunately no Pitt Island longhorns.

Threats to the survival of the Pitt Island longhorn can really only be identified once its biology and habitat are better understood.