A terrestrial invertebrate inventory of Quail Island (Otamahua): towards the restoration of the invertebrate community

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Abstract

The ecological communities of Quail Island (Otamahua) in Lyttelton Harbour, Banks Peninsula, New Zealand, are being restored to a more natural condition. Invertebrates were collected from the island and identified to produce an inventory. Banks Peninsula endemic species currently known from Quail Island include: five spider species *Misgolas borealis*, *Migas saxatilis*, *Maniho ngaitahu*, *Pahora kaituna* and *Stanwellia* sp., a tenebrionid beetle *Mimopeus granulosus*, a cockroach *Celatoblatta* sp., a ground weta *Hemiandrus* sp., a cicada *Kikihia* sp., a silverfish *Heterolepisma* sp., a millipede *Icosidesmus schenkeli* and a snail *Charopa pseudocoma*. A rare native aphid, *Aphis cottieri*, was found on *Muehlenbeckia complexa* and the populations represent some of the largest known for this aphid. Species absent from Quail Island but found close by in Orton Bradley Park include a tree weta (Anostostomatidae) *Hemideina femorata* and five ground beetle

(Carabidae) species. Insects proposed for introduction are listed and habitat requirements are discussed.

Keywords: Quail Island – invertebrates – checklist – ecological restoration – Otamahua – biodiversity – Banks Peninsula – endemism – New Zealand.

Introduction

Quail Island (Otamahua) is in Lyttelton Harbour, 13 km east of Christchurch, New Zealand and at 81 ha, is Canterbury's largest island. High cliffs on the northeastern side are a legacy of the island's volcanic history. The majority of the original vegetation was removed in pre-European times (Burrows *et al.* 1999), but a small number of native plant species persist and numbers are increasing with each year's planting programme (Burrows & Leckie 2001). Quail Island is a recreational reserve managed by the Department of Conservation. The Quail Island Ecological Restoration Trust, in partnership with Department of Conservation, are currently restoring the plant and animal communities (Burrows *et al.* 1999; Genet & Burrows 1999; Norton *et al.* 2003).

At low tide, mudflats connect the island to Moepuku Point on the mainland, and reinvasion by some mammalian predators remains a constant threat to native fauna including invertebrates. However, Quail Island's distance from the closest forest remnants and the sea around the island provides a barrier to large flightless insects, and will require human assistance to establish these species on the island. Efforts to eradicate rabbits using Pindone (1997-8) have resulted in a few remaining on the island. Cats and mustelids (stoats, ferrets, and weasels) were also thought to have been eradicated from the island at the same time; however the trapping of three mustelids over 2001-2 on the island adjacent to the mudflats that link with the mainland at low tide demonstrates the constant threat of reinvasion by these introduced vertebrates. From 1999 to 2002 cage trapping, spotlighting and Fenn trapping reduced hedgehog populations to low levels. In August 2002 a Talon® (brodifacoum) poison operation using bait-stations was undertaken to eradicate rats and mice. In August 2003, several monitoring methods showed evidence only of mice. It is hoped that additional funding will enable successful eradication of the mice in the near future with the primary aim to restore whole biotic communities as fully functioning systems. As the island is currently classified as a recreational reserve, it is likely to be managed as a multiple-use/restoration island (Towns *et al.* 1990a).

Between six and 12 million years ago Banks Peninsula was an island (Wilson 1998) and this isolation has resulted in the peninsula having a high proportion of endemic invertebrates (Wells *et al.* 1983). Many Banks Peninsula (including Quail Island and Port Hills) insects have become extinct or endangered due to deforestation, farming practices and the introduction of predators (including hedgehogs, rats, mice, mustelids and cats) (Wells *et al.* 1983). Several of the larger species in particular (e.g. *Mecodema howitti*

Castlenau, *Hemideina ricta* (Hutton) and *Zeadelium gratiosum* (Broun)) are threatened by introduced predators and habitat loss (Sherley 1998; Pawson & Emberson 2000; McGuinness 2001; Anderson *et al.* 2003), making Quail Island a potentially important refuge for such species. Larger flightless invertebrates such as tree weta and ground beetles (Carabidae) are particularly vulnerable to local extinction, because their nocturnal behaviour exposes them to mammalian predators, and their poor dispersal powers hinder reestablishment of populations (Lövei & Cartellieri 2000).

The invertebrate fauna provides the greatest contribution to species richness in terrestrial communities including islands, and is a critical component of their ecology (Hutcheson *et al.* 1999; Grove & Stork 2000). The roles of invertebrates include pollination, nutrient cycling and seed dispersal (Gibbs 1990; Keesing & Wratten 1997; Keesing & Wratten 1998; Williams 2003) and they also provide prey for insectivorous birds (including bellbirds) and lizards (Falla *et al.* 1987; Freeman 1997; Williams 2003) and other invertebrates. Although Butcher *et al.* (1979) produced a checklist of the foreshore fauna of Quail Island, no previous large-scale collecting has been undertaken to survey the terrestrial invertebrate fauna of Quail Island.

This work aims to provide:

1) An inventory of the invertebrate fauna.

2) A list of species which are most likely absent, by comparing the fauna with invertebrates collected from similar habitats on Banks Peninsula including Orton Bradley Park.

3) Baseline records for long-term monitoring.

4) Identification of pest invertebrates.

A Quail Island invertebrate inventory will allow informed decision making for species introductions to fulfill the primary aim of restoring the biodiversity of the island (Norton *et al.* 2003).

Methods

Pitfall trapping was the main collection method used in this study because it requires little maintenance and captures invertebrates passively. Pitfalls also allowed five habitats to be compared simultaneously and can be replicated on an annual basis so that faunal changes can be monitored over the restoration process. Pitfall traps were made from 350 ml honey pots (# NA6628, Stowers) with a collecting diameter of 8 cm and were filled with c. 100 ml of monopropylene glycol (antifreeze) to preserve specimens and c. 0.5 ml of detergent to reduce the surface tension. Galvanised metal roofs 20 x 20 cm supported by four wire legs were used to prevent rain and plant debris from filling the pitfalls. Thirty traps were used over the damper southern half of the island in five habitat types (Figure 1): introduced grassland (G); recently restored forest habitat (native plants established in 1998) (R); twenty-year-old native patches (T); established/regenerating native shrubland (ER); and pine (*Pinus radiata* D. Don) and macrocarpa (*Cupressus macrocarpa* Hartweg) stands (PM). Pitfalls were used continuously for 14 months (11 November 1998 to 11 January 2000), with the traps cleared approximately monthly.

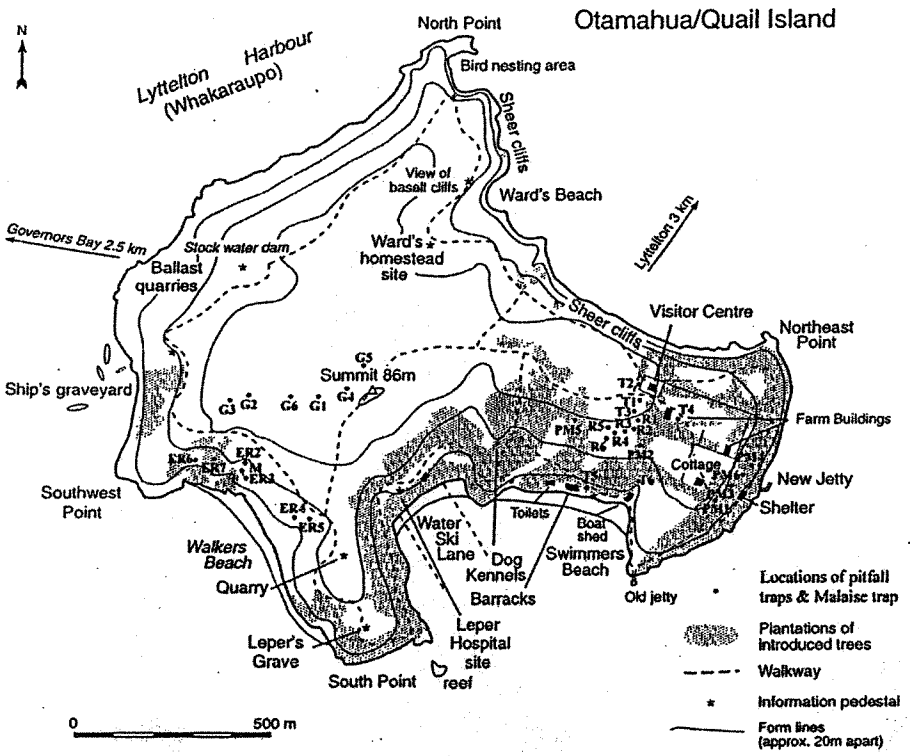

Figure 1. Locations of pitfall traps and Malaise trap used for long-term monitoring on Quail Island. Key: M = Malaise trap, G = grass, R = native trees planted in 1998, PM = pine & macrocarpa trees, T = native trees planted c.1980, ER= established/regenerating native trees (See methods for full descriptions of habitats.)

Further trapping took place for approximately one month over each subsequent summer period: 13 December 2000 to 11 January 2001, 13 December 2001 to 11 January 2002 and 18 December 2002 to 16 January 2003. Additional pitfall traps (other than those shown in Fig. 1) were used to randomly sample other sites of ecological importance e.g. beach, under cliffs and native vegetation.

A Malaise trap (Hutcheson 1990) was used continuously for one year in original shrubland (Fig. 1), which includes flax (*Phormium tenax* J.R. & G. Forst.), kanuka (*Kunzea ericoides* (A. Rich.) Joy Thomps.), *Muehlenbeckia australis* (G. Forst. f.) Meissn., and *Muehlenbeckia complexa* (A. Cunn.) Meissn. This vegetation is surrounded by bracken (*Pteridium esculentum* Forst. f.) and introduced grasses (Burrows *et al.* 1999). The trap contents were cleared monthly at the same time as those of the pitfall traps.

Other collection methods used were light trapping, yellow pan trapping (Wratten *et al.* 1995), litter sampling, beating and hand collecting in native remnants. Wooden discs (Bowie & Frampton 2004) were used to simulate logs to assist hand collection of species such as snails, flatworms, native harvestmen and beetles. Wooden discs made of oak (*Quercus* sp.), pine (*Pinus radiata*), macrocarpa (*Cupressus macrocarpa*) and black beech (*Nothofagus solandri* (Hook. f.) Oerst. var. *solandri*) were grouped at eight sites around a native patch of

scrub. To confirm the presence or absence of tree weta on Quail Island, 60 'weta motels' (untreated pine blocks with holes) were attached to five tree species to provide refugia for detection (Bowie 2001; Bowie *et al.* unpublished).

Magnificent Gully in Orton Bradley Park, 5 km away from Quail Island (see Burrows & Leckie 2001), was sampled for ground beetles (Carabidae) as a close 'mainland' comparison. Twelve pitfall traps were set between 8 December 1999 and 11 January 2000. Six traps were in native bush, dominated by kanuka, whiteywood (*Melicytus ramiflorus* J.R. & G. Forst.) and kowhai (*Sophora microphylla* Aiton), and six were in exotic grassland 10 m from bush edge. In addition, carabids were collected from under eight black beech discs amongst kanuka scrub to compare with Quail Island fauna.

Sixty weta motels (Bowie 2001) were also placed on trees at Orton Bradley Park. Weta motels were checked for weta presence at 3-monthly intervals for one year.

Several factors were used to choose which of the invertebrates missing from Quail Island were possible candidates for introduction:

1) Size; larger invertebrates are more vulnerable to mammalian predators, such as rats (Bremner *et al.* 1984), and would benefit from introduction due to reduced predation pressure.

2) Species for which the distribution is known to exist nearby on the mainland.

3) Species for which the ecological information is known.

4) Banks Peninsula endemicity (the Port Hills and Quail Island are included) and threatened/endangered status or reduced distribution of species based on Department of Conservation species ranking systems (Molloy & Davis 1994).

5) Species that are relatively easy to monitor.

Results

Over 667 species, 199 families and 30 orders of invertebrates were collected from Quail Island (Appendix 1), of which approximately 28% were Diptera, 21% were Coleoptera, 16% were Hymenoptera, 9% were Lepidoptera and 8% were Araneae and 28% in 25 remaining orders. The majority of the Diptera and Hymenoptera were collected in a Malaise trap, while pitfall traps caught most of the Coleoptera species. Approximately 77% of the species identified are New Zealand endemics.

Banks Peninsula endemics

Five spider species collected on Quail Island are endemic to Banks Peninsula. These were *Misgolas borealis* (Forster), *Migas saxatilis* Wilton, *Maniho ngaitahu* Forster & Wilton, *Pahora kaituna* Forster and a *Stanwellia* sp. Other Banks Peninsula endemics included the tenebrionid beetle *Mimopeus granulosus* (Breme), a cockroach *Celatoblatta* sp., a ground weta *Hemiandrus* sp., a silverfish *Heterolepisma* sp. Escherich, a millipede *Icosidesmus schenkeli* Carl, a cicada *Kikihia* sp. and a snail *Charopa pseudocoma* Suter.

Rare species

Populations of the native aphid *Aphis cottieri* Carver, thought to be endangered and threatened with extinction in the

short term (Pawson & Emberson 2000), were found on *M. complexa*. There are at least three Quail Island colonies of this aphid (Bowie 2001) and these represent one of the largest known populations to date (MAWS). An agromyzid fly, *Pseudonapomyza* sp.1, collected from a Malaise trap on Quail Island is a new record for New Zealand. A rare species of crane fly, *Neoalexandria conveniens* (Tipulidae), was collected from the Malaise trap in the mature flax and kanuka area. Motanau Island is the only other location in Canterbury from which this species has been recorded (PMJ).

Coleoptera – *key results*

Of the seven carabid species found on Quail Island, four are native, but none are endemic to Banks Peninsula (Table 1). In contrast, Orton Bradley Park pitfalls yielded six native carabids including two Banks Peninsula endemics, *Megadromus guerinii* (Chaudoir) and *Holcaspis suteri* (Broun). Other carabids found here, but not on Quail Island, included *Holcaspis intermittans* (Chaudoir) and *Megadromus antarcticus* (Chaudoir) (Table 1).

Although the huhu beetle *Prionoplus reticularis* White was collected on Quail Island, other large beetles such as longhorn beetle *Ochrocydus huttoni* Pascoe (Cerambycidae) and stag beetle *Paralissotes reticulatus* (Westwood) (Lucanidae) were not found.

Arachnida – *key results*

A total of 53 spider species were collected from Quail Island of which 26% were introduced to New Zealand, while five species were Banks Peninsula endemics (see above).

Artificial weta roost (weta motels) – key results

No weta were found in the Quail Island weta motels, but tree weta (*Hemideina femorata* Hutton) and cave weta were found in Orton Bradley Park weta motels. Spiders were the main occupants at all sites, and motel occupation by invertebrates was considerably lower on Quail Island (Bowie *et al.* unpublished). Several invertebrate species were collected only from weta motels. These include the darkling beetle *Artystona rugiceps* Bates (Tenebrionidae) and the spiders *Clubiona huttoni* Forster and *Cambridgea ambigua* Blest & Vink.

Wooden discs – key results

Ground beetles (Carabidae) were found under the wooden discs at Quail Island and Orton Bradley Park. Six carabid species were found under discs, four at Orton Bradley Park and two at Quail Island. Other native invertebrates under discs included slugs (absent from Quail Island), flatworms, snails, harvestmen, millipedes, centipedes and spiders (Bowie & Frampton 2004).

Discussion

Johns (1986) in a survey of Banks Peninsula reserves found 1416 species of arthropods, while Ward *et al.* (1999) collected 885 species in the Hinewai Reserve alone. Given that Quail Island has no significant mature native forest, it is not unexpected to find a lower number of species (667). Although invertebrates have been collected throughout the entire island, and over 11,500 pitfall trap days have been used,

Table 1. New Zealand endemic ground beetle (Carabidae) species collected in Banks Peninsula (BP) surveys. ([1] = nomenclature based on Larochelle & Larivière (2001); * = Candidate species for introduction to Quail Island; ? = identified to genus only; p=present)

Species collected[1] (**bold** = B.P. endemic)	Quail Island *(This study)*	Orton Bradley *(This study)*	Five sites on BP (May-Sept) *(Gorton unpublished)*	Ahuriri Bush Scenic Reserve *(Butcher & Emberson 1981)*	Hinewai Reserve *(Ward et al. 1999)*	Banks Peninsula Survey *(Johns 1986)*
"Anchomenus" sp.				p	p	p
"Argutor" pantomelas				p		p
Aulacopodus maorinus					p	p
Bembidium parviceps						p
Cicindela latecincta	p					p
Demetrida dieffenbachii		p				p
Dicrochile aterrima						p
Dicrochile whitei	*			p		p
Euthenarus brevicollis						p
Holcaspis angustula	p	p	p	p	p	p
Holcaspis elongella	p		p	p	p	p
Holcaspis intermittens	*	p		p		p
Holcaspis suteri	*	p	p	p	p	p
Lecanomerus sharpi						p
Mecodema fulgidum						p
Mecodema howittii	*					p
Mecodema oregoides	*		p	p	p	p
Mecyclothorax rotundicollis					p	p
Megadromus antarcticus		p	p	p	p	p
Megadromus guerinii	*	p	p		p	p
Metaglymma moniliferum	p					p
Notagonum feredayi						p
Notagonum submetallicum					p?	p
Oopterus laevicollis				p		p
Oopterus puncticeps					p	
Platynus macropterus						p
Pelodiaetus sp.						p
Selenochilus piceus					p?	p
Syllectus anomalus						p
Triplosarus novaezelandiae						p
Zabronothus striatulus	*		p	p	p	p
Zeanillus phyllobius						p
TOTALS	**4**	**6**	**7**	**11**	**13**	**31**
B.P. endemics	**0**	**2**	**3**	**3**	**5**	**6**

some invertebrate species may be present but so scarce that they have not been collected. The absence of rats and hedgehogs may take a few years to allow these small populations to increase to detectable levels.

Spiders

The spider fauna of Quail Island is typical of a modified habitat with several large-bodied species absent (e.g. *Porrhothele antipodiana* (Walckenaer)),

due to predation and habitat destruction. The highly modified island landscape and the relative isolation and higher rainfall of Hinewai (Ward *et al.* 1999) most likely contributed to the lower proportion of introduced spiders observed by Ward *et al.* (1999) at Hinewai (9%) compared with Quail Island (26%).

Aphids

The presence of *A. cottieri* (Carver 2000) on Quail Island offers an excellent opportunity to conserve this species through plantings and management of small-leaved pohuehue *Muehlenbeckia complexa*. Other native aphid species absent from Quail Island could be introduced once sufficient host plants are established, e.g., *Paradoxaphid plagianthi* Cottier on ribbonwood *Plagianthus regius* (Hochr.) and *Aphis healyi* Cottier on native broom *Carmichaelia australis* R. Brown.

Hymenoptera

Not all the Hymenoptera could be identified due to the lack of funding, and as a result, those identified only contributed to 14.6% of the invertebrate species collected on Quail Island. The exotic braconid wasp *Meteorus pulchricornis* Wesmael is an accidentally introduced lepidopteran parasitoid with a very wide host range. It was first recorded from New Zealand in 1996 and since then has been recorded from both exotic and endemic hosts (Berry 1997; Berry & Walker unpublished). Although collection records are mainly from modified habitats, this braconid has been found extensively parasitising the native kowhai moth *Uresiphita polygonalis maorialis* Felder and Rogenhofer in Auckland (Berry unpublished). As kowhai moth is present on Quail Island, it is likely that this species is the host, or one of the hosts of *M. pulchricornis* in this system.

Flies

Diptera was the most diverse order making up 28.5% of the invertebrate species identified from Quail Island, most of which were collected using a Malaise trap. Two exceptions were *Tricimba* spp. (Chloropidae) and *Megaselia* spp. (Phoridae), which were collected in pitfall traps in large numbers. Given the scarcity of mature forest Mycetophilidae were surprisingly diverse on Quail Island with 34 species identified. This family prefers damp, forested sites (Ward *et al.* 1999), which was shown by the 61 species collected at Hinewai Reserve (Ward *et al.* 1999).

Problem species

The spider *Steatoda capensis* Hann was common under logs in drier areas on the island and could be a problem when beetle species are introduced in the future. The spider's presence was often associated with larger beetle prey remains (mainly from Carabidae, Elateridae and Tenebrionidae). Invertebrate pest species (detrimental to ecological restoration) not yet collected on Quail Island include the white-tailed spider *Lampona cylindrata* (L. Koch) and the introduced wasp *Vespula germanica* (F.). Although *V. vulgaris* (L.) has been collected from Quail Island, colonies have not yet established. However, with the development of forest canopy, *Vespula* wasp colonization will probably occur in time. One species, unwanted because of its ecological invasiveness, is the

Argentine ant (*Linepithema humile* (Mayr)). This ant species has been recorded in Christchurch and there are concerns that it could be transported to Quail Island in plant pots and root trainers during restoration plantings. Eradication of an Argentine ant infestation on Tiritiri Matangi Island has recently been attempted using poison baits (Harris & Green 2001) with some success. However, prevention of accidental ant introductions is the best strategy. The use of movement control, hygiene and poison baits placed in plant stockpiles, may avoid accidental introductions and the expense of eradication in the future.

Some invertebrates collected were associated with vertebrate pests. The mouse flea *Leptopsylla segnis* (Schönherr) and the rat flea *Nosopsyllus fasciatus* (Bosc) (see Appendix 1) found in pitfalls, were indicative of the rodent population found at the time. The number and distribution of these flea species caught in pitfall traps has increased with increasing rodent numbers (Bowie unpublished) and could be used as an indicator of rodent presence. An interesting absence is the rodent flea *Nosopsyllus londiniensis londiniensis* (Rothschild), which has been collected mostly near ports, evidently coming in via shipping (R. Pilgrim, pers. comm.). One chicken flea, *Ceratophyllus gallinae* (Schrank), was also collected in a pitfall trap and is likely to be from a passerine, possibly a blackbird *Turdus merula* L., song thrush *Turdus philomelos* Brehm or starling *Sturnus vulgaris* L. An interesting find on a trapped dead rat was the margarodid bug, *Coelostomidia deboerae* Morales. This record represents the southern-most known specimen collected (Morales 1991). Two known plant hosts, totara *Podocarpus totara* and black pine *Prumnopitys taxifolia* (D. Don) de Laub (Morales 1991) exist on Quail Island (Burrows & Leckie 2001).

Restoration

The restoration of forest and shrub cover on Quail Island will allow re-colonisation by some flying insect species, particularly native Diptera (flies), Lepidoptera (Moths and butterflies) and Hymenoptera (wasps, bees and ants) from forest remnants around the Lyttelton Harbour basin. However, some invertebrates, such as the larger flightless beetles (Kuschel 1990) and tree weta, are unlikely to naturally colonise and their establishment will require human intervention. With the lack of decaying native logs and litter associated with 'mature' forest, and with predation by mammalian pests, it is not surprising that Quail Island has apparently lost invertebrates associated with these habitats, such as the stag and longhorn beetles. The paucity of logs for invertebrates on Quail Island and the decades required for mature trees to grow to produce them naturally, means that logs will have to be sourced from nearby sites (such as Orton Bradley Park or Ahuriri Scenic Reserve) and/or use the existing pine and macrocarpa trees on the island. Sourcing native logs from off the island may have the advantage of introducing absent fungi, bacteria and small invertebrates that are part of the log habitat. However, logs will require careful screening to reduce the risk of accidental introductions of undesirable species (Miskelly 1999). Recent work using wooden discs as carabid refuges on Quail Island and at Lincoln

University shows good potential as a technique for release and monitoring (Bowie & Frampton 2004). When trees on Quail Island are felled for management purposes, some of the logs should be cut into discs and kept for use as refuges in specific areas.

Although Quail Island still has mice present, it has potential as a refuge for larger bodied threatened invertebrates that are susceptible to predators such as rats and hedgehogs. The proximity of Quail Island to the mainland and recreational boat landings make it vulnerable to mammal reinvasions (Atkinson 1989), so it will require constant monitoring and predator control strategies. Regardless of this, reduced predator densities in New Zealand 'mainland islands' (Ell 2000) have shown many benefits to native fauna (Innes *et al.* 1999). Quail Island's vulnerability is considered to be somewhere between that of a mainland island and an offshore island (Derek Brown, pers. comm.). It provides an opportunity for invertebrate species unique to Banks Peninsula and coastal Canterbury to be given a predator-free island habitat in a similar way to that provided by Matiu-Somes Island and Tiritiri Matangi Island for the Wellington and Auckland regions respectively (Watts & Gibbs 2000; Voullaire 1996).

Candidate species for introduction

A comparison of carabid species with those collected elsewhere on Banks Peninsula indicated that this beetle family is poorly represented on Quail Island (Table 1). Banks Peninsula has several invertebrates that are threatened, endangered or range restricted, including *Mecodema howitti* Laporte de Castelnau (Carabidae) (Anderson 2000) and *Hemideina ricta* (Anostostomatidae) (Wells *et al.* 1983; Sherley 1998). If invertebrate introductions to Quail Island are successful, endangered species such as *M. howitti* may thrive with low populations of mammalian predators and provide valuable source populations for future translocations. Quail Island could have at least seven more native carabid species introduced (to a total of 11) when suitable vegetation has been restored on the island (in Table 1). Carabid and other species identified as possible candidates for introduction are given with their preferred habitat (Table 2). *M. guerinii* was chosen for introduction rather than *M. antarcticus* (Chaudoir) for two reasons; *M. guerinii* is a Banks Peninsula endemic (Anderson 2000) and *M. antarcticus* is a wide-spread Canterbury species (Larochelle & Larivière 2001). Mandible indentations on carabid elytra matching those of *M. antarcticus* provide circumstantial evidence that this species preys on smaller carabid species (RME).

Tree weta are also absent from Quail Island. There are two species on Banks Peninsula, *H. ricta*, the Banks Peninsula tree weta, which is restricted to the eastern portion of Banks Peninsula, and *H. femorata*, the Canterbury tree weta, which is more widespread (Townsend *et al.* 1997). As the two species are thought to hybridise (Morgan-Richards & Townsend 1995), only one species should be introduced to the island. The tree species currently being planted at Quail Island will eventually provide good tree weta habitat. On Banks Peninsula, 95% of the *H. femorata* and 34% of *H. ricta* were found

Table 2. Possible invertebrate candidates, habitat required and date for introduction to Quail Island.

Release site (Bowie 2001)	Species	Family	Common name	Banks Peninsula Endemic	Habitat required by invertebrate species	Source population for introduction	Approximate date for species introduction[1]
1	*Megadromus guerinii*	Carabidae	Ground beetle	Yes	Some shrub cover, logs / wooden discs	Orton Bradley Park/ Ahuriri Reserve	2003-4
2	*Holcaspis intermittens*	Carabidae	Ground beetle	No	Bush cover, logs / wooden discs	Orton Bradley Park/ Ahuriri Reserve	2003-6
3	*Holcaspis suteri*	Carabidae	Ground beetle	Yes	Bush cover, logs / wooden discs	Orton Bradley Park/ Ahuriri Reserve	2003-6
4	*Mecodema oregoides*	Carabidae	Ground beetle	Yes	Bush cover, logs / wooden discs	Ahuriri Reserve	2003-6
5	*Ochrocydus huttoni*	Cerambycidae	Longhorn beetle	No	Mainly kanuka & manuka	Orton Bradley Park	2003-6
6	*Hemideina femorata* or (*H. ricta*)	Anostostomatidae	Tree weta	No / (Yes)	Canopy for dispersal, roosting sites / 'weta motels', leaf litter for oviposition	Orton Bradley Park/ (Eastern BP)	2003-7
7	*Omedes* sp.	Tenebrionidae	Darkling Beetle	No	Ice plant on coastal edges	Motunau Island	2004-9
8	*Mimopeus* sp.	Tenebrionidae	Darkling Beetle	Yes	Shingle & *Muehlenbeckia*	Kaitorete Spit	2005-10
9	*Mecodema howittii*	Carabidae	Ground beetle	Yes	Bush cover, logs / wooden discs	Eastern BP reserves	2006-12
10	*Pseudaneitea maculata*	Athoracophoridae	Native slug	No	Bush cover, logs / wooden discs	Orton Bradley Park	2003-12
11	*Paralissotes reticulatus*	Lucanidae	Stag beetle	No	Rotten logs / wooden discs	Ahuriri Reserve	2006-12

[1] Dates and order are indicative only and are dependent on species priorities and the time taken for appropriate habitat to be sufficiently 'developed'.

on kanuka (*K. ericoides*) (Townsend *et al.* 1997), which is the main tree species (15.6% of planted species) on Quail Island (Burrows & Leckie 2001). The introduction of the kanuka long-horn beetle (*Ochrocydus huttoni* Pascoe) (Cerambycidae), would help tree weta success as *Hemideina* species (Anostostomatidae) are often found in tunnels made by *O. huttoni* larvae (Field 2001). However, due to the paucity of mature native trees and associated roost sites for tree weta, artificial weta roosts (Trewick & Morgan-Richards 2000) may need to be used initially. Weta motels should provide a suitable method to introduce and monitor success of weta populations on Quail Island. Other notable absences from Quail Island include native slugs (Athoracophoridae). One slug species, *Pseudaneitea maculata* (Collinge), is present in nearby Orton Bradley Park where it was found under wooden discs as adults and eggs (Bowie & Frampton 2004), indicating they could be readily introduced using wooden discs provided as refuges.

Translocations

Translocation of fauna for restoration (Meads 1994) should be from sites as close as possible to Quail Island so that specimens are ecologically suited to local conditions. Botanists attempt to restrict translocated or propagated material to within five kilometres of source, but disjunctions in faunal distributions can often make this difficult (Craig & Veitch 1990). Two sites close to Quail Island, Magnificent Gully in Orton Bradley Park, and Ahuriri Scenic Reserve, provide good habitats to source various beetles (particularly carabids) and *H. femorata* (Bowie *et al.* unpublished, Bowie & Frampton 2004; Butcher & Emberson 1981; Gorton unpublished).

Each proposed species transfer should be weighed against restoration goals, and the limitations on Quail Island of size (81 ha) and habitat, all of which may impose restrictions on the potential numbers of species. The habitat requirements of the species proposed for transfer should be carefully considered. Specific protocols and guidelines need to be followed to ensure the integrity and success of the colonising populations (Anonymous 1990; Craig & Veitch 1990; Gibbs 1990; Towns *et al.* 1990b). It should also be remembered that Quail Island will always face the threat of a potential rodent, hedgehog or mustelid reinvasion. It is therefore important that other 'safer' islands are considered as alternatives for endangered species.

In addition to restoring species richness of invertebrates that were once likely to have been present on Quail Island, the transfer of some ecologically appropriate species with high conservation values could also be considered. Populations of these invertebrates on Quail Island will gain a reproductive advantage with reduced numbers, or absence of, populations of mammalian predators, compared with mainland invertebrate populations in the presence of predators (e.g. predation of land snails by possums, hedgehogs and rats (McGuinness 2001)). Factors affecting reintroduction success and failures are poorly understood (Scott & Carpenter 1987; Griffith *et al.* 1989; Armstrong *et al.* 1994; Sherley 1994) and the need to have a good scientific design in restoration monitoring is

important to understanding the success of programmes in the long-term (Gibbs 1990; Armstrong *et al.* 1994; Atkinson 1994). A measurable goal of invertebrate translocation success could be that introduced species have reached sufficiently healthy populations on Quail Island to allow future translocations to be sourced from the island. Community and ecosystem endpoints are harder to set as there are no predator-free refuges on Banks Peninsula to use as a reference.

Continuing invertebrate monitoring on Quail Island will be invaluable to understanding changes associated with ecological restoration and in identifying indicator species that will contribute to the knowledge of restoration processes.

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Appendix 1

Inventory of terrestrial arthropods collected on Quail Island, Canterbury.

Key:

Collection methods: PF, pitfall trap; MT, Malaise trap; P, pan trap; HC, hand collected; BT, beating tray; LE, litter extraction; LT; light trap; OB; observed on island; SN; sweep net.

Species distribution status: BP endemic, only found on Banks Peninsula; E, only found in New Zealand; I, found elsewhere.

ARACHNIDA

ACARI (Mites)

Anystidae
Genus indet. sp. 1; PF

Eriophyidae (Gall mites; bud mites)
Aceria carmichaeliae Lamb; E; Gall on *Carmichaelia australis*

Erythraeidae
Erythrites sp. 1; PF

Neotrichozetidae
Neotrichozetes ?spinulosa (Michael); PF

Oribatidae
Genus indet. sp. 1; PF
Genus indet. sp. 2; PF
Genus indet. sp. 3; PF
Genus indet. sp. 4; PF

Parasitidae
Genus indet. sp. 1; PF

ARANEAE (Spiders)

Amphinectidae
Maniho ngaitahu Forster & Wilton; BP endemic; PFs under mature trees sites

Anapidae
Zealanapis armata (Forster); E; PF under *Coprosma* & *Pteridium esculentum*

Araneidae (Orbweb spiders)
Argiope protensa L. Koch; I
Colaranea viriditas (Urquhart); E
Eriophora heroine (L. Koch); I
Eriophora pustulosa (Walckenaer); I

Clubionidae (Sac spiders)
Clubiona huttoni Forster; E; Weta motel (#53) on kanuka
Clubiona peculiaris L. Koch; E; Under manuka bark
Clubiona sp; E

Corinnidae
Supunna picta (L. Koch); I

Desidae
Badumna longinqua (L. Koch); I

Gnaphosidae
Anzacia gemmea (Dalmas); I
Hemicloea rogenhoferi L. Koch; I
Scotophaeus pretiosus (L. Koch); I; HC; ex. *Cordyline australis*
Taieria erebus L. Koch; E; PF; under Ngaio; 20yr restoration site
Taieria kaituna Forster; E; PFs in native sites

Hahniidae (Dwarf sheet spiders, lesser cobweb spiders)
Rinawa cantuaria Forster; E; PF; under Kanuka; lemonwood & *Hebe*

Idiopidae (Ground dwelling trapdoor spiders)
Misgolas borealis (Forster); (BP trapdoor spider); BP endemic; PF under bracken; *Coprosma* & kanuka

Linyphiidae
Araeoncus humilis (Blackwall); I
Diplocephalus cristatus (Blackwall); (Common money spider); I; PF Beneath bracken; *Muehlenbeckia* and *Coprosma;* rock ledge
Laetesia trispathulata (Urquhart); E
Microctenonyx subitaneus (O.P.-Cambridge); I; PF; under *Muehlenbeckia* and matagouri
Pseudafroneta incerta (Bryant); E; PF under kanuka; lemonwood; ngaio and *Hebe*
Tenuiphantes tenuis (Blackwall); I; PF; Beneath rock ledge

Lycosidae (Wolf spiders)
Allotrochosina schauinslandi (Simon); (Brown wolf spider); E; PF; Beneath damp rock ledge
Anoteropsis hilaris (L. Koch); (Garden wolf spider); E; PF; under flax & kanuka

Migidae
Migas saxatilis Wilton; (Tree trapdoor spider); BP endemic; PF

Miturgidae
Cheiracanthium stratioticum L. Koch; I; HC; ex foxglove? On Walkers Beach

Nemesiidae
Stanwellia sp. 1; BP endemic; PF; Beneath rock ledge

Pisauridae
Dolomedes minor L. Koch; (Nurseryweb spider); E; PF; *Muehlenbeckia*

Salticidae (Jumping spiders)
Holoplatys sp. 1; E; PF; under flax
Trite auricoma (Urquhart); E
Genus indet. sp. 1; E; HC; on rocks close to water edge on King Billy Island
Genus indet. sp. 2; E
Genus indet. sp. 3; E
Genus indet. sp. 4; E
Genus indet. sp. 5; E
Genus indet. sp. 6; E

Stiphidiidae
Cambridgea ambigua Blest & Vink; E; Weta motel (#11) in manuka
Cambridgea inaequalis Blest & Vink; E; PF under kanuka
Cambridgea quadromaculata Blest & Taylor; E

Synotaxidae
Pahora cantuaria Forster; E
Pahora kaituna Forster; BP endemic; PF

Tetragnathidae
Tetragnatha sp. 1; E

Theridiidae (Cobweb spider)
Achaearanea veruculata (Urquhart); E; PF; Beneath rock ledge & *Hebe* & HC at night on macrocarpa
Steatoda capensis Hann; (False katipo); I
Genus indet. sp. 1; E
Genus indet. sp. 2; E; PF
Genus indet. sp. 3; E; PF
Genus indet. sp. 4; E; PF & LE; Beneath *Quercus ilex* (Holm oak)

Thomisidae (Crab spiders)
Diaea sp. 1; E; PT; under scrub near stockdam
Sidymella sp. 1; E; PF; under *Muehlenbeckia* and flax

Zoridae
Argoctenus sp. 1; E; HC; ex. *Kunzea ericoides* near Leper Colony

PSEUDOSCORPIONES (pseudoscorpions)

Cheliferidae
Protochelifer sp. 1; PF

Chernetidae
Genus indet. sp. 1; PF & oak LE
Maorichernes sp. 1; E; PF under flax

Olpiidae
Xenolpium longiventer (L. Koch & Keyserling); LE; *Olearia* / *Pittosporum* near jetty

OPILIONES (Harvestman)

Phalangiidae
Phalangium opilio L; (European harvestmen) I; HC; on foxglove-like plant at Walker's Beach

Triaenonychidae
Algidia cuspidata Hogg; E
Nuncia obesa grimmetti Forster; E

CHILOPODA (Centipedes)

Henicopidae
Haasiella sp. 1; E; LE beneath *Quercus ilex*
Henicops maculatus Newport; E; HC ex. rotten stump

DIPLOPODA (Millipedes)

Dalodesmidae
Icosidesmus schenkeli Carl; BP endemic; PF; established site & oak grove
Icosidesmus sp. 1; HC dead *C. australis* branch / under *Muehlenbeckia*

Julidae
Cylindroiulus brittanicus (Verhoeff); I; HC ex root trainers & rotten log

Polyzoniidae
Siphonethus sp. 1; PF; under *Muehlenbeckia*; matagouri & flax

Siphonophoridae
Siphonophora sp. 1; E; LE ex. oak grove

Gonibregmatatidae
Zelanophilus provocator (Pocock); E; HC under log beneath macrocarpa trees
Zelanion sp. 1; E; PF under flax in established site

CRUSTACEA

AMPHIPODA (Amphipods)

Talitridae (Litter hoppers)
Makawe hurleyi (Duncan); E; PF & under wooden discs. Widespread

ISOPODA (Isopods)

Porcellionidae (Slaters)
Porcellio scaber Latreille; (Common slater); E; PF; widespread

MOLLUSCA (Molluscs)

STYLOMMATOPHORA (Slugs and land snails)

Charopidae
Allodiscus adrianus (Hutton); E; PF; Beneath rock ledge
Cavellia buccinella (Reeve); E; PF; oak grove
Charopa brookesi (Dell); E; PF
Charopa pseudocoma Suter; BP endemic; PF; Beneath rock ledge
Discocharopa eta (Pfeiffer); E; PF; under *Hebe*

Limacidae
Deroceras panaormitanum (Lessona & Pollonera); (Brown field slug); I; PF
Deroceras reticulatum Muller; (Grey field slug); I; PF; Beneath rock ledge

Pierinae
Therasia n. sp. cf. *valeria;* E; HC Beneath rock ledge
Therasia valeria Hutton; E; Under rock & on dead *C. australis* seed head

ANNELIDA (Earthworms)

Acanthodrilidae
Maoridrilus uliginosus (Hutton); E; HC under log discs above Walkers Beach

Lumbricidae
Octolasion cyaneum (Savigny); I; Under log discs above Walkers Beach

TUBELLARIA (Flatworms)

Geoplanidae
'*Newzealandia*' sp. 1; PF in grass and recently restored areas

INSECTA

BLATTODEA (Cockroaches)

Blattidae
Celatoblatta sp. 1; BP endemic; PF under bark & in scrub near stock dam

COLEOPTERA (Beetles)

Aderidae
?*Scraptogetus* sp. 1; PF in grass & BT off matagouri

Anobiidae (borer & furniture beetles)
Hadrobregmus magnus (Dumbleton); E; Dead from rotten log
Ptinus tectus Boieldieu; Brown spider beetle; I; PT; near cave on cliffs
Genus indet. 1; BT from matagouri near stock dam
Genus indet. 2; PT under *Griselinia littoralis* under cliffs

Anthicidae
Trichananca fulgida Werner and Chandler; I; LE sample from pine and macrocarpa

Anthribidae (fungus weevils)
Euciodes suturalis Pascoe; I; HC from tall grass in recent restoration site
Sharpius sandageri (Broun); E; PF
Xenanthribus hirsutus Broun; E; PF; beneath *Griselinia littoralis* on cliffs
Genus indet. sp. 1; PF; beneath *Griselinia littoralis* on cliffs

Carabidae (Ground beetles)
Agonocheila antipodum (Bates); (Twospotted ground beetle); E; HC on tree trunks at night
Anomotarus ?illawarae (Macleay); I (Aust.); HC under manuka bark
Cicindela latecincta White; (Tiger beetle); E; HC near clay bank on cliff shore

Holcaspis angustula (Chaudoir); E; PF; in oak grove
Holcaspis elongella (White); E; PF; Beneath matagouri
Laemostenus complanatus (Dejean); I; HC under log; King Billy Island only
Metaglymma moniliferum Bates; E; PFs and HC beneath fallen logs

Cerambycidae (Longhorn beetles)
Oemona hirta (F.); (Lemon tree borer); E; MT in kanuka/flax area
Prionoplus reticularis White; (Huhu beetle); E; HC pupae from rotting logs
Somatidia sp. 1; HC ex. Rotten log on King Billy Island
Zorion guttigerum Westwood; (Flower longhorn); E; HC from tall grass in manuka stand
Genus indet. sp. 1; PF; beneath bracken and pine/ macrocarpa
Genus indet. sp. 2; PF; Beneath ngaio
Genus indet. sp. 3; HC from flax at night & MT in Kanuka & flax

Chaetosomatidae
Chaetosoma scaritides Westwood; E; HC under bark; Quail Is. only known Banks Peninsula collection site

Chrysomelidae (Leaf beetles)
Pilacolaspis sp. 1; PT beneath *Griselinia littoralis* on cliffs
Genus indet. 1; PF

Coccinellidae (Ladybirds)
Coccinella leonina F; (Orangespotted ladybird); I; HC
Coccinella undecimpunctata L; (11-spotted ladybird); I; Commonly OB; Under dead *Cordyline australis* branch
Rhyzobius sp. 1; SN from *Chrysanthemoides monilifera* beneath cliff
Rhyzobius sp. 2; PT; beneath *Grisilinia littoralis* on cliff
Rhyzobius sp. 3; MT in flax/kanuka
Veronicobius sp. 1; PF; in scrub near stockdam
Veronicobius sp. 2; PF; beneath flax
Veronicobius sp. 3; HC on macrocarpa trunk at night
Veronicobius sp. 4; PF
Veronicobius sp. 5; PF beneath bracken & manuka
Veronicobius sp. 6; MT
Genus indet. 1; BT ex. *Olearia peniculata*
Genus indet. 2; PF on sandy ledge under cliff

Corylophidae (Hooded beetles)
Anisomeristes sp. 1; PF under *Muehlenbeckia*; matagouri & flax
Anisomeristes sp. 2; PF; beneath ngaio
Holopsis sp. 1; PF
Holopsis sp. 2; PF
Holopsis sp. 3; PF
Holopsis sp. 4; PF
Holopsis sp. 5; PF
Holopsis sp. 6; PF

Cryptophagidae (Silken fungus beetles)
?*Ephistemus globulus* (Paykull); I; PF
Genus indet. 1; PF

Curculionidae (Weevils)
Brachycerinae Genus indet. 1; PF
Brachycerinae Genus indet. 2; BT from *Muehlenbeckia* vine near stockdam
Cossoninae Genus indet. sp. 1; PT; near cave on cliffs
Cryptorhynchini Genus indet. sp. 1; PF
Cryptorhynchini Genus indet. sp. 2 ; ex. *Phorium tenax* flower stalk
Cryptorhynchini ?*Clypeolus* sp. 1; HC from scrub near stock dam
Gonipterus scutellatus (Gyllenhal); (Gum tree weevil); I; HC ex. *Eucalyptus* leaves
Molytini ?*Phrynixus* sp. 1
Otiorhynchus ovatus (L.); (Strawberry root weevil); I; PF
Pentarthrum sp. 1; LE ex. *Pittosporum* patch behind shelter
Peristoreus sp. 1; LE ex. *Pittosporum* patch behind shelter
Phloeophagosoma pedatum Wollaston; E; HC from inside *Phormium tenax* flower stalk
Scolytinae? sp. 1; HC from grass
Genus indet. sp. 1; PF
Genus indet. sp. 2; PF
Genus indet. sp. 3; PF
Genus indet. sp. 4; MT in Kanuka/flax
Genus indet. sp. 5; PF
Genus indet. sp. 6; SN from grass

Dermestidae (Hide / carpet beetles)
Trogoderma sp. 1; PF; beneath *Hebe*
Trogoderma sp. 2; PF
Trogoderma sp. 3; PF in T site

Elateridae (Click beetles)
Agrypnus variabilis (Candeze); I; HC dead under rotten log
'*Elatichrosis*' sp. 1; HC dead under burnt log
Conoderus exsul (Sharp); I; PF in manuka near Leper colony site
Thoramus ?wakefieldi Sharp; (Wakefield's click beetle); E; HC dead specimens from logs
Genus indet. sp. 1; ex. Spider web at Information Centre

Histeridae (Pill beetles)
Genus indet. sp. 1; LE from pine and macrocarpa plantation

Languriidae (Slender beetles)
Loberus nitens (Sharp); E; SN from *Chrysanthemoides monilifera* on cliff shore

Latridiidae
Aridius nodifera (Westwood); I; PF; beneath *Muehlenbeckia*
?Aridius sp. 1; PF
Bicava sp. 1; PF in grass/tussock
Bicava sp. 2; PF in grass/tussock
Bicava sp. 3; PF in grass/tussock
Bicava sp. 4; PF in grass/tussock
Bicava sp. 5; MT in flax / kanuka
Bicava sp. 6; MT in flax / kanuka
Bicava sp. 7; PF
Cortinicara hirtalis (Broun); I; SN from *Chysanthemoides monilifera* on cliff shore
Enicmus sp. 1; PF; beneath lemonwood and kanuka
Lithostygnus sp. 1; PF; under ngaio
Lithostygnus sp. 2; PF
Lithostygnus sp. 3; PF
Genus indet. sp. 1; MT

Leiodidae
Cholevinae; genus indet. sp. 1; PF
Leiodinae; genus indet. sp. 1; PF; Beneath *Hebe* and *Cordyline australis*
Leiodinae; genus indet. sp. 2; PF

Lucanidae (Stag beetles)
Mitophyllus irroratus Parry; E; ex. Spider web at info. Centre

Lycidae (Net-winged beetles)
Porrostoma rufipenne (F.); I ; ex. rotting pine logs

Melyridae (Soft-winged flower beetles)
'*Dasytes*' sp. 1; BT from unknown creeper near stock dam

Mycetophagidae (Hairy fungus beetles)
'*Triphyllus*' sp. 1; PF; under kanuka & ngaio
Genus indet. sp. 1; PF

Nitidulidae (Pollen beetles)
Genus indet. sp. 1; PF; beneath flax & *Muehlenbeckia*
Genus indet. sp. 2; PF
Genus indet. sp. 3; PF

Oedemeridae (Lax beetles)
Selenopalpus aciphyllae Broun; I; HC from tall grass near stock dam
Thelyphassa brouni Hudson; E; PF

Ptiliidae (Feather-winged beetles)
Acrotrichis insularis (Maklin); I; LE sample from oak grove
Genus indet. sp. 1; PF
Genus indet. sp. 2; PF
Genus indet. sp. 3; PF

Scarabaeidae (Scarab beetles / chafers)
Adoryphorus couloni (Burmeister); (Australian black beetle); I; HC in loose soil near gull colony
Costelytra diurna Given; (Diurnal grass grub); E; PF
Costelytra zealandica (White); (Common grass grub); E; PF
Odontria ?smithi Broun; E; LT
Odontria striata White; E; LT
Odontria sp. 1; E; PF under kanuka
Odontria sp. 2; PF
Odontria sp. 3; PF
Pyronota sp. 1; (Manuka chafer); E; MT in kanuka/flax

Scirtidae (Marsh beetles)
Cyphon sp. 1; LE ex. *Quercus ilex*

Silvanidae
Cryptomorpha brevicollis (White); E ; HC under damp base sheath of *Phormium tenax* flower stalk

Staphylinidae (Rove beetles)
Aleocharinae Genus indet. sp. 1; PF
Aleocharinae Genus indet. sp. 2; PF
Aleocharinae Genus indet. sp. 3; PF
Aleocharinae Genus indet. sp. 4; PF
Aleocharinae Genus indet. sp. 5; PF
Aloconota sp. 1; PF
Atheta atriceps (Broun); PF; E; under kanuka
Atheta zealandica Cameron; PF; I; under lemonwood
Baeocera punctatissima Lobi and Leschen; E; PF under most trees
'*Ocalea*' near *fungicola*; PF; beneath flax
'*Ocalea*' sp. 1; PF
Ocypus ater (Gravenhorst); I; PF
Ocypus sp. 1; PF
Oligota sp. 1; PF; beneath *Muehlenbeckia*; matagouri & flax
Omaliomimus sp. 1; PF; beneath flax
Pselaphinae; indet. Genus sp. 1; PF

Tenebrionidae (Darkling beetles / mealworms)
Aphtora rufipes Bates; E; PF
Artystona rugiceps Bates; E; Dead in weta motel
Mimopeus granulosus (Breme); (False wireworm); BP endemic; HC from logs on King Billy Is. Rare
Mimopeus opaculus Bates; (False wireworm); E; PF & under wooden disc

Zopheridae (Rough mould beetles)
Pristoderus bakewelli (Pascoe); E; PF; under *Hebe*; Kanuka; Lemonwood; flax and *Coprosma*
Pycnomerus sp. 1; PF
Pycnomerus sp. 2; PF
Pycnomerus sp. 3; LE ex. pine and macrocarpa plantation

Genus indet. sp. 1; BT from matagouri near stock dam

COLLEMBOLA (Springtails)

Onychiuridae
Genus indet. sp. 1; PF Walker's Beach

Sminthuridae
Bourlettiella hortensis (Fitch) (Garden springtail); I; PF
Sminthurus viridus (L.) (Lucerne flea); I; PF

Tomoceridae
Genus indet. sp. 1

DERMAPTERA (Earwigs)

Labiduridae
Anisolabis littorea (White); (Seashore earwig); E; HC under seaweed on cliff shore
Chaetospania brunneri (Bormans); I; HC under *Olearia* bark 30 m asl

Forficulidae
Forficula auricularia L; (European earwig); I; HC ex. pine tree trunk at night

DIPTERA (Flies)

Agromyyzidae (Leaf-mining flies)
Cerodontha angustipennis Harrison; E; MT beside flax/kanuka
Cerodontha australis Malloch; I; MT beside flax/kanuka
Liriomyza ?brassicae (Riley); I; MT beside flax/kanuka
Liriomyza nr. *chenopodii* (Watt); I; MT beside flax/kanuka
Liriomyza flavolateralis (Watt); E; MT beside flax/kanuka
Liriomyza ?urticae (Watt); MT beside flax/kanuka
Liriomyza ?watti Spencer; E; MT beside flax/kanuka
Liriomyza sp. 1; MT beside flax/kanuka
Liriomyza sp. 2; MT beside flax/kanuka
Pseudonapomyza sp. 1; New record for NZ; MT beside flax/kanuka

Anisopodidae (Wood gnats)
Sylvicola notatus (Hutton); E; MT beside flax/kanuka & PF

Anthomyiidae
Anthomyia punctipennis (Wiedemann); I; PT near cave in cliff

Asilidae (Robber flies)
Neoitamus varius Walker; E; HC in grass

Bibionidae (Marsh flies)
Dilophus nigrostigma (Walker); E; MT beside flax/kanuka
Dilophus sp. 1; MT beside flax/kanuka

Calliphoridae (Blowflies; bluebottles; greenbottles)
Calliphora stygia (F.); (Brown blowfly); I; PF & PT in manuka
Pollenia sp. 1; E; MT beside flax/kanuka
Xenocalliphora hortona (Walker); E; PF

Cecidomyidae (Gall flies)
Lestremia ?novaezelandiae Marshall; E; MT beside flax/kanuka
Genus indet. sp. 1; MT beside flax/kanuka
Genus indet. sp. 2; MT beside flax/kanuka

Ceratopogonidae (Biting midges)
Atrichopogon sp. 1; E; MT beside flax/kanuka
Dasyhelea sp. 1; MT beside flax/kanuka
Dasyhelea sp. 2; MT beside flax/kanuka
Dasyhelea sp. 3; MT beside flax/kanuka

Chamaemyiidae
Chamaemyia ?polystigma (Meigen); I; MT beside flax/kanuka

Chironomidae (Non-biting midges)
Chironomus zealandicus Hudson; E; MT beside flax/kanuka
Paratrichocladius pluriserialis (Freeman); I; MT beside flax/kanuka
Orthocladiinae indet. sp. 1; MT beside flax/kanuka
Genus indet. sp. 1; MT beside flax/kanuka
Genus indet. sp. 2; MT beside flax/kanuka
Genus indet. sp. 3; MT beside flax/kanuka

Chloropidae (Grass flies)
Aphanotrigonum huttoni (Malloch); E; MT beside flax/kanuka
Conioscinella fulvithorax Spencer; E; MT beside flax/kanuka
Gaurax flavoapicalis (Malloch); MT beside flax/kanuka
Tricimba ?deansi (Malloch); E; wingless; PF
Tricimba ?flaviseta Malloch; E; winged; PF & MT beside flax/kanuka

Coelopidae (Kelp flies; seaweed flies)
Chaetocoelopa littoralis (Hutton); E; (Kelp fly); LT

Culicidae (Mosquitoes)
Aedes antipodeus (Edwards); E; MT beside flax/kanuka
Culex pervigilans Bergroth; (Vigilant mosquito); E; HC as larvae from stock dam

Ditomyiidae (Fungus gnats)
Nervijuncta wakefieldi (Edwards); E; MT in flax/kanuka

Dolichopodidae (Long-footed flies)
Hercostomus sp. 1; E; MT in flax/kanuka
Parentia fuscata (Hutton); E; MT in flax/kanuka
Parentia griseicollis (Becker); E; MT in flax/kanuka
Parentia restricta (Hutton); E; MT in flax/kanuka
Parentia sp. 1; MT in flax/kanuka

Tetrachaetus bipunctatus Parent; E; MT in flax/kanuka

Drosophilidae (Vinegar fly)
Drosophila busckii Coquillet; I; LE ex pine & macrocarpa
Drosophila immigrans Sturtevant; I; MT beside flax/kanuka
Drosophila neozelandica Harrison; E ; MT beside flax/kanuka
Scaptomyza fuscitarsis Harrison; E ; MT beside flax/kanuka

Empididae (Dance flies)
Hilarempis ochrozona Collin; E; MT beside flax/kanuka
Hilarempis sp. 1; E; MT beside flax/kanuka
Oropezella bifurcata Collin; E; MT beside flax/kanuka

Ephydridae (Shore flies)
Ditrichophora flavitarsis (Tonnoir and Malloch); E; MT in flax/kanuka
Hydrellia tritici Coquillett; I; MT in flax/kanuka
Parahyadina sp. 1; E; MT in flax/kanuka
Psilopa metallica (Hutton); (Metallic black pasture fly); E; MT in flax/kanuka
Scatella nubeculosa Tonnoir & Malloch; E; MT in flax/kanuka
Scatella sp. 1; MT in flax/kanuka

Helomyzidae
Allophylopsis distincta Tonnoir & Malloch; E; MT in flax/kanuka
Allophylopsis ?fuscipennis Tonnoir & Malloch; E; MT in flax/kanuka
Prosopantrum flavifrons (Tonnoir & Malloch); I; MT in flax/kanuka
Prosopantrum sp. 1; MT in flax/kanuka
Xeneura picata (Hutton); E; ex. *Griselinia littoralis* & MT in flax/kanuka

Helosciomyzidae
Helosciomyza subalpina Tonnoir & Malloch; E; MT in flax/kanuka
Napaeosciomyza ?rara (Hutton); E; MT in flax/kanuka

Huttoninidae
Proschaeta prima Malloch; E; MT in flax/kanuka

Keroplatidae (Fungus gnats)
Cerotelion leucoceras (Marshall); E; MT in flax/kanuka
Cerotelion tapleyi Edwards; E; MT in flax/kanuka
Chiasmosneura milligani (Tonnoir); E; MT in flax/kanuka
Macrocera scoparia Marshall; E; MT in flax/kanuka
Pyrtaula agricolae (Marshall); E; MT in flax/kanuka
Pyrtaula campbelli (Tonnoir); E; MT in flax/kanuka
Pyrtaula carbonaria (Tonnoir); E; MT in flax/kanuka
Pyrtaula ?rutila (Edwards); E; MT in flax/kanuka
Pyrtaula sp. 1; E; MT in flax/kanuka

Lauxaniidae
Poecilohetaerella antennata Harrison; E; MT in flax/kanuka
Poecilohetaerella bilineata (Hutton); (White-striped litter fly); E; MT in flax/kanuka
Poecilohetaerella punctatifrons (Tonnoir & Malloch); E; MT in flax/kanuka
Sapromyza areneria Tonnoir & Malloch; E; MT beside flax/kanuka

Milichiidae
Paramyia sp. 1; MT in flax/kanuka; New published record for New Zealand

Muscidae (House flies)
'Spilogona' melas (Schiner); E; MT in flax/kanuka
'Spilogona' sp. 1; E; MT in flax/kanuka
'Spilogona' sp. 2; E; MT in flax/kanuka
'Spilogona' sp. 3; E; MT in flax/kanuka

Mycetophilidae (Fungus gnats)
Anomalomyia guttata (Hutton); E; MT in flax/kanuka
Anomalomyia minor (Marshall); E; MT in flax/kanuka
Brevicornu rufithorax (Tonnoir); MT in flax/kanuka
Cawthronia nigra Tonnoir; E; MT in flax/kanuka
Cycloneura flava Marshall; E; MT in flax/kanuka
Exechia hiemalis (Marshall); E; MT in flax/kanuka
Mycetophila colorata Tonnoir; E; MT in flax/kanuka
Mycetophila diffusa Tonnoir; E; MT in flax/kanuka
Mycetophila dilatata Tonnoir; E; MT in flax/kanuka
Mycetophila fagi Marshall; E; ex. white-cap mushroom (reared to adults) & MT
Mycetophila filicornis Tonnoir; E; MT in flax/kanuka
Mycetophila integra Tonnoir; E; MT in flax/kanuka
Mycetophila latifascia Edwards; E; MT in flax/kanuka
Mycetophila marginepunctata Tonnoir; E; ex. white-cap mushroom (reared to adults)
Mycetophila ?marshalli Enderlein / *?pseudomarshalli* Tonnoir; E; MT in flax/kanuka
Mycetophila nigricans Tonnoir; E; MT in flax/kanuka
Mycetophila ?nitens Tonnoir; E; MT in flax/kanuka
Mycetophila ornatissima Tonnoir; E; MT in flax/kanuka
Mycetophila ?pollicata Edwards; E; MT in flax/kanuka
Mycetophila solitaria Tonnoir; E; MT in flax/kanuka
Mycetophila subspinigera Tonnoir; E; MT in flax/kanuka
Mycetophila vulgaris Tonnoir; E; MT in flax/kanuka

Mycetophila nr. *phyllura* Edwards; E; MT in flax/kanuka
Mycetophila sp. 1; MT in flax/kanuka
Mycomya flavilatera Tonnoir; E; MT in flax/kanuka
Mycomya ?furcata Edwards; E; MT in flax/kanuka
Parvicellula triangula Marshall; E; MT in flax/kanuka
Tetragoneura minima Tonnoir; E; MT in flax/kanuka
Tetragoneura sp. 1; E; MT in flax/kanuka
Trichoterga incisurata Edwards; E; MT in flax/kanuka
Zygomyia acuta Tonnoir; E; MT in flax/kanuka
Zygomyia costata Tonnoir; E; MT in flax/kanuka
Zygomyia ?ruficollis Tonnoir; E; MT in flax/kanuka
Zygomyia sp. 1; E; MT in flax/kanuka

Pallopteridae (Waving-wing flies)
Maorina apicalis (Walker); E; MT in flax/kanuka

Phoridae (Scuttle flies)
Antipodiphora nana Schmitz; E; MT beside flax/kanuka
Antipodiphora subarcuata Schmitz; E; MT beside flax/kanuka
Antipodiphora sp. 1; E; MT beside flax/kanuka
Aphiura breviceps Schmitz; E; MT beside flax/kanuka
Beckerina polysticha Schmitz; E; MT beside flax/kanuka
Kierania grata Schmitz; E; MT beside flax/kanuka
Megaselia halterata (Wood); I; MT beside flax/kanuka
Megaselia impariseta Bridarolli; I; MT beside flax/kanuka
Megaselia rufipes (Meigen); I; PF
Metopina sp. 1; E; PF in grass
Phorinae n. sp. 1; MT beside flax/kanuka
Triphleba atripalpis Schmitz; E; MT beside flax/kanuka
Triphleba fuscithorax Schmitz; E; MT beside flax/kanuka
Triphleba rufithorax Schmitz; E; MT beside flax/kanuka

Pipunculidae (Big headed flies)
Pipunculus deansi Tonnoir; E; MT beside flax/kanuka

Pseudopomyzidae
Pseudopomyza flavitarsis (Harrison); E; MT beside flax/kanuka

Psychodidae (Moth flies)
Psychoda harrisi Satchell; I; LE ex. *Quercus ilex* & MT beside flax/kanuka
Psychoda penicillata Satchell; I; MT beside flax/kanuka
Psychoda sp. 1; MT beside flax/kanuka
Psychoda sp. 2; MT beside flax/kanuka

Sarcophagidae (Flesh flies)
Hybopygia varia (Walker); (Striped dung fly); I; MT beside flax/kanuka & LT

Scatopsidae (Dung flies)
Coboldia fuscipes (Meigen); I; MT beside flax/kanuka

Sciaridae (Root gnats)
Bradysia sp; MT beside flax/kanuka
Corynoptera sp. 1; E; MT beside flax/kanuka
Ctenosciara sp. 1; E; MT beside flax/kanuka
Genus indet. sp. 1; MT beside flax/kanuka

Sphaeroceridae (Small dung flies)
'Leptocera' mediospinosa (Duda); I; MT beside flax/kanuka
Phthitia sp. 1; MT beside flax/kanuka

Stratiomyidae (Soldier flies)
Zealandoberis substituta (Walker); E; MT beside flax/kanuka

Syrphidae (Flower flies; Hover flies)
Allograpta ropalus (Walker); (Flax gum syrphid); E; MT in flax/kanuka & larvae in flax gum
Eristalis tenax (L.); (Drone fly); I; Near cliff shore amongst heavy vegetation
Melangyna novaezelandiae (Macquart); (Large hover fly); E; On flowers - most places
Melanostoma fasciatum (Macquart); (Small hover fly); E; PT in scrub near stock dam
Psilota decessa (Hutton); E; MT beside flax/kanuka

Tachinidae
Calcager apertum Hutton; E; MT in flax/kanuka
Campylia sp. 1; E; MT in flax/kanuka
Mallochomacquartia flavohirta (Malloch); E; MT in flax/kanuka
Occisor sp. 1; E; MT in Kanuka flax area
Pales ?nr. *clathrata* (Nowicki); E; MT in flax/kanuka
Pales ?nyctemeriana Hudson; E; MT in flax/kanuka
Pales ?n. sp. casta group 1; E; MT in flax/kanuka
Pales ?n. sp. casta group 2; E; MT in flax/kanuka
Pales ?n. sp 1; E; MT in flax/kanuka
?Plagiomyia sp. 1; E; MT in flax/kanuka
Procissio sp. 1; E; MT in flax/kanuka
Protohystricia alcis (Walker); (*Wiseana* parasite); E; MT in flax/kanuka
Protohystricia sp. 1; E; SN ex. manuka patch near Leper colony
Zealandotachina sp. 1; E; MT in flax/kanuka
Zealandotachina sp. 2; E; MT in flax/kanuka
Genus indet. sp. 1; MT in flax/kanuka

Therevidae (Stiletto flies)
Anabarhynchus sp. 1; E; MT in flax/kanuka

Tipulidae (Crane flies)
Amphineurus hudsoni Edwards; MT in flax/kanuka & PF
Discobola gibberina Alexander; MT in flax/kanuka
Leptotarsus albistigmus Edwards; E; reared from HC larvae ex. rotten log
Leptotarsus dichroithorax Alexander; E; MT in flax/kanuka
Leptotarsus sinclairi (Edwards); E; MT in flax/kanuka
Leptotarsus sp. 1; E; PT (yellow) near Leper Colony
Limonia aegrotans Edwards; E; MT in flax/kanuka
Limonia fasciata (Hutton); E; MT in flax/kanuka
Limonia multispina (Alexander); E; MT in flax/kanuka
Limonia repanda (Edwards); E; MT in flax/kanuka
Limonia nr. sulphuralis Edwards; E; MT in flax/kanuka
Neoalexandriaria conveniens Walker; E; Rare; MT in flax/kanuka
Paralimnophila skusei (Hutton); E; PT (yellow) near cave on cliff
Zealandoglochina 'huttoni' (Edwards); MT in flax/kanuka

Trichoceridae (Winter crane flies)
Paracladura sp. 1; E; MT in flax/kanuka

HEMIPTERA (Bugs)

Anthocoridae (Minute pirate bugs)
Buchananiella whitei Reuter; I; PF

Aphididae (Aphids)
Acyrthosiphon kondoi Shinji; (Blue-green lucerne aphid); I; OB on clover
Aphis cottieri Carver; (*Muehlenbeckia* aphid); E; PF under *Muehlenbeckia complexa*
Aulacorthum solani (Kaltenbach); (Foxglove aphid); I; OB on dock
Brachycaudus rumexicolens (Patch); I; HC from *Muehlenbeckia complexa*
Capitophorus elaeagni (del Guercio); (Thistle aphid); HC on thistle
Hyperomyzus lactucae (L.); (Sow thistle aphid); HC on sow thistle
Macrosiphum euphorbiae (Thomas); (Potato aphid); I; HC on sow thistle; nettle; yarrow & clover
Myzus ornatus Laing; (Ornate aphid); HC from *Muehlenbeckia complexa*
Myzus persicae (Sulzer); (Green peach aphid); I; OB on chickweed
Neophyllaphis totarae Cottier; (Totara aphid); E; HC ex. *Podocarpus totara* above boat shed
Rhopalosiphum padi (L.); (Cereal aphid); I; OB on grass
Sitobion sp. *nr. fragariae* (Walker); (Grain aphid); OB on grass
Uroleucon sonchi (L.); (Brown sow thistle aphid); HC on sow thistle

Cercopidae (Spittle bugs)
Philaenus spumarius (L.); (Meadow spittlebug); I; SN in long grass

Cicadellidae (Leafhoppers)
Arahura sp. 1; ex. PF
Eucanthella insularis Evans; I; Info. centre
Deltocephalinae indet. sp. 1; PF

Cicadidae (Cicadas)
Amphipsalta zealandica (Boisduval); (Chorus cicada); E; HC in grass at night
Kikihia 'peninsularis'; (Banks Peninsula cicada); BP endemic; SN grass near natives
Rhodopsalta cruentata (F.); (Redtailed cicada); E; SN in grass; Walker's Beach

Cixiidae
Oliarus oppositis (Walker); HC on flax

Lygaeidae (Seed bugs)
Nysius huttoni White; (Wheat bug); E; PT; cliffs
Rhypodes anceps (White); E; PF

Margarodidae
Coelostomidia deboerae Morales; ex. rat trapped in grass
Coelostomidia zealandica (Maskell); (Great giant scale); E; PF under kanuka; weta motels in kanuka

Miridae (Plant bugs)
Chinamiris aurantiacus Eyles & Carvalho; E; PF
Diomocoris ostiolum Eyles; E; MT
Diomocoris punctatus Eyles; E; BT in matagouri near stock dam
Xiphoides sp. 1; E; MT

Notonectidae (Backswimmers)
Anisops assimilis F.B. White; (Common backswimmer); E; Stock dam

Pentatomidae (Shield bugs; stink bugs)
Cermatulus nasalis ?nasalis (Westwood); I; HC in spider web
Monteithiella humeralis (Walker); I; HC on *Olearia* sp. near info centre

Pseudococcidae (Mealybugs)
Balanococcus diminutus (Leonardi); (Flax mealybug); E; HC from flax on Walkers Beach

Psyllidae (Plant hoppers; plant lice)
Genus indet. sp. 1; HC ex. *Muehlenbeckia*

Reduviidae (Assassin bugs)
Empicoris angulipennis (Bergroth); E; PF
Empicoris rubromaculatus (Blackburn); (Thread-legged bug); I; PF

Rhyparochromidae (Seed bugs; a former subfamily of Lygaeidae)

Metagerra obscura White; E; PF under matagouri; flax & *Muehlenbeckia*
nr *Tomocoris* sp. 1; E; PF

HYMENOPTERA (wasps; bees & ants)

Aphelinidae
Coccophagus sp. 1; MT
Euryischia sp. 1; MT

Apidae (Social bees)
Apis mellifera L; (Honey bee); I; OB regularly
Bombus terrestris (L.); (Two banded bumble bee); I; OB regularly

Bethylidae
Dicondylus alpinus (Gourlay); MT
Goniozus sp. 1; MT
Sierola sp. 1; MT

Braconidae
Alysiinae genus indet. sp. 1; ex. dead *Misgolas borealis* under wooden disc
Aphaereta aotea Hughes & Woolcock; MT
Aphidius sp. 1; MT
Aspilota sp. 1; MT
Dolichogenidea tasmanica (Cameron); LE from broadleaf of cliff
Glyptapanteles sp. 1; MT
Pholetesor sp. 1; MT
Microgastrinae Genus indet. sp. 1; MT
Ascogaster parrotti Walker & Huddleston; MT
Meteorus ?annettae Huddleston; MT
Meteorus pulchricornis (Wesmael); MT
Microctonus sp. 1; MT
Opius sp. 1; MT
?Rogas sp. 1; MT
Rogadinae Genus indet. sp. 1; MT

Ceraphronidae
Genus indet. sp. 1; MT

Colletidae (Colletid bees)
Hylaeus agilis (Smith); E; reared from dead flax stalk
Leioproctus fulvescens (Smith); E; PT on sandy cliff ridge
Leioproctus imatatus Smith; E; PT in kanuka

Diapriidae
Diphoropria kuscheli Naumann; MT
Diphoropria sinuosa Naumann; MT
Entomacis sp. 1; MT
Gladicauda sp. 1; MT
Spilomicrus sp. 1; MT
Spilomicrus sp. 2; MT
Stylaclista sp. 1; MT
Stylaclista sp. 2; MT
Trichopria sp. 1; MT
New genus 1; MT
New genus 2; MT

Elasmidae
Elasmus sp. 1; MT

Encyrtidae
Coelopencyrtus australis Noyes; MT
Copidosoma floridanum (Ashmead); (Green looper parasite); MT
Odiaglyptus biformis Noyes; (Grass meallybug parasite); MT
Tetracnemoidea sp. 1; MT

Eucoilidae
Eucoilidae Genus indet. sp. 1; MT
?Trybliographa sp. 1; MT

Eucharotidae
Aprostocetus ?zosimus Walker; MT

Eulophidae
Chrysonotomyia sp. 1; MT
Diaulomorpha sp. 1; MT
Hemiptarsenus varicornis (Girault); MT
Melittobia sp. 1; MT
Pediobius metallicus (Nees); I; MT
Sympiesis sp. 1; MT
Zealachertus nr. *binarius* Berry; MT
Zealachertus nephelion Berry; MT
Zealachertus planus Berry; MT
Zealachertus tortriciphaga Berry; MT

Eumenidae
Ancistrocerus gazella *(Pz); HC on dirt track above ski lane*

Eupelmidae
Macroneura vesicularis (Ratzius); MT
Macroneura sp. 1; MT

Figitidae
Anacharis ?zealandica Ashmead; (lacewing parasite) ; I ; MT
Figitinae Genus indet. sp. 1; MT

Formicidae (Ants)
Amblyopone saundersi Forel; E; MT
Huberia striata (Fr. Smith); E; PF
Hypoponera edwardi (Forel); I; HC under logs on King Billy Island
Prolasius advena (Fr. Smith); E; MT & PF beneath Kanuka

Halictidae (Sweat or halicid bees)
Lasioglossum sordidum (Smith); E; PT on sandy cliff ridge

Ichneumonidae (Ichneumonid wasps)
Aclosmation sp. 1; MT
Aucklandella sp. 1; MT
Campoplex sp. 1; MT
Casinaria sp. 1; MT
Certonotus fractinervis (Vollenhoven); (Giant Ichneumonid); E; HC ex. bark of pine tree near cliff

Diadegma sp. 1; MT
Diplazon laetatorius (F.); I; (Hover fly parasite), MT near flax & kanuka
Echthromorpha intricatoria (F.); (Australian Ichneumon); I; MT near flax & kanuka
Eutanyacra lictatoria (Erichson); I; HC in grass
Glabridorsum stokesii (Cameron); (leafroller parasite); I; P near cave on cliff
Ichneumon sp. 1; SN in restored area (R)
Levansa sp. 1; MT
Mesochorus sp. 1; MT
Megastylus sp. 1; P on broadleaf on cliff
Netelia sp. 1; MT
Ophion sp. 1; MT
Pterocormus promissorius (Erichson); I; SN in restored area (R)
Xanthocryptus novozealandicus (Dalla Torre); (Lemon tree borer parasite); MT near flax & kanuka
Genus indet. sp. 1; MT near flax & kanuka
?Oxytorinae sp. 1; MT
Tersilochinae genus indet. sp. 1; MT
New genus sp. 1; MT

Mymaridae (Fairy flies)
Anagroidea sp. 1; MT
Australomyar sp. 1; MT

Platygastridae
Genus indet. sp. 1; MT

Pompilidae (Spider wasps)
Priocnemis monachus (Smith); E; HC from grass & matagouri near stock dam
Priocnemis ordishi Harris; PF

Prototrupidae
Fustiserphus sp. 1; MT
Oxyserphus sp. 1; MT
Oxyserphus sp. 2; MT
Oxyserphus sp. 3; MT
Oxyserphus sp. 4; MT

Pteromalidae
Aphobetus maskelli Howard; MT
Gastrancistrus sp. 1; MT
Pseudanogmus sp. 1; MT
?*Trichomalopsis* sp. 1; reared from fly pupae found on weeds

Scelionidae
Baeus sp. 1; PF
Baeus sp. 2; PF
Idris sp. 1; MT
Genus indet. sp. 1; MT

Vespidae (Social wasps)
Vespula vulgaris (L.); HC

LEPIDOPTERA (Moths & butterflies)

Arctiidae (Tiger moths)
Nyctemera annulata (Boisduval); (Magpie moth); E; SN ex. grassland /herbaceous weeds

Choreutidae (Metalmark moths)
Tebenna micalis (Mann); I; LT

Crambidae (Grass moths)
Deana hybreasalis (Walker); E; LT
Eudonia sp. 1; LT
Eudonia excilis (Knaggs); E; LT
Eudonia minualis (of Hudson not Walker); E; LT
Eudonia philerga (Meyrick); E; LT
Eudonia sabulosella (Walker); (Sod webworm); E; LT
Eudonia submarginalis (Walker); E; LT
Orocrambus cyclopicus (Meyrick); E; LT
Orocrambus ramosellus (Doubleday); E; LT
Orocrambus vulgaris (Butler); E; LT
Udea flavidalis (Doubleday); E; LT
Uresiphita polygonalis maorialis (Felder & Rogenhofer); (Kowhai moth); I ; OB damage on kowhai trees

Gelechiidae
Genus indet. sp. 1; LT

Geometridae (Looper moths)
Chloroclystis filata (Guenée); I ; LT
Declana floccosa Walker; (Forest semilooper); E; LT
Declana leptomera (Walker); E; Under weta motel; reared from pupa
Epicyme rubropunctaria (Doubleday); HC at night on Bracken
Epiphryne verriculata (Felder & Rogenhofer); (Cabbage tree moth); E; OB damage on *Cordyline australis*
Epyaxa lucidata (Walker); E; LT
Epyaxa rosearia (Doubleday); E; LT
Helastia cinerearia (Doubleday); E; LT
Homodotis megaspilata (Walker); E; LT
Hydriomena deltoidata (Walker); E; HC at night on bracken
Hydriomena sp. 1; reared from larva ex. *Muehlenbeckia*
Pseudocoremia leucelaea (Meyrick); LT
Pseudocoremia sp. 1; LT
Scopula rubraria (Doubleday); LT
Xanthorhoe semifissata (Walker); E; HC at night on bracken
Xyridacma ustaria Walker

Hepialidae (Ghost moths)
Wiseana sp. 1; Porina; Dug up under grass around kanuka

Lycaenidae (Blues & coppers)
Lycaena salustius (F.); (Common copper); OB flying in grassland
Zizina otis labradus (Godart); (Common grass-blue); OB flying in grassland

Noctuidae (Owlet moths)
Agrotis ipsilon aneituma Walker; (Greasy cutworm); E; LT
Graphania lignana (Walker); E; LT
Graphania morosa (Butler); E; LT
Graphania phricias (Meyrick); E; LT
Graphania ustistriga (Walker); E; LT
Graphania sp. 1; LT
Persectania aversa (Walker); (Southern armyworm); E; LT
Rhapsa scotosialis Walker; E; LT
Proteuxoa comma (Walker); E; LT
Tmetolophota atristriga (Walker); E; LT
Tmetolophota propria (Walker); E; LT
Tmetolophota steropastis (Meyrick); (Flax notcher); E; LT

Nymphalidae
Bassaris gonerilla gonerilla (F.); (Red admiral); E; OB flying in grassland
Bassaris gonerilla ida (Alfken); (Yellow admiral); E; OB flying in grassland
Danaus plexippus (L.); (Monarch butterfly); I; OB flying in grassland (vagrant)

Oecophoridae
Gymnobathra sarcoxantha Meyrick; E; LT
Genus nr *'Leptocroca'* sp. 1; LT,
Stathmopoda horticola Dugdale; E; BT off lemonwood

Pieridae
Artogeia rapae (L.); (Cabbage white butterfly); I; OB regularly

Psychidae (Case moth)
Liothula omnivora (Fereday); (Common bagmoth); E; HC on pine tree near cliff

Pterophoridae (Plume moths)
Pterophorus innotatalis Walker; E; LT

Tineidae (Clothes moths)
Genus indet. sp. 1; HC ex. pine log on ground

Tortricidae (Leafrollers)
Capua intractana (Walker); LT
'Capua' semiferana (Walker); E; LT
Crocidosema plebejana Zeller; LT
Epiphyas postvittana (Walker); (Lightbrown apple moth); I; LT
Planotortrix excessana (Walker); (Greenheaded leafroller); LT
Strepsicrates ?macropetana (Meyrick); SN in afternoon

MANTODEA (Praying mantis)

Mantidae
Orthodera noveazealandiae (Colenso); (NZ Praying mantis); E

NEUROPTERA (Lacewings and antlions)

Coniopterygidae
Cryptoscenea australiensis (Enderlein); PF under *Hebe*

Hemerobiidae (Brown lacewings)
Micromus tasmaniae (Walker); (Tasmanian lacewing); I; SN in grass
Wesmaelius subnebulosus (Stephens); I; BT ex. ngaio at Walker's Beach

Myrmeleontidae
Weeleus acutus (Walker); (Ant lion); E; LT

ODONATA (Damselflies & dragonflies)

Coenagrionidae
Xanthocnemis zealandica McLachlan; (Red damselfly); E; SN at stock pond

Corduliidae
Procordulia smithii (White); E; OB near stock dam

Lestidae
Austrolestes colensonis (White); (Blue damselfly); E; SN at stock pond

ORTHOPTERA (Crickets; grasshoppers; weta)

Acrididae (Short-horned grasshoppers)
Phaulacridium marginale (Walker); (NZ grasshopper); E; PF in grass

Anostostomatidae (Ground weta)
Hemiandrus n. sp; BP endemic; PF & HC at night on tree trunks and on ground

Gryllidae (Crickets)
Bobilla sp. 1;
Teleogryllus commodus (Walker); (Black field cricket); PF in grassed area

Rhaphidophoridae (Cave weta)
Pleioplectron simplex (Hutton); E; PF & HC during day in dark damp places

Tettigoniidae (Longhorn grasshoppers)
Conocephalus sp. 1.

PHASMATODEA (Stick insects)

Phasmatidae
Argosarchus spiniger White; (Large spiny stick insect); E; HC ex. dead cabbage tree flower stalk
Mimarchus salebrosus (Hutton); (Lesser rough-spinned stick insect); E; HC on MT under kanuka

PHTHIRAPTERA (Sucking lice)

Polyplacidae
Polyplax spinulosa (Bermeister); (Rat louse); I ; ex. Rat in trap box

PSOCOPTERA (Booklice; psocids)

Caeciliidae
Caecilius flavistigma Tillyard; PF under manuka above Leper colony site

Ectopsocidae
Ectopsocus sp. 1; MT near flax & kanuka

Trogiidae
Trogium pulsatorium (L.); (Deathwatch psocid)

SIPHONAPTERA (Fleas)

Ceratophyllidae
Ceratophyllus gallinae (Schrank); (European chicken flea); I; PF in native scrub
Leptopsylla segnis (Schonherr); (Mouse flea); I; PFs (mainly in grass)
Nosopsyllus fasciatus (Bosc); (European rat flea); I; PFs (mainly in grass)

THYSANOPTERA (Thrips)

Thripidae
Genus indet. sp. 1; MT & PFs

THYSANURA (Silverfish)

Lepismatidae
Heterolepisma sp. 1; E; ex. rotten log

Meinertellidae (Bristletails)
Nesomachilis sp. 1; PF