

The beetle (Coleoptera) fauna of the Antipodes Islands, with comments on the impact of mice; and an annotated checklist of the insect and arachnid fauna

J. W. M. Marris*

The beetle fauna of the Antipodes Islands is described, and the origin, distribution and biogeography of the fauna discussed. Collections from Bollons Island in the Antipodes group are reported for the first time. A total of 25 species is recorded from the islands, including seven new species and nine new distribution records from the islands. Nine species (36%) are endemic to the Antipodes Islands, 14 (56%) species are indigenous, one species is introduced and one is of unknown origin. The fauna is most closely allied to the Auckland and Campbell Islands but has links with other subantarctic islands of the New Zealand subregion and the New Zealand mainland. Comparison between the invertebrate faunas of Antipodes Island and mouse-free Bollons Island indicate that mice have had a major impact on both the abundance and faunal composition of the Antipodes Island invertebrates. An annotated checklist of the insects and arachnids of the Antipodes Islands is given. A total of 150 insect species and 20 arachnids is recorded. Nine species are new to science and 31 are newly recorded from the islands. Two new bird hosts of ectoparasitic insect species are recorded for New Zealand and two are recorded for the Antipodes Islands.

Keywords insects Coleoptera, arachnids Antipodes Islands endemism biogeography, subantarctic fauna mice

INTRODUCTION

The Antipodes Islands (49°41'S, 178°48'E) lie 730 km south-east of the South Island of New Zealand (Fig. 1). The total land area of the islands is about 2100 ha, with Antipodes Island the largest at 2025 ha. Bollons Island, 1.5 km to the north-east, is about 50 ha, while Archway, Leeward and the Inner and Outer Windward Islands are all around 5 ha. Several islets and stacks lie off the main island. The coast of the main island features steep encircling cliffs with a few rocky platforms and boulder beaches. Inland, broad plateaux ranging from 100 to 300 m extend across the island with several conical peaks rising from them, of which Mts Galloway (366 m) and Waterhouse (361 m) are the highest.

The Antipodes Islands are of volcanic origin, and rocks from the islands have been dated at 0.5 Myr (Adams 1981). The Auckland and Campbell Islands to the west are also largely volcanic but are composed of older rocks (12–25 and 6.5–11 Myr respectively) (Adams 1981). The Bounty Islands, the closest neighbouring islands 220 km to the north, in contrast, are composed of early Jurassic granite (Higham 1991).

Deposits of peat up to 5 m thick blanket most of Antipodes Island (Higham 1991). The vegetation is mainly rolling tussock grassland with scattered areas of shrubland, fernland, herbfield, bog and swamp. The islands are important breeding grounds for several land and

*Entomology Research Museum, Soil, Plant and Ecological Sciences Division, P O Box 84, Lincoln University, Canterbury New Zealand, email marris@lincoln.ac.nz

seabird species, including large colonies of erect-crested (*Eudyptes sclateri* Buller) and rockhopper (*Eudyptes chrysocome* (Forster)) penguins and wandering albatross (*Diomedea exulans* Linnaeus). New Zealand fur seal (*Arctocephalus forsteri* (Lesson)) and southern elephant seal (*Mirounga leonina* (Linnaeus)) also breed on the islands. Warham and Johns (1975) gave an extensive account of the climate, physiography, geology, biology and human history of the islands. The flora of Antipodes Island was reviewed by Godley (1989).

The Antipodes Islands' arthropod fauna is perhaps the least well known of any of the New Zealand subantarctic islands. This reflects the relatively infrequent visits by scientists to the islands compared with the Auckland, Campbell and Snares Islands. Warham and Johns (1975) summarised the history of scientific and entomological exploration of the Antipodes Islands. Apparently the first entomological collections were made by Prof F. W. Hutton during a visit in 1901. Further collections were made by E. G. Turbott during a 1950 expedition led by R. A. Falla. The most concerted effort, however, was made during the 1969 University of Canterbury expedition, which included two entomologists, P. M. Johns and G. Kuschel. Horning (1986) specialised in collecting tardigrades, nematodes and lice during a 1978 visit to the islands, whereas Patrick (1994) concentrated on the lepidopteran fauna on a 1990 expedition. Patrick (1994) listed a number of taxonomic studies resulting from these collections. However, no checklist of the arthropod fauna exists for the Antipodes Islands.

The aim of this study was to summarise the beetle fauna of the Antipodes Islands, its origins, distribution, ecology and biogeographical relationships. This summary is based on collections made during a 1995 visit to the islands, museum collection records and literature records. A secondary aim was to compare the impact of mice on the terrestrial arthropod fauna of Antipodes Island with that of mouse-free Bollons Island. Collection and literature records were also collated to provide a checklist of the arachnid and insect fauna of the islands.

METHODS

The expedition, led by the Department of Conservation, visited the Antipodes Islands from 30 October to 29 November 1995. On arrival at the islands, a visit of about 7 hours was made to Bollons Island by three of the expedition team (John Marris, Angus McIntosh and Alan Tennyson). The team spent the remaining time solely on Antipodes Island, based at Hut Cove at the eastern end of Anchorage Bay. Although collecting was concentrated on the beetle fauna, other invertebrate groups were also collected.

On Antipodes Island, a wide range of collecting techniques was used, including pitfall, yellow pan, Malaise and light trapping, aquatic sampling, sweep netting, beating, insecticidal fogging, litter extraction and hand collecting. Lice were collected by hand from penguins and several other seabird species. A range of habitats was sampled, including in and around penguin colonies, among coastal tussock, coastal herbs, beach wrack, coastal rocks and cliffs, inland tussock grassland, shrubland and herbfields, and on rocky outcrops. Collecting was mostly concentrated in the north-east corner of the island, around Anchorage Bay, Reef Point, and Stella Bay, which provided a broad range of habitats. Collections were also made from the North Plains, on Mt Galloway, Dougall Stream and from among the rock outcrops and herbfields of the Central Plateau.

Collecting on Bollons Island was done by hand and by litter sampling. The collecting was concentrated around a small penguin colony, among tussock grassland and on rock outcrops at the south-western end of the island. Collecting from Bollons Island during the 1995 expedition was the first from that island, and provided the only known collection from any of the smaller islands of the group.

A representative sample of these collections has been curated and identified as fully as

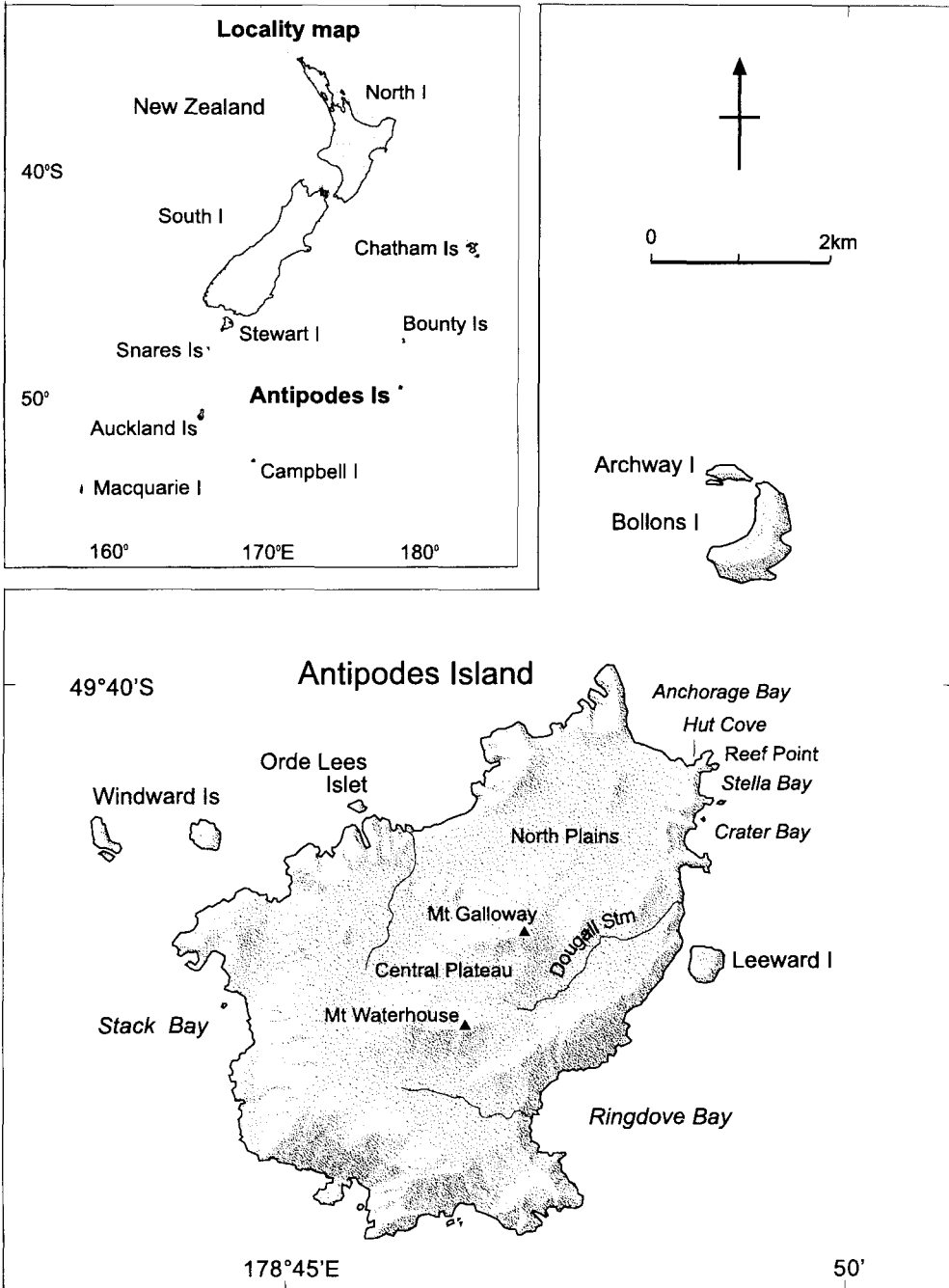


Fig. 1 The Antipodes Islands showing localities mentioned in the text. Adapted from a map provided courtesy of the Department of Conservation.

possible. These specimens and the residue of samples (stored in 70% ethanol) are held in the Entomology Research Museum, Lincoln University, unless otherwise noted. All Phthiraptera have been deposited with R. L. Palma (Museum of New Zealand, Wellington) and all Siphonaptera with R. L. C. Pilgrim (University of Canterbury, Christchurch). A sample of the Hymenoptera has been retained by J.W. Early (Auckland Museum, Auckland).

Data on the beetle fauna were based on collection records from the 1995 expedition, specimen records from the Entomology Research Museum, Lincoln University (LUNZ), New Zealand Arthropod Collection, Auckland (NZAC), Museum of New Zealand, Wellington (MONZ), Canterbury Museum, Christchurch (CMNZ), The Natural History Museum, London (BMNH) and the private collection of B. I. P. Barratt, Dunedin, and from published records. Comments on habitat are based on specimen records from the 1995 expedition unless otherwise noted.

The subantarctic islands of the New Zealand subregion in this paper includes the Antipodes, Auckland, Bounty, Campbell and Snares Islands and the Australian-administered Macquarie Island.

RESULTS

The beetle fauna

A total of 25 species is recorded from the islands, of which 15 are new records and seven are new to science. The new species are: *Loxomerus* n. sp., *Leptusa* n. sp. 1, *Leptusa* n. sp. 2, '*Stenomalius*' n. sp., *Orchesia* sp. nr *rennelli*, *Antarcticodomus* n. sp. and *Ptinosa* n. sp. New species records for the Antipodes Islands are: *Atheta* sp., *Leptusa chiltoni*, *Allodrepa decipiens*, *Crymus kronii*, *Omaliumimus venator*, *Quediocafus insolitus*, *Veronicobius aucklandiae*, *Holopsis oblongus* and *Antarcticodomus fallai*. Many of the new species and new records were collected previously, particularly during the 1969 University of Canterbury expedition, but not recorded in the published literature. All species records from Bollons Island are new records and are noted below.

Key to abbreviations and terminology

- 'First record' Is the first published record for the species from the Antipodes Islands.
- 'New record' Is noted as the first record where no published record exists for the species from the Antipodes Islands.
- 'Origin' Refers to whether a species is endemic, indigenous or introduced.
- 'Endemic' Refers to species endemic to the Antipodes Islands.
- 'Distribution' Refers to the localities in addition to the Antipodes Islands from which the species is known.
- AU Auckland Islands.
- BO Bounty Islands.
- CA Campbell Island.
- MQ Macquarie Island.
- SN Snares Islands.
- CH Chatham Islands.
- NZ Includes mainland New Zealand, Stewart Island and associated offshore islands.
- 'Other' Refers to localities outside the New Zealand subregion.
- Recorded as present.
- Not recorded as present.

CARABIDAE***Kenodactylus audouini* (Guérin, 1830)**

First record Johns 1974

Origin Indigenous

Distribution AU ■, BO □, CA ■, MQ □, SN ■, CH □, NZ ■, Other ■ Patagonia, Falkland Is

Comments Antipodes Islands specimens were collected from under stones in damp shingle and under coastal mat plants. One specimen was collected from Bollons Island from tussock litter. Johns (1974) noted the ability of adults and larvae of this species to live under seawater, and thus the possibility of their transoceanic dispersal. The adult is illustrated (as *Kenodactylus capito* Broun) in Darlington (1964) and the larva in Johns (1974).

***Loxomerus* new species**

First record New record

Origin Endemic

Comments Adults and larvae were collected from Bollons Island from under tussock mats and rocks. P. M. Johns (pers. comm. 1999) collected the remains of dead specimens from one site on the North Plains, Antipodes Island. No live specimens have been collected from Antipodes Island. *Loxomerus* n. sp. is very similar to *Loxomerus brevis* (Blanchard) from the Auckland Islands. The Antipodes Islands species differs most obviously in its brown colouration and has more parallel-sided elytra with more deeply impressed striae, a more constricted pronotal base, and a smoother dorsal surface to the head.

***Oopterus clivinoides* Guérin, 1841**

First record Johns 1974

Origin Indigenous

Distribution AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

Comments Collected infrequently on Antipodes Island from under coastal mat plants and among coastal vegetation. Common on Bollons Island among tussock bases and under rocks. Johns (1974) commented that Antipodes Island specimens were confined to low stony areas associated with penguin colonies or seal haul-outs. The adult is illustrated (as *Oopterus tarsalis* (Broun)) in Darlington (1964).

HYDROPHILIDAE***Tormissus guanicola* (Broun, 1904)**

First record Ordish 1974

Origin Indigenous

Distribution AU □, BO ■, CA □, MQ □, SN □, CH □, NZ □, Other □

Comments A terrestrial species commonly associated with penguin colonies among guano and under stones. Collected from tussock bases and under rocks on Bollons Island. Not collected from Antipodes Island during the 1995 expedition despite searching appropriate habitat. The larva is described and illustrated (as *Thomosis guanicola*) in Ordish (1974).

HYDRAENIDAE***Meropathus campbellensis* Brookes, 1951**

First record Ordish 1971

Origin Indigenous

Distribution AU □, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

Comments: Found among coastal rock and vegetation and on Bollons Island among tussock litter. Ordish (1984) recorded *M. campbellensis* from among littoral debris and bird nesting material on Campbell Island and from porous rock on the Antipodes Islands. The adult is illustrated in Gressitt and Samuelson (1964a) and the larva is illustrated in Samuelson (1964).

PTILIIDAE

***Ptinella atrata* Johnson, 1975**

First record: Johnson 1975

Origin: Indigenous

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

Comments: Found in coastal vegetation and scrub litter on Antipodes Island and from tussock litter on Bollons Island.

STAPHYLINIDAE

ALEOCHARINAE

***Atheta* species indeterminate**

First record: New record

Origin: Unknown

Distribution: Unknown

Comments: Recorded in an unpublished list by P. M. Hammond (BMNH).

***Leptusa chiltoni* (Broun, 1909)**

First record: New record

Origin: Indigenous

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

Comments: Not collected on the 1995 expedition. NZAC specimens were collected mid-littorally from among *Spiroborus* in 1969. The adult and larva are illustrated (as *Baeostethus chiltoni*) in Steel (1964).

***Leptusa* new species 1**

First record: New record

Origin: Apparently endemic

Comments: One specimen from under coastal mat plants on Antipodes Island. The specimen is held in the LUNZ collection.

***Leptusa* new species 2**

First record: New record

Origin: Apparently endemic

Comments: Found in coastal vegetation on Antipodes Island. Five specimens are held in the LUNZ collection.

OMALIINAE

***Allodrepa decipiens* Steel, 1964**

First record: New record

Origin: Indigenous

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

Comments: Widespread on Antipodes Island among vegetation and litter, also collected

from Bollons Island from seabird-burrow litter. The adult and larva are illustrated in Steel (1964)

***Crymus kronii* (Kiesenwetter, 1877)**

First record New record

Origin Indigenous

Distribution AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ ■, Other □

Comments Found in littoral and coastal habitats under kelp and rocks and from among coastal vegetation, also collected from Bollons Island. The adult and larva are illustrated (as *Arpediomimus kroni*) in Steel (1964)

***Omaliomimus venator* (Broun, 1909)**

First record New record

Origin Indigenous

Distribution AU ■, BO □, CA ■, MQ ■, SN ■, CH □, NZ ■, Other □

Comments Found in rotting *Durvillaea* on Antipodes Island. Not found on Bollons Island. The adult and larva are illustrated in Steel (1964)

'*Stenomalius*' new species

First record New record

Origin Endemic

Comments Found on petrel carcasses, in albatross nest litter and among tussock grassland vegetation on Antipodes Island and on Bollons Island in tussock and seabird-burrow litter

STAPHYLININAE

***Quediocafus insolitus* (Sharp, 1886)**

First record New record

Origin Indigenous

Distribution AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other □

Comments Found under tussock mats and among coastal vegetation on Antipodes and Bollons Islands. Known from the North and South Islands of New Zealand

ANOBIIDAE

***Ptinus tectus* Boieldieu, 1856**

First record Watt 1971

Origin Introduced

Distribution AU ■, BO □, CA ■, MQ □, SN ■, CH ■, NZ ■, Other ■ cosmopolitan

Comments A cosmopolitan pest of domestic stored products. Watt (1971) recorded this species from food stores on the Antipodes Islands, noting that it was reported to be fairly common until the shed (i.e., the castaway depot) was cleaned out. Not collected during the 1995 expedition

COCCINELLIDAE

***Veronicobius aucklandiae* (Kirsch, 1877)**

First record New record

Origin Indigenous

Distribution AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

Comments: Widespread on a range of vegetation on Antipodes Island, also found among tussocks on Bollons Island. The adult is illustrated in Chapin (1964).

CORYLOPHIDAE

***Holopsis oblongus* Endrödy-Younga, 1964**

First record: New record

Origin: Indigenous

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

Comments: Found in coastal areas on Antipodes Island and from tussock litter on Bollons Island. The adult and larva are illustrated in Gressitt and Samuelson (1964b).

MELANDRYIDAE

***Orchesia* species near *rennelli* Gressitt & Samuelson, 1964**

First record: New record

Origin: Endemic

Comments: Mainly collected on lichen-encrusted rock from coastal to high altitude habitats on Antipodes Island. Not found on Bollons Island. This species is similar to *O. rennelli* from the Auckland and Campbell Islands but is darker and the dorsal surface is less pubescent. The adult and larva of *O. rennelli* are illustrated in Gressitt and Samuelson (1964a).

TENEBRIONIDAE

***Pseudhelops antipodensis* Watt, 1992**

First record: Watt 1971

Origin: Endemic

Comments: Known only from the type series (nine specimens), three specimens collected in 1995 from a rock outcrop in the Central Plateau on Antipodes Island and the dead remains of one specimen found under rock slivers on a rock outcrop on the North Plains near Stella Bay. The adult is illustrated (as *Pseudhelops tuberculatus antipodensis*) in Watt (1971).

***Pseudhelops clandestinus* Watt, 1992**

First record: Watt 1971

Origin: Endemic

Comments: On Antipodes Island, *P. clandestinus* is known only from the type series (three specimens), five specimens collected in 1995 from a rock outcrop in the Central Plateau and the dead remains of 15 specimens from a rock outcrop on the North Plains near Stella Bay. On Bollons Island, by contrast, this species was found commonly under rocks and among tussock bases.

SALPINGIDAE

***Antarcticodomus fallai* Brookes, 1951**

First record: New record

Origin: Indigenous

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

Comments: On lichen- and alga-covered coastal rock on Antipodes Island, and on Bollons Island among coastal tussock vegetation. The leg colour of the Antipodes Islands specimens is generally paler than those from the Auckland and Campbell Islands but otherwise compare closely. The adult and larva are illustrated in Spilman (1967).

***Antarcticodomus* new species**

First record Recorded by Patrick (1994) as “Chrysomelid sp”

Origin Indigenous

Distribution AU , BO , CA , MQ , SN , CH , NZ , Other

Comments Found on lichen-encrusted rocks from coastal to high altitude habitats on Antipodes Island This species is distinguished from *A fallai* by its smaller size, its usually metallic-green colour, and by its more parallel-sided and heavily punctured pronotum This is apparently the same species as is found on the Bounty Islands, recorded here for the first time, although it differs in having slightly coarser microsculpture between the punctures of the pronotum

CERAMBYCIDAE***Ptinostoma* new species**

First record New record

Origin Endemic

Comments Found in tussock grassland and shrubland litter on Antipodes Island only

CURCULIONIDAE***Gromilus insularis antipodarum* Kuschel, 1964**

First record Kuschel 1964

Origin Endemic

Comments Found in tussock-grassland litter on Antipodes and Bollons Islands Kuschel (1971) recorded *G insularis* subspecies from the Auckland (*G i insularis* Blanchard) and Campbell (*G i robustus* (Brookes)) Islands May (1971) described the larva and pupa of this species and discusses features of the subspecies The larvae are found among roots (May 1971)

The insect and arachnid fauna

An annotated checklist of the insect and arachnid fauna from the Antipodes Islands is given in the Appendix A total of 150 insects and 20 arachnids (three Pseudoscorpionidea, 16 Araneae and one Acarina) is recorded from the islands Seven of the insect species are new to science and 25 species are new records Two new bird hosts of ectoparasitic insect species are recorded for New Zealand and two are recorded for the Antipodes Islands Twenty insect species are recorded as endemic to the Antipodes Islands Two arachnid species are new to science and six are new records from the islands Two arachnid species are endemic to the Antipodes Islands

One noteworthy discovery during the 1995 expedition was a weta species on Bollons Island Two of the Bollons Island team (Angus McIntosh and Alan Tennyson) independently found, but were unable to collect, three specimens of what appears to be a species of cave weta (Rhaphidophoridae) The specimens were described as ‘grasshopper like’ with long hind legs and relatively long antennae Body lengths were estimated to be about 10 mm There are no previous records of weta from the Antipodes Islands Endemic genera of cave weta are present on each of the other New Zealand subantarctic island groups except Macquarie Island so a species on the Antipodes Islands is not unexpected

Other groups of terrestrial arthropods that occur on the Antipodes Islands but are not listed here are Chilopoda, non-ixodid Acarina, Isopoda, Amphipoda and Collembola Major taxonomic revisions are required for some groups, such as the Acarina and Collembola, to

make identifications possible. Inclusion of these groups would extend the checklist significantly.

DISCUSSION

Composition of the beetle fauna

The diversity and origin of the fauna is summarised in Table 1. A total of 25 beetle species, from 21 genera from 13 families, is recorded from the islands. By comparison, the Auckland Islands have 57 species from 17 families, the Bounty Islands nine species from seven families, Campbell Island 40 species from 15 families, Macquarie Island eight species from two families, and the Snares Islands 25 species from 14 families (Greenslade 1990; Klimaszewski and Watt 1997; J. W. M. Marris, unpubl. data; Williams 1982; Young 1995). Emberson (1998) recorded 286 species in 45 families from the much larger and more northerly Chatham Islands.

Nine beetle species (36%) are endemic to the Antipodes Islands, 14 species (56%) are indigenous and one species, the cosmopolitan stored products pest *Ptinus tectus*, is introduced. *Atheta* sp. is of unknown origin and distribution. The high level of endemism is surprising given the islands' geological youth. By comparison, 36% of the beetles from Campbell Island, 44% for the Bounty Islands and none from Macquarie Island are endemic (Greenslade 1990; Gressitt 1964; J. W. M. Marris, unpubl. data). No figures are available for the Auckland Islands' beetle fauna as a whole, however, Kuschel (1971) recorded 44% of the Curculionidae as endemic. Emberson (1998) recorded 28% of Chatham Islands beetles as endemic. No figures have been published for the Snares Islands. Patrick (1994) noted 22 species of Lepidoptera from the Antipodes Islands with four (18%) endemic, 15 (68%) indigenous and three domestic or vagrant species.

Most diverse, at family-group level, is Staphylinidae with nine species, followed by Carabidae with three species, and Tenebrionidae and Salpingidae with two species each. Only one species of Curculionidae (*Gromilus insularis antipodarum*) is known from the Antipodes Islands, whereas this family is strongly represented on the Auckland (25 species), Campbell (14) and Snares (9) Islands (Kuschel 1971). The absence of weevils from Bounty Islands is to be expected, given the absence of vascular plants there and the almost exclusively phytophagous habit of this family.

Seven beetle families, known from the subantarctic islands of the New Zealand subregion (Klimaszewski and Watt 1997; Greenslade 1990; J. W. M. Marris, unpubl. data), are not known from the Antipodes Islands. They are: Anthribidae, Byrrhidae, Zopheridae (formerly recorded as Colydiidae), Latridiidae, Leiodidae, Mycetophagidae and Scarabaeidae (Snares Islands only). The absence of Byrrhidae is surprising given that species of *Epichorius* occur on all but the Bounty Islands (Watt 1971). Conversely, the Antipodes Islands are the only islands where the family Cerambycidae (*Ptinostoma* n. sp.) has been recorded.

Table 1 Summary of the species diversity of the beetles of the Antipodes Islands.

No. families	No. genera	No. species	Endemic	Introduced	Indigenous
13	21	25	9 ^{1,2}	1	14

¹*Gromilus insularis antipodarum* is included as an endemic subspecies.

²*Atheta* sp. is of unknown origin and has not been included in the summary.

Biogeographical affinities of the beetle fauna

The Antipodes Islands beetles, when examined at generic level, are clearly allied to the New Zealand subregion, with minor Australian and Southern Hemisphere links (e.g., *Kenodactylus* and *Meropathus*). When examined at the species level, however, the fauna is strongly allied with that of the subantarctic islands of the New Zealand subregion, particularly Campbell Island (sharing ten species) and the Auckland Islands (seven species) (Table 2). Only one species, the widespread staphylinid *Omalomimus venator*, is shared with the much more distant Macquarie Island, which has a limited beetle fauna. Only two species (*Tormissus guanicola* and *Antarcticodomus* n. sp.) are shared with the Antipodes Islands' nearest neighbour, the Bounty Islands, reflecting the depauperate nature of the Bounty Islands' beetle fauna. These two species, however, are endemic to these two island groups. Affinities with the Snares Islands (two species) and the New Zealand mainland (three species) are minimal. No indigenous species are shared with the Chatham Islands. One species, *Kenodactylus audouini*, is circumpolar in distribution, with records from Patagonia and the Falkland Islands.

The close affinity of the Antipodes Islands beetle fauna with the Auckland and Campbell Islands fits with Godley's (1989) proposed "Campbell Province", linking the Antipodes, Auckland, Campbell and Macquarie Islands based on phytogeographical similarities. Godley (1989) also noted the strong botanical links with the New Zealand mainland and, to a lesser extent, the Chatham Islands. The flora of the Snares Islands, like the beetles, is more closely allied with Stewart Island and the New Zealand mainland (Fineran 1969). In contrast, Patrick (1994) found the moth fauna most closely related to the New Zealand mainland, particularly southern South Island, with weaker links to the Chatham Islands. The two moth species shared between the Antipodes and Bounty Islands are, like the beetles, endemic to these two island groups (Patrick 1994). Further examples of Antipodes-Bounty Islands endemics are the spider *Orepukia nummosa* (Hogg) and the dipterans *Psychoda acutipennis* Tonnoir and *Apetaenus littoreus* (Hutton) (see Appendix).

The insect and arachnid fauna

A total of 150 insects from 12 orders and 20 arachnids (three Pseudoscorpionidea, 16 Araneae and one Acarina) is recorded from the Antipodes Islands. The ectoparasitic Phthiraptera and Siphonaptera account for 31% (47 species) of the insect fauna. This reflects the high diversity and density of their bird hosts on the islands (although one siphonapteran is parasitic on mice). The most diverse order is the Phthiraptera with 40 species. Among the free-living insects, however, the Diptera (32 species), Coleoptera (25 species) and Lepidoptera

Table 2 Biogeographic affinities of the beetle species of the Antipodes Islands

Endemic	Introduced	AU	BO	CA	MQ	SN	NZ	Other
9 ^{1,2}	1 ¹	7	2	10	1	2	3	1 ⁴

AU = Auckland Islands, BO = Bounty Islands, CA = Campbell Island, MQ = Macquarie Islands, SN = Snares Islands, NZ = New Zealand mainland (including Stewart Island)

¹ *Gromulus insularis antipodarum* is included as an endemic subspecies

² *Atheta* sp. is of unknown origin and has not been included in the summary

³ *Ptinus tectus* has also been introduced to AU, CA, SN and NZ. These records have not been included in the summary

⁴ *Kenodactylus audouini* is also recorded from Patagonia and the Falkland Islands

(23 species) are the dominant orders that, when combined, account for 78% of the terrestrial fauna.

Diversity comparisons with other New Zealand subantarctic islands are difficult due to a lack of equivalent data. However, about 450 terrestrial arthropods are known from the Auckland Islands, including 24 species of spider and more than 200 species of insects (Young 1995); 38 insects and two spiders are known from the Bounty Islands (Williams 1982; J. W. M. Marris, unpubl. data); over 380 terrestrial invertebrates are known from Campbell Island, with 16 spiders and over 200 insects (Gressitt 1964; Young 1995), 164 terrestrial invertebrates are known from Macquarie Island including two spiders, 88 mites and 31 insects (Greenslade 1990); and 250 invertebrate species from the Snares Islands including 132 insects (Young 1995).

Ten percent of the arachnid fauna (two of 21 species), 13% of the total insect fauna (20 of 150) and 18% of the free-living insect fauna (19 of 103) are endemic to the Antipodes Islands. Gressitt (1964) found 47% of the 300 described land arthropods from Campbell Island as endemic. This was an overestimate, however, since more recent studies (e.g., Harrison 1976; Patrick 1994) have shown that many of these species are more widely distributed. Thirty two percent of the Bounty Islands terrestrial insects are endemic (J. W. M. Marris, unpubl. data). Greenslade (1990) recorded 17% of the Macquarie Island terrestrial invertebrate fauna as endemic. No figures are available for the Auckland and Snares Islands.

Impact of mice

House mice (*Mus musculus* Linnaeus) are the only introduced mammalian predators resident on the Antipodes Islands (Atkinson & Taylor 1991). They were first recorded on Antipodes Island by Waite (1909) who wrote, "I am told by Captain Bollons that mice are very numerous at the Government depots on Campbell and Antipodes Islands". None of the other islands of the Antipodes group is known to have mice (Atkinson & Taylor 1991). The only other subantarctic island in the New Zealand subregion supporting mice as the only resident mammals is Enderby Island in the Auckland Islands group (Atkinson & Taylor 1991; Copson 1986). On Antipodes Island, mice are widespread, ranging from the coast to the highest peak. Mouse numbers can reach very high levels. Moors (unpubl. data, cited in King 1990) reported 40 to 77 catches/100 trap nights in November 1978, while McIntosh (1996) recorded up to 117 catches/100 trap nights in November 1995. McIntosh (1996) found mouse numbers to be highest around a penguin colony and lowest on Mt Galloway.

The invertebrate collecting on Bollons Island during the 1995 expedition allows a comparison between mouse-free Bollons Island and Antipodes Island, and so provides a unique opportunity to examine the impact of predation by mice on the invertebrate fauna of Antipodes Island. The evidence collected strongly suggests that mice have had, and continue to have, a major impact on both the abundance and faunal composition of the Antipodes Island invertebrates.

The extinction of two species on Antipodes Island may be due to mouse predation. Live specimens of *Loxomerus* n. sp. have been collected only from Bollons Island, where it is relatively common. Dead remains of this species were collected from dry rock of volcanic spatter cones on Antipodes Island by P. M. Johns (pers. comm. 1999) during the 1969 University of Canterbury expedition, but no live specimens were found. It is likely, given the level of collecting over the years, that this species is either extinct or survives at very low densities on Antipodes Island. The most likely reason for this is predation by mice. Insect remains can exist in good condition for decades, given dry conditions (Worthy & Holdaway 1996), and it is possible that the *Loxomerus* n. sp. remains collected by Johns date back to when mouse density was lower than present, or even to when mice were absent from the

island. Similarly, the unidentified weta species (discussed above) has been seen only on Bollons Island. Again, the most likely scenario is that this species has been exterminated or reduced to a very low density on Antipodes Island by mouse predation. Crafford and Scholtz (1987) hypothesised that mice caused the extinction of the moth *Pringleophaga kerguelensis* Enderlein on subantarctic Marion Island. More extensive surveying of Bollons Island, and surveys of other islands in the Antipodes group, may reveal further taxa not represented on Antipodes Island. It may also clarify whether the absence of representatives of some beetle families, such as Byrrhidae, and the paucity of Curculionidae, are natural or induced by mouse predation on Antipodes Island.

Evidence also suggests that mice have a severe impact on the abundance of many arthropods on Antipodes Island. Table 3 compares numbers of the larger (i.e., length > 4 mm) beetle species collected on Antipodes (over a period of 26 days) and mouse-free Bollons Islands (during a 7 h visit). Differences in abundance between Bollons Island and Antipodes Island are dramatic. In most cases significantly more specimens were collected from Bollons Island in seven hours than from Antipodes Island in 26 days. For example, the tenebrionid *Pseudhelops clandestinus* was the most commonly collected beetle on Bollons Island (53 specimens) but only five specimens were found on Antipodes Island, all from one rock outcrop. Two beetle species collected from Bollons Island, *Loxomerus* n. sp. (19 specimens) and *Tormissus guanicola* (8 specimens), were not found on Antipodes Island at all. In contrast, the carabid *Kenodactylus audouini* was found more commonly on Antipodes Island. However, this is predominantly an intertidal to littoral species, found on rocky shores or wave-exposed rock habitats, which are either not present, or were not collected from, on Bollons Island. The tenebrionid *Pseudhelops antipodensis* was not collected on Bollons Island, but this species has rarely been collected on Antipodes Island, and then only from a single rock outcrop. Appropriate habitat for this species may not have been searched on Bollons Island.

Differences in beetle distribution and abundance over Antipodes Island may also be explained by corresponding differences in mouse abundance. Kuschel (1971) found the weevil *Gromilus insularis antipodarum* to be virtually absent below 100 m altitude, though extremely common from about 250 m upwards to the tops. Similarly, a high proportion (8 out of 19) of this species collected during the 1995 expedition was from the summit of Mt Galloway (altitude 366 m). This distribution pattern correlates well with differences in mouse abundance and (by implication) predation pressure. McIntosh (1996) found the lowest density of mice (9 catches/100 trap nights) at the summit of Mt Galloway, and showed a trend towards reduced abundance with increasing altitude. The restricted distribution of the two

Table 3 Comparison of numbers of larger (>4 mm) beetle species collected from Antipodes Island (over 26 days) and Bollons Island (over 7 hours).

Species (max. length in mm)	Antipodes Island	Bollons Island
<i>Kenodactylus audouini</i> (4.8)	18	1
<i>Loxomerus</i> n. sp. (11.8)	0	19
<i>Oopterus clivinooides</i> (5.6)	7	33
<i>Tormissus guanicola</i> (5.5)	0	8
<i>Quediocafius insolitus</i> (10.9)	3	15
<i>Pseudhelops antipodensis</i> (7.2)	3	0
<i>Pseudhelops clandestinus</i> (8.2)	5	50
<i>Gromilus insularis antipodarum</i> (5.4)	19	3

tenebrionid species, *Pseudhelops antipodensis* and *P. clandestinus*, which have been collected only from a single rock outcrop on the Central Plateau at 300 m altitude, may also be a result of reduced mouse predation pressure with altitude. This is supported by the collection of dead remains of both species from a rock outcrop on the North Plains near Stella Bay at about 80 m altitude, which shows that these species were previously more widespread on the island.

Antipodes and Bollons Islands are apparently similar in age, geology, climate and vegetation. It is, therefore, difficult to explain the differences in the composition and abundance of the beetle fauna by anything other than mouse predation on Antipodes Island.

Other invertebrate groups, such as Lepidoptera and Diptera, spiders and terrestrial snails, are likely to be similarly affected by mouse predation. Copson (1986) found that invertebrates formed the main part of mouse diet on Macquarie Island, with spiders and moth larvae most common. Gleeson and van Rensburg (1982) found mice on Marion Island to be largely insectivorous. Larvae of the moth *Pringleophaga marioni* Viette predominated in their diet, although spiders and adult, larval and pupal stages of weevils were also common. Crafford and Scholtz (1987) attributed differences in the biomass of weevil and moth larvae between neighbouring Marion and Prince Edward Islands to predation by the mice on Marion Island.

Indirect effects of mouse predation on invertebrates may also have an impact on the Antipodes Island ecosystem. Crafford (1990) found that mice on Marion Island indirectly affected decomposition and nutrient mineralisation processes through their removal of a large proportion of the population of the detritivorous moth *Pringleophaga marioni*, and the same may apply on Antipodes Island. Mice may also compete with insectivorous land birds such as the endemic Antipodes Island snipe (*Coenocorypha aucklandica meinertzhagenae* Rothschild) for insect and other invertebrate prey.

CONCLUSIONS

The Antipodes Islands have a small beetle fauna, reflecting the islands' small size, high latitude and young age. A high level of endemism is evident, despite the relative youth of the islands. The fauna is clearly of New Zealand origin and is most strongly allied to the New Zealand subantarctic islands, particularly the Auckland, Bounty and Campbell Islands.

Like the beetle fauna, the Antipodes Islands' insect and arachnid fauna is small and exhibits a high level of endemism.

There has been extensive collecting on Antipodes Island, and knowledge of the arthropod fauna there is probably fairly complete. Collections made from the brief visit to Bollons Island indicate, however, that further survey work on the mouse-free, outer islands is likely to reveal additional species records for the Antipodes group.

Young (1995) considered that, despite the presence of mice, the islands remain largely pristine and that they have no urgent restoration needs. This study challenges that view. Strong anecdotal evidence suggests that mice on Antipodes Island are having a marked detrimental effect on the diversity and abundance of the invertebrate fauna. Two species have probably been exterminated by mouse predation and at least two others may be on the brink of extinction. Indirect effects of mouse predation may have implications for the functioning of the island's terrestrial ecosystem. More extensive surveying of the invertebrate fauna of Bollons Island and other offshore islands, as discussed above, is needed to determine the full extent of the impact of mice. Eradication of mice should be seriously considered if an appropriate procedure can be developed. Currently, the largest island from which mice have been eradicated is Enderby Island, in the Auckland Islands group (Department of Conservation, unpubl. data from the Island Eradication Database). Enderby Island, at 710 ha, is about one third the area of Antipodes Island.

ACKNOWLEDGMENTS

I am grateful to the Department of Conservation for the opportunity to visit the islands. Thanks are due to the members of the 1995 Antipodes Islands expedition, particularly expedition leader Pete McClelland and Angus McIntosh, for their contributions to the insect collecting and general assistance.

I greatly appreciate the taxonomic assistance kindly provided by the following: David Blest, Australian National University, Canberra (Araneae), John Early, Auckland Museum, Auckland (Hymenoptera), Vic Eastop, Natural History Museum, London (Hemiptera Aphididae), Rowan Emberson, Lincoln University, Canterbury (Coleoptera Carabidae), Peter Hammond, The Natural History Museum, London (Coleoptera Staphylinidae), Mark Harvey, Western Australian Museum, Perth (Pseudoscorpionidae), Rosa Henderson, Landcare Research, Auckland (Hemiptera Pseudococcidae), Peter Johns, University of Canterbury, Christchurch (Coleoptera Carabidae), Jan Klimaszewski, Landcare Research, Auckland (Coleoptera Staphylinidae), David McAlpine, Australian Museum, Sydney (Diptera Coelopidae), Steve Marshall, University of Guelph, Canada (Diptera Sphaeroceridae), Laurence Mound, CSIRO, Canberra (Thysanoptera), Ricardo Palma, Museum of New Zealand, Wellington (Phthiraptera), Brian Patrick, Otago Museum, Dunedin (Lepidoptera), Bob Pilgrim, University of Canterbury, Christchurch (Phthiraptera and Siphonaptera), Courtenay Smithers, Australian Museum, Sydney (Psocoptera), Margaret Thayer, Field Museum of Natural History, Chicago (Coleoptera Staphylinidae Omaliinae), Cor Vink, Lincoln University, Canterbury (Araneae) and John Ward, Canterbury Museum, Christchurch (Trichoptera).

I thank Rowan Emberson and Eric Scott for their valuable comments which helped to improve the manuscript.

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R99013 Received 23 August 1999 accepted 1 November 1999

APPENDIX AN ANNOTATED CHECKLIST OF THE ARACHNIDS AND INSECTS FROM THE ANTIPODES ISLANDS

Key to abbreviations and terminology

- 'Distribution' Refers to the localities in addition to the Antipodes Islands from which the species is known
- AU Auckland Islands
- BO Bounty Islands
- CA Campbell Island
- MQ Macquarie Island
- SN Snares Islands
- CH Chatham Islands
- NZ Includes mainland New Zealand, Stewart Island and associated offshore islands
- 'Other' Refers to localities outside the New Zealand sub-region
- Recorded as present
- Not recorded as present

ARACHNIDA PSEUDOSCORPIONIDEA

CHEIRIDIIDAE

Apocheiridium validissimum Beier, 1976

Distribution AU □, BO □, CA □, MQ □, SN □, CH ■, NZ □, Other □

Comments New record for the Antipodes Islands

CHERNETIDAE

Apatochernes antarcticus knoxi Beier, 1976

Distribution AU □, BO □, CA □, MQ □, SN ■, CH □, NZ □, Other □

Systellochernes zonatus Beier, 1964

Distribution AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ ■, Other □

ARANEAE

ARANEIDAE

Eriophora pustulosa (Walckenaer, 1841)

Distribution AU ■, BO ■, CA ■, MQ □, SN □, CH ■, NZ ■, Other ■ Australia

Comments New record for the Antipodes Islands Probably a self introduced species (C. J. Vink pers. comm. 1999)

SALTICIDAE

Clynotis barresis Hogg, 1909

Distribution AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

New genus and species

Comments Origin and distribution unknown New record for the Antipodes Islands

DESIDAE

Aasparia delli (Forster, 1955)

Distribution AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

Gohia falcata (Hogg, 1909)

Distribution AU ■, BO □, CA □, MQ □, SN □, CH □, NZ □, Other □

MICROPHOLCOMMATIDAE

New genus and species

Comments: Origin and distribution unknown. New record for the Antipodes Islands.

THERIDIIDAE

***Pholcomma antipodianum* (Forster, 1955)**

Distribution: Uncertain. See note below.

Comments: Forster (1955) described *Pholcomma antipodianum* from a single male specimen. Forster (1964) later described *Pholcomma hickmani* Forster from a single female specimen from Campbell Island, noting that it may prove to be identical to *P. antipodianum*. Examination of male and female specimens collected during the 1995 expedition supports Forster's (1964) view (C. J. Vink pers. comm. 1999), however, until the type specimens are examined this material is recorded as *P. antipodianum*.

LINYPHIIDAE

***Haplinis horningi* (Blest, 1979)**

Distribution: AU ■, BO □, CA □, MQ □, SN □, CH □, NZ □, Other □

***Haplinis minutissima* (Blest, 1979)**

Distribution: Endemic.

***Haplinis mundenia* (Urquhart, 1894)**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other □

Comments: New record for the Antipodes Islands.

***Parafroneta marrineri* (Hogg, 1900)**

Distribution: AU ■, BO □, CA ■, MQ ■, SN □, CH □, NZ □, Other □

***Leptyphantes tenuis* (Blackwall, 1852)**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other ■: Europe

Comments: New record for the Antipodes Islands.

***Erigone wiltoni* Locket, 1973**

Distribution: AU ■, BO □, CA □, MQ □, SN ■, CH □, NZ ■, Other □

***Laetesia bellissima* Millidge, 1988**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other □

***Drapetisca australis* Forster, 1955**

Distribution: Endemic.

AGELINIDAE

***Orepukia nummosa* (Hogg, 1909)**

Distribution: AU □, BO ■, CA □, MQ □, SN □, CH □, NZ □, Other □

ACARINA

IXODIDAE

***Ixodes uriae* White, 1852**

Distribution: AU ■, BO □, CA ■, MQ ■, SN ■, CH □, NZ ■, Other ■: bipolar

No other species of Acarina are recorded in the literature from the Antipodes Islands.

INSECTA

ORTHOPTERA

RHAPHIDOPHORIDAE

Genus and species indeterminate

Comments: Origin and distribution unknown. New record for the Antipodes Islands. See text for details.

PSOCOPTERA

ECTOPSIDAE

***Ectopsocus californicus* (Banks, 1903)**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other ■: Australia, North and Central America

Comments: Probably accidentally introduced. This species is known from a single specimen on the Antipodes Islands, collected in 1969 (C. N. Smithers pers. comm. 1996). It is unlikely that this species has established.

PSEUDOCAECILIIDAE

***Austropsocus insularis* Smithers, 1962**

Distribution AU ■, BO □, CA ■, MQ ■, SN ■, CH □, NZ □, Other □

TROGIIDAE

***Lepinotus patruelis* Pearman, 1931**

Distribution AU ■, BO □, CA ■, MQ □, SN ■, CH □, NZ ■, Other ■ Cosmopolitan

Comments New record for the Antipodes Islands

PHTHIRAPTERA

The host species listed are those from the Antipodes Islands only The further distribution of all the lice species listed is the same as that of their host species

PHILOPTERIDAE

Austrogoniodes concii* (Kéler, 1952)**Host *Eudyptes sclateri* Buller, 1888 – Erect-crested penguinAustrogoniodes cristati* Kéler, 1952**Host *Eudyptes sclateri* Buller, 1888 – Erect-crested penguin***Austrogoniodes hamiltoni* Harrison, 1937**Host *Eudyptes chrysocome* (Forster, 1781) – Rockhopper penguin***Austrogoniodes macquariensis* Harrison, 1937**Host *Eudyptes chrysocome* (Forster, 1781) – Rockhopper penguin***Docophoroides brevis* (Dufour, 1835)**Host *Diomedea exulans* Linnaeus, 1758 – Wandering albatross***Docophoroides murphyi* (Kellogg, 1914)**Host *Macronectes halli* Mathews, 1912 – Northern giant petrel***Episbates pederiformis* (Dufour, 1835)**Host *Diomedea exulans* Linnaeus, 1758 – Wandering albatross***Forficuloecus pilgrimi* Guimarães, 1985**Hosts *Cyanoramphus unicolor* (Lear, 1831) – Antipodes Island parakeet*Cyanoramphus novaezelandiae hochstetteri* (Reischek, 1889) – Reischek's parakeet***Halipeurus (Halipeurus) falsus pacificus* Edwards, 1961**Host *Pelecanoides urinatrix exsul* Salvin, 1896 – Subantarctic diving petrel***Halipeurus (Halipeurus) mundae* Edwards, 1961**Host *Puffinus assimilis elegans* Giffoli and Salvadori, 1869 – Subantarctic little shearwater***Halipeurus (Halipeurus) procellariae* (J.C. Fabricius, 1775)**Hosts *Pterodroma lessona* (Garnot, 1826) – White-headed petrel*Pterodroma mollis* (Gould, 1844) – Soft-plumaged petrel***Halipeurus (Synnautes) pelagicus* (Denny, 1842)**Host *Fregetta tropica* (Gould, 1844) – Black-bellied storm petrel***Harrisoniella hopkinsi* Eichler, 1952**Host *Diomedea exulans* Linnaeus, 1758 – Wandering albatross***Naubates fuliginosus* (Taschenberg, 1882)**Hosts *Procellaria aequinoctialis* Linnaeus, 1758 – White-chinned petrel*Procellaria cinerea* Gmelin, 1789 – Grey petrel***Naubates prioni* (Enderlein, 1908)**Host *Pachyptila turtur* (Kuhl, 1820) – Fairy prion***Naubates pterodromi* Bedford, 1930**Host *Pterodroma mollis* (Gould, 1844) – Soft-plumaged petrelComments *Pterodroma mollis* is a new host record for New Zealand (R. L. Palma pers. comm. 1996)***Paraclisis diomedae* (J.C. Fabricius, 1775)**Hosts *Diomedea melanophrys* Temminck, 1828 – Black-browed albatross*Phoebastria palpebrata* (Forster, 1785) – Light-mantled albatross***Paraclisis hyalina* (Neumann, 1911)**Host *Diomedea exulans* Linnaeus, 1758 – Wandering albatross***Paraclisis obscura* (Rudow, 1869)**Host *Macronectes halli* Mathews, 1912 – Northern giant petrel***Pelmatocerandra setosa* (Giebel, 1876)**

- Host: *Pelecanoides urinatrix exsul* Salvin, 1896 – Subantarctic diving petrel
***Perineus circumfasciatus* Kéler, 1957**
 Hosts: *Diomedea melanophrys* Temminck, 1828 – Black-browed albatross
Phoebetria fusca (Hilsenberg, 1822) – Sooty albatross
 Comments: *Phoebetria fusca* is a new host record for New Zealand (R. L. Palma pers. comm. 1996).
- Perineus macronekti* Palma and Pilgrim, 1988**
 Host: *Macronectes halli* Mathews, 1912 – Northern giant petrel
- Philoceanus fasciatus* (Carriker, 1958)**
 Host: *Fregetta tropica* (Gould, 1844) – Black-bellied storm petrel
- Philoceanus garrodiae* (Clay, 1940)**
 Host: *Garrodia nereis* (Gould, 1841) – Grey-backed storm petrel
- Philopterus* species**
 Host: *Anthus novaeseelandiae steindachneri* Reischeck, 1889 – Antipodes Island pipit
- Saemundssonina* (*Puffinoecus*) species**
 Hosts: *Pterodroma lessonii* (Garnot, 1826) – White-headed petrel
Pterodroma mollis (Gould, 1844) – Soft-plumaged petrel
 Comments: *Pterodroma mollis* is a new host record for the Antipodes Islands (R. L. Palma pers. comm. 1999).
- Saemundssonina* (*Saemundssonina*) *desolata* Timmermann, 1959**
 Host: *Pachyptila turtur* (Kuhl, 1820) – Fairy prion
- Saemundssonina* (*Saemundssonina*) *nereis* Timmermann, 1959**
 Host: *Garrodia nereis* (Gould, 1841) – Grey-backed storm petrel
- Saemundssonina* (*Saemundssonina*) species 1**
 Host: *Fregetta tropica* (Gould, 1844) – Black-bellied storm petrel
- Saemundssonina* (*Saemundssonina*) species 2**
 Host: *Phoebetria palpebrata* (Forster, 1785) – Light-mantled albatross
- Trabeculus hexakon* (Waterston, 1914)**
 Hosts: *Procellaria aequinoctialis* Linnaeus, 1758 – White-chinned petrel
Procellaria cinerea Gmelin, 1789 – Grey petrel
- Trabeculus mirabilis* (Kellogg, 1896)**
 Host: *Puffinis assimilis elegans* Giglioli and Salvadori, 1869 – Subantarctic little shearwater
- Trabeculus schillingi* Rudow, 1866**
 Hosts: *Pterodroma lessonii* (Garnot, 1826) – White-headed petrel
Pterodroma mollis (Gould, 1844) – Soft-plumaged petrel
- MENOPONIDAE
- Ancistrona vagelli* (J.C. Fabricius, 1787)**
 Host: *Pterodroma lessonii* (Garnot, 1826) – White-headed petrel
- Austromenopon affine* (Piaget, 1890)**
 Host: *Diomedea exulans* Linnaeus, 1758 – Wandering albatross
- Austromenopon popellus* (Piaget, 1890)**
 Hosts: *Pterodroma lessonii* (Garnot, 1826) – White-headed petrel
Pterodroma mollis (Gould, 1844) – Soft-plumaged petrel
Procellaria aequinoctialis Linnaeus, 1758 – White-chinned petrel
- Austromenopon stammeri* Timmermann, 1963**
 Host: *Pachyptila turtur* (Kuhl, 1820) – Fairy prion
- Austromenopon* species 1**
 Host: *Fregetta tropica* (Gould, 1844) – Black-bellied storm petrel
- Austromenopon* species 2**
 Host: *Coenocorypha aucklandica meinertzhagenae* Rothschild, 1927 – Antipodes Island snipe
- Heteromenopon* (*Keamenopon*) species**
 Host: *Cyanoramphus unicolor* (Lear, 1831) – Antipodes Island parakeet

HEMIPTERA

APHIDIDAE

***Aulacorthrum circumflexum* (Buckton, 1876)**

Distribution: AU ■, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other ■: worldwide

Comments: New record for the Antipodes Islands.

***Aulacorthrum solani* (Kaltenbach, 1843)**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ ■, Other ■: worldwide

***Brachycaudus helichrysi* (Kaltenbach, 1843)**

Distribution: AU ■, BO □, CA ■, MQ □, SN ■, CH □, NZ ■, Other ■: worldwide

***Cavariella aegopodii* (Scopoli, 1763)**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other ■: widespread in temperate and warm temperate regions

***Jacksonia papillata* Theobald, 1923**

Distribution: AU ■, BO □, CA ■, MQ ■, SN □, CH □, NZ ■, Other ■: Iceland, Europe, USA, Argentina, South Georgia

***Sitobion near fragariae* (Walker, 1848)**

Distribution: AU □, BO □, CA □, MQ □, SN ■, CH □, NZ ■, Other ■: Australia (Tasmania, South Australia, New South Wales) (V.F. Eastop, pers. comm. 2000)

Comments: Palmer (1974) recorded this species from the Antipodes Islands as *Macrosiphon* (*Sitobion*) *fragariae* (Walker). However, *Sitobion* near *fragariae* differs from *S. fragariae* in that large specimens of alatae that develop at low temperatures bear secondary rhinaria on the fourth antennal segment (Blackman et al. 1990; V.F. Eastop, pers. comm. 2000). *Sitobion* near *fragariae* is presumed to have originated in temperate Asia (V.F. Eastop, pers. comm. 2000).***Myzus ascalonicus* Doncaster, 1946**

Distribution: AU ■, BO □, CA ■, MQ ■, SN □, CH □, NZ ■, Other ■: Australia, Europe, India, Japan, North America, South America

***Rhopalosiphum padi* (Linnaeus, 1758)**

Distribution: AU □, BO □, CA □, MQ ■, SN □, CH □, NZ ■, Other ■: worldwide

PSEUDOCOCCIDAE

***Balanococcus danthoniae* (Morrison, 1925)**

Distribution: AU □, BO □, CA ■, MQ □, SN □, CH □, NZ ■, Other □

Comments: New record for the Antipodes Islands. Campbell Island is a new distribution record for this species based on NZAC specimens (R. C. Henderson pers. comm. 1996).

THYSANOPTERA

THRIPIDAE

***Anaphothrips zelandicus* Mound, 1978**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH ■, NZ ■, Other □

***Aptinothrips rufus* (Haliday, 1836)**

Distribution: AU □, BO □, CA □, MQ □, SN ■, CH ■, NZ ■, Other ■: Widespread in temperate climates

***Physemothrips hadrus* Mound, 1978**

Distribution: AU ■, BO □, CA □, MQ □, SN ■, CH □, NZ ■, Other □

Comments: Mound and Walker (1982) noted that specimens from the Antipodes Islands were intermediate between *Physemothrips hadrus* and *P. chrysodermus* Stannard.

NEUROPTERA

HEMEROBIIDAE

***Micromus tasmaniae* (Walker, 1860)**

Distribution: AU ■, BO □, CA □, MQ □, SN □, CH ■, NZ ■, Other ■: Australia

COLEOPTERA

CARABIDAE

***Kenodactylus audouini* (Guérin, 1830)**

Distribution: AU ■, BO □, CA ■, MQ □, SN ■, CH □, NZ ■, Other ■: Patagonia, Falkland Is

***Loxomerus* new species**

Comments: Endemic. New record for the Antipodes Islands.

***Oopterus clivinoides* Guérin, 1841**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □
HYDROPHILIDAE

***Tormissus guanicola* (Broun, 1904)**

Distribution: AU □, BO ■, CA □, MQ □, SN □, CH □, NZ □, Other □
HYDRAENIDAE

***Meropathus campbellensis* Brookes, 1951**

Distribution: AU □, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □
PTILIIDAE

***Ptinella atrata* Johnson, 1975**

Distribution: AU ■, BO □, CA □, MQ □, SN □, CH □, NZ □, Other □
STAPHYLINIDAE

***Allodrepa decipiens* Steel, 1964**

Distribution: AU □, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □
Comments: New record for the Antipodes Islands.

***Atheta* species**

Comments: The origin and distribution of this species is unknown. New record for the Antipodes Islands.

***Crymus kronii* (Kiesenwetter, 1877)**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ ■, Other □
Comments: New record for the Antipodes Islands.

***Leptusa chiltoni* (Broun, 1909)**

Distribution: AU □, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □
Comments: New record for the Antipodes Islands.

***Leptusa* new species 1**

Comments: Apparently endemic. New record for the Antipodes Islands.

***Leptusa* new species 2**

Comments: Apparently endemic. New record for the Antipodes Islands.

***Omaliomimus venator* (Broun, 1909)**

Distribution: AU ■, BO □, CA ■, MQ ■, SN ■, CH □, NZ ■, Other □
Comments: New record for the Antipodes Islands.

***Quediocafus insolitus* (Sharp, 1886)**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other □
Comments: New record for the Antipodes Islands.

'*Stenomalius*' species

Comments: Endemic. New record for the Antipodes Islands.

ANOBIIDAE

***Ptinus tectus* Boieldieu, 1856**

Distribution: AU ■, BO □, CA ■, MQ □, SN ■, CH ■, NZ ■, Other ■: cosmopolitan
Comments: An introduced species, probably brought to the islands with provisions for the castaway depot or with expedition supplies.

COCCINELLIDAE

***Veronicobius aucklandiae* (Kirsch, 1877)**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □
CORYLOPHIDAE

***Holopsis oblongus* Endrödy-Younga, 1964**

Distribution: AU □, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □
Comments: New record for the Antipodes Islands.

MELANDRYIDAE

***Orchesia* species near *rennelli* Gressitt & Samuelson, 1964**

Comments: Endemic. New record for the Antipodes Islands.

TENEBRIONIDAE

***Pseudhelops antipodensis* Watt, 1992**

Distribution: Endemic.

***Pseudhelops clandestinus* Watt, 1992**

Distribution Endemic

SALPINGIDAE

***Antarcticodomus fallai* Brookes, 1951**

Distribution AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

Comments New record for the Antipodes Islands

***Antarcticodomus* new species**

Distribution AU □, BO ■, CA □, MQ □, SN □, CH □, NZ □, Other □

Comments New record for the Antipodes Islands

CERAMBYCIDAE

***Ptinostoma* new species**

Comments Endemic New record for the Antipodes Islands

CURCULIONIDAE

***Gromilus insularis antipodarum* Kuschel, 1964**

Distribution Endemic

SIPHONAPTERA

Host species listed are only for those found on the Antipodes Islands

RHOPALOPSYLLIDAE

***Parapsyllus cardinis* Dunnet, 1961**

Distribution AU ■, BO □, CA □, MQ ■, SN □, CH □, NZ □, Other □

Hosts *Coenocorypha aucklandica meinertzhagenae* Rothschild, 1927 – Antipodes Island snipe*Cyanoramphus novaezelandiae hochstetteri* (Reischek, 1889) – Reischek's parakeet*Cyanoramphus unicolor* (Lear, 1831) – Antipodes Island parakeet*Pelecanoides urinatrix exsul* Salvin, 1896 – Subantarctic diving petrel*Procellaria aequinoctialis aequinoctialis* Linnaeus, 1758 – White-chinned petrel*Procellaria cinerea* Gmelin, 1789 – Grey petrel***Parapsyllus nestoris antichthones* Smit, 1979**

Distribution AU □, BO ■, CA □, MQ □, SN □, CH ■, NZ □, Other □

Hosts *Cyanoramphus novaezelandiae hochstetteri* (Reischek, 1889) – Reischek's parakeet
Cyanoramphus unicolor (Lear, 1831) – Antipodes Island parakeet

Comments Smit (1979) noted that this species is confined to the Antipodes Islands but prions visiting the Antipodes Islands are responsible for introducing occasional specimens to the Bounty and Chatham Islands

***Parapsyllus longicornis* (Enderlein, 1901)**

Distribution AU ■, BO □, CA ■, MQ □, SN ■, CH ■, NZ ■, Other ■ Argentina (Punta Dungeness), Falkland Islands, Amsterdam Island, Tristan da Cunha, St Paul Island

Host *Cyanoramphus unicolor* (Lear, 1831) – Antipodes Island parakeet***Parapsyllus magellanicus magellanicus* Jordan, 1938**

Distribution AU ■, BO □, CA ■, MQ ■, SN ■, CH □, NZ □, Other ■ Argentina (Tierra del Fuego), Falkland Islands, South Georgia

Hosts *Cyanoramphus unicolor* (Lear, 1831) – Antipodes Island parakeet*Diomedea exulans* Linnaeus, 1758 – Wandering albatross*Pelecanoides urinatrix exsul* Salvin, 1896 – Subantarctic diving petrel*Procellaria aequinoctialis aequinoctialis* Linnaeus, 1758 – White-chinned petrel*Pterodroma lessona* (Garnot, 1826) – White-headed petrelComments *Procellaria aequinoctialis aequinoctialis* is a new host record for the Antipodes Islands (R L C Pilgrim pers comm 1998)

PYGIOPSYLLIDAE

***Notiopsylla enciari enciari* Smit, 1957**

Distribution AU ■, BO □, CA □, MQ ■, SN ■, CH □, NZ □, Other ■ South Georgia (R L C Pilgrim pers comm 1998)

Hosts *Cyanoramphus unicolor* (Lear, 1831) – Antipodes Island parakeet*Procellaria cinerea* Gmelin, 1789 – Grey petrel*Pterodroma lessona* (Garnot, 1826) – White-headed petrel

***Notiopsylla kerguelensis tenuata* Smit, 1979**

Distribution: Endemic.

Hosts: *Cyanoramphus unicolor* (Lear, 1831) – Antipodes Island parakeet

Procellaria cinerea Gmelin, 1789 – Grey petrel

Pelecanoides urinatrix exsul Salvin, 1896 – Subantarctic diving petrel

CERATOPHYLLIDAE

***Nosopsyllus (Nosopsyllus) fasciatus* (Bosc, 1800)**

Distribution: AU ■, BO □, CA ■, MQ ■, SN □, CH ■, NZ ■, Other ■: cosmopolitan

Host: *Mus musculus* Linnaeus, 1758 – House mouse

Comments: An introduced species, as is its host

DIPTERA

TIPULIDAE

***Erioptera antipodarum* Alexander, 1953**

Distribution: Endemic.

KEROPLATIDAE

***Pyrtaula campbelli* (Tonnoir, 1927)**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other □

MYCETOPHILIDAE

***Allodia brunnea* Harrison, 1964**

Distribution: AU □, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

Comments: New record for the Antipodes Islands.

PSYCHODIDAE

***Psychoda acutipennis* Tonnoir, 1920**

Distribution: AU □, BO ■, CA □, MQ □, SN □, CH □, NZ □, Other □

***Psychoda eremita* Quate, 1964**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

***Psychoda surcoufi* Tonnoir, 1922**

Distribution: AU ■, BO □, CA ■, MQ ■, SN □, CH □, NZ ■, Other ■: Australia, Chile, St Helena, France

CHIRONOMIDAE

***Chironomus antipodensis* Sublette & Wirth, 1980**

Distribution: Endemic.

***Gressittius antarcticus* (Hudson, 1892)**

Distribution: AU ■, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other □

***Parochlus rennelli* Sublette & Wirth, 1980**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

***Semiocladius kuscheli* Sublette & Wirth, 1980**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

***Telmatogeton antipodensis* Sublette & Wirth, 1980**

Distribution: Endemic.

PSEUDOPOMYZIDAE

***Pseudopomyza antipoda* (Harrison, 1955)**

Distribution: AU ■, BO □, CA ■, MQ □, SN ■, CH □, NZ □, Other □

AGROMYZIDAE

***Chromatomyia syngenesiae* Hardy, 1849**

Distribution: AU ■, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other ■: Australia, Palearctic

***Liriomyza antipoda* Harrison, 1976**

Distribution: Endemic.

ASTEIIDAE

***Asteia levis* Hutton, 1902**

Distribution: AU ■, BO □, CA □, MQ □, SN ■, CH □, NZ ■, Other □

AUSTRALIMYZIDAE

***Australimyza anisotomae* Harrison, 1953**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ ■, Other □

COELOPIDAE

***Icaridion debile* (Lamb, 1909)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

Comments: McAlpine (1991) noted that *Icaridion debile* has been confused with *Icaridion nigrifrons* and, therefore, knowledge of the distribution of this species is incomplete.

***Icaridion nasutum* Lamb, 1909**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

***Icaridion* species probably *nigrifrons* (Lamb, 1900)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

Comments: McAlpine (1991) noted that knowledge of the distribution of this species is incomplete because of confusion with *Icaridion debile* (see above) and other species.

SPHAEROCERIDAE

***Phthitia lobocercus* Marshall, 1992**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

Comments: New record for the Antipodes Islands. See comments for *Phthitia thomasi* below.

***Phthitia* new species near *nothomasi* Marshall, 1992**

Comments: New record for the Antipodes Islands. See comments for *P. thomasi* below.

***Phthitia thomasi* (Harrison, 1959)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other : Australia

Comments: Harrison (1976) recorded *Leptocera thomasi* Harrison from the Antipodes, Auckland and Campbell Islands, New Zealand. Marshall (1989) subsequently recorded this species from Australia. Marshall and Smith's (1992) review found that Harrison's (1959) paratypes included a mixture of *P. thomasi*, *P. nothomasi* and *P. empirica* (Hutton). The record of *P. thomasi* from the Antipodes Islands remains questionable until Harrison's specimens are re-examined.

EPHYDRIDAE

***Hydrellia enderbii* (Hutton, 1902)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other : Australia

Comments: New record for the Antipodes Islands.

***Scatella vittithorax* Malloch, 1925**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other : Australia

TETHINIDAE

***Apetaenus australis* (Hutton, 1902)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

***Apetaenus littoreus* (Hutton, 1902)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

MUSCIDAE

***Paralimnophora depressa* Lamb, 1909**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

***Spilogona aucklandica* (Hutton, 1902)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

FANNIIDAE

***Fannia canicularis* (Linnaeus, 1761)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other : widespread

CALLIPHORIDAE

***Calliphora stygia* (Fabricius, 1782)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other : Australia, Papua New Guinea, New Caledonia

***Ptilonesia auronotata* (Macquart, 1855)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other : Australia

***Xenocalliphora antipoda* (Hutton, 1902)**

Distribution: Endemic.

TRICHOPTERA

HYDROPTILIDAE

***Oxyethira albiceps* (McLachlan, 1862)**

Distribution: AU , BO , CA , MQ , SN , CH , NZ , Other

LEPIDOPTERA

TINEIDAE

***Proterodesma turbotti* (Salmon & Bradley, 1956)**

Distribution: AU □, BO ■, CA □, MQ □, SN □, CH □, NZ □, Other □

PSYCHIDAE

***Reductoderces* species**

Distribution: AU □, BO ■, CA □, MQ □, SN □, CH □, NZ □, Other □

YPONOMEUTIDAE

***Plutella antiphona* Meyrick, 1901**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ ■, Other □

***Plutella xylostella* (Linnaeus, 1758)**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other ■: cosmopolitan

COLEOPHORIDAE

***Coleophora versurella* Zeller, 1849**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other ■: cosmopolitan

Comments: Known from a single specimen and considered to be a vagrant (Patrick 1994).

OECOPHORIDAE

***Atomotricha chloronota* Meyrick, 1914**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other □

***Hofmannophila pseudopretella* (Stainton, 1849)**

Distribution: AU ■, BO □, CA ■, MQ □, SN ■, CH ■, NZ ■, Other ■: cosmopolitan

Comments: An introduced, domestic species found in the castaway depot on Antipodes Island (Dugdale 1971).

ELACHISTIDAE

***Elachista galathea* antipodensis (Dugdale, 1971)**

Distribution: Endemic.

PYRALIDAE

***Diplosetis perieresalis* (Walker, 1859)**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH ■, NZ ■, Other ■: India and East Asia

CRAMBIDAE

***Eudonia alba*fascicula (Salmon & Bradley, 1956)**

Distribution: Endemic.

***Eudonia sabulosella* (Walker, 1863)**

Distribution: AU ■, BO □, CA □, MQ □, SN □, CH ■, NZ ■, Other □

Comments: Patrick (1994) considered Hudson's (1909) Auckland Island record of this species was in fact a variety of *Eudonia psammitis campbellensis*.

***Eudonia* species *psammitis* group (*mawsoni* (Womersley and Tindale, 1937), *campbellensis* Munroe, 1964)**

Distribution: AU ■, BO □, CA ■, MQ ■, SN □, CH ■, NZ ■, Other □

Comments: Patrick (1994) placed Antipodes Islands specimens in this group, and noted their resemblance to *Eudonia psammitis campbellensis* and *Eudonia mawsoni*.

***Eudonia* new species**

Distribution: Endemic.

***Mnesictena antipoda* (Salmon & Bradley, 1956)**

Distribution: Endemic.

***Musotima nitidalis* (Walker, 1866)**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ ■, Other □

***Orocrambus siriellus* (Meyrick, 1882)**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH ■, NZ ■, Other □

***Udea antipoda* (Salmon & Bradley, 1956)**

Distribution: Endemic.

GEOMETRIDAE

***Austrocidaria similata* (Walker, 1862)**

Distribution: AU ■, BO □, CA ■, MQ □, SN ■, CH ■, NZ ■, Other □

***Microdes epicryptis* Meyrick, 1897**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH ■, NZ ■, Other □
ARCTIIDAE

***Nyctemera annulata* (Boisduval, 1832)**

Distribution: AU □, BO □, CA □, MQ □, SN ■, CH ■, NZ ■, Other □

Comments: Patrick (1994) recorded this as a vagrant on the Snares Islands.

NOCTUIDAE

***Agrotis ipsilon aneituma* Walker, 1865**

Distribution: AU ■, BO □, CA ■, MQ ■, SN □, CH ■, NZ ■, Other ■: Australia, Papua New Guinea

Comments: A south-west Pacific subspecies of a cosmopolitan species (Patrick 1994).

***Graphania ustistriga* Walker, 1857**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH ■, NZ ■, Other □

***Mythimna separata* Walker, 1865**

Distribution: AU □, BO □, CA □, MQ □, SN □, CH □, NZ ■, Other ■: worldwide

Comments: Known from three specimens and considered to be a vagrant by Patrick (1994).

HYMENOPTERA

DIAPRIIDAE

***Antarctopria latigaster* Brues, 1920**

Distribution: AU ■, BO □, CA ■, MQ ■, SN ■, CH □, NZ ■, Other □

EUCOILIDAE

***Kleidotoma subantarcticana* Yoshimoto, 1964**

Distribution: AU □, BO ■, CA ■, MQ □, SN □, CH □, NZ □, Other □

Comments: New record for the Antipodes Islands.

ENCYRTIDAE

***Tetracnemoidea bicolor* (Girault, 1915)**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ ■, Other ■: Australia

EULOPHIDAE

***Sympiesis* species probably *campbellensis* (Kerrich & Yoshimoto, 1971)**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □

Comments: New record for the Antipodes Islands. J. W. Early (pers. comm. 1996) noted that the stigma of Antipodes Islands specimens was more elongate than indicated in the description and illustration of *S. campbellensis*.

MYMAROMMATIDAE

***Palaeomymar insulare* (Valentine, 1971)**

Distribution: AU ■, BO □, CA ■, MQ □, SN □, CH □, NZ □, Other □