

The Conservation Requirements of
New Zealand's Nationally
Threatened Invertebrates

THREATENED SPECIES OCCASIONAL PUBLICATION NO. 20

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1. Purpose

This document provides information on the key conservation requirements of threatened invertebrates of highest priority for conservation action, as identified by the Department of Conservation's Species Priority Ranking System (Molloy & Davis 1994). The purpose of this document is to assist Department of Conservation staff to set national priorities for threatened invertebrate recovery programmes and to establish key recovery actions.

2. Objectives

The objectives of this document are:

1. To provide descriptive information on each threatened invertebrate species, including its conservation status, habitat, threats, and conservation work undertaken to date.
2. To describe the key conservation actions needed to initiate or continue the recovery of each threatened invertebrate.
3. To identify any significant themes arising from analysis of the information collated to meet objectives 1 and 2.

3. Background

3.1 WHAT ARE INVERTEBRATES?

Invertebrates are animals without a backbone. They are an extremely diverse group, both in form and function, and inhabit virtually every type of environment found on earth. They dominate the earth's biota, both in terms of numbers of species and biomass.

Arthropods are animals covered with a jointed exoskeleton, and form a major component of the invertebrate group. They include organisms such as spiders, insects, and crustaceans. Platnick (1992, p. 18) stated "Let me be blunt: speaking of biodiversity is essentially equivalent to speaking about arthropods. In terms of numbers of species, other animal and plant groups are just a gloss on the arthropod theme."

Other major members of the invertebrate group include Porifera (sponges), cnidarians (corals, jellyfish, sea anemones), Platyhelminthes (flatworms), nematodes (round worms), annelids (segmented worms), molluscs (snails, chitons, clams, octopods, squid), and echinoderms (sea stars, sea urchins, sea cucumbers, sand dollars). Despite their abundance, invertebrates are often overlooked, because many are small, cryptic, or inhabit niches that are not obvious, nor immediately visible, to us.

3.2 WHY CONSERVE INVERTEBRATES?

There is a general public perception that most invertebrates are undesirable, a prejudice built up through years of humans competing with invertebrates for resources, in particular food. The fact that a small proportion of invertebrates are vectors for disease has further tarnished their reputation. This means that education at all levels of society is required to overcome the misconception of invertebrates as 'bad' or detrimental.

Invertebrates have many positive roles, and those considered 'pests' comprise only a fraction of the total invertebrate fauna. Invertebrates are extremely important components of the world's biota. They help maintain ecosystem functions through activities such as the cycling of nutrients, breaking down of pollutants, and production of soil. They are an important source of food for many animals and may also constitute a source of food for humans. Invertebrates are also vital to the fertilisation of a vast number of plants.

In short, without invertebrates, much of the life on earth today would cease to exist.

3.3 NEW ZEALAND'S INVERTEBRATES

New Zealand has a unique biota with a high proportion of endemic invertebrates relative to many countries. Our long geographic isolation of about 80 million years (Cooper & Millener 1993), the changing climate, shorelines, orogenies, glaciation, and vulcanism have all helped shape the composition of the fauna we have today (Klimaszewski & Watt 1997). Many of our invertebrate species have a Gondwana origin (Klimaszewski & Watt 1997), and prior to the arrival of humans Australia would have been the dominant source of immigrant species to New Zealand, arriving via the prevailing westerly winds and ocean currents (Cooper & Millener 1993).

Species that evolved during our long isolation did so without pressure from mammalian predators (apart from bats). As such, we have a large proportion of species that are ill equipped to deal with introduced mammalian predators. These species often lack the appropriate behavioural adaptations to successfully counteract the prey-seeking behaviour of the predator. New Zealand has a high proportion of large, flightless, ground-dwelling invertebrates, some of which produce a strong odour, and whose main defence mechanism is to remain still (e.g. giant weta). Whilst this behaviour may be a successful survival strategy to cope with many endemic predators (e.g. tuatara, tomtit), it is an often fatal one when dealing with introduced mammalian predators that utilise both sight and smell to locate their prey (e.g. rats). A number of species may also have safe daytime refuges (e.g. Banks Peninsula tree weta), but their nocturnal activity makes them vulnerable to introduced predators that hunt at night.

Today our endemic invertebrates continue to face a variety of pressures, including reduction of habitat, habitat modification, and increased predation and competition from introduced species. Whilst many of these pressures have always been present to some degree, human activities have served to intensify the level of pressure, often with a synergistic effect resulting.

3.4 NUMBERS OF INVERTEBRATES IN NEW ZEALAND

Invertebrates comprise 95% of known species (Monaghan 1999). Of the invertebrates, insects are the most diverse group. Other groups may have more individuals, but insects have the most variety. Recent estimates suggest around 80,000 invertebrate species in New Zealand's marine, freshwater, and land environments (D. Gordon pers. comm. 2000). Watt (1976) estimated c. 20,000 terrestrial and freshwater arthropod species. However, Kuschel (1990) estimated that our native beetle fauna may incorporate around 10,000-10,500 species. If beetles comprise about 50% of the known New Zealand insect fauna (Watt 1982a), then this means we could have around 20,000 species of insects alone. Currently there is a review and inventory of New Zealand's biodiversity being undertaken. A more exact estimate of the number of invertebrate taxa present in New Zealand, will be available upon completion of the species inventory being listed in *The New Zealand inventory of biodiversity: a species 2000 symposium review* (in prep).

In comparison to the estimated 80,000 invertebrate species, there are about 350 terrestrial vertebrate species (Watt 1976) in New Zealand, including 46 endemic landbird and 35 endemic seabird species (Taylor 2000), and c. 2,000 endemic vascular plant species (Mark 1985; Dopson et al. 2000). That equates to around 230 times as many invertebrates as vertebrates, and 40 times as many invertebrates as endemic vascular plants, in New Zealand. Invertebrates dominate our flora and fauna, however, there is still a lot of work to be done to raise the awareness of their existence and ensure their conservation.

3.5 ENDEMIC INVERTEBRATES

Endemic species are those which are native to a particular country, region etc. (Collins Pocket English Dictionary). For our purposes, endemic invertebrates are defined as those which only breed within the New Zealand Exclusive Economic Zones, as defined in the Territorial Sea and Exclusive Economic Zone Act 1977 (Molloy and Davis 1994). Endemic invertebrates are very important because they represent a unique gene pool, and as such, they contribute significantly to global biodiversity. Biodiversity is defined as the totality of genes, species, and ecosystems in a region (Di Castri & Younes 1996). Whilst New Zealand's invertebrate biodiversity is probably higher at present than ever before, owing to the introduction of many exotic invertebrates, the loss of each endemic invertebrate sees a reduction in overall global biodiversity. It is our responsibility under the Convention on Biological Diversity, an international agreement that came into force in December 1993, to conserve New Zealand's biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources (Anon. 2000b). It is not unusual for estimates of species endemism for New Zealand's invertebrate orders to be around 80-90% (Watt 1982a; Klimaszewski & Watt 1997; abstracts from Species 2000: New Zealand Millennium Symposium).

3.6 THREATENED INVERTEBRATES

A number of our endemic invertebrates are threatened. These threats include susceptibility to predation, susceptibility to displacement by competition, dependence on a threatened host or habitat type, and restriction to a habitat that is undergoing major modification. It is impossible to state how many endemic invertebrates are threatened when we have not described many of them, and know little about their ecological requirements. Twenty percent of New Zealand's flora is considered to be under some form of threat (Dopson et al. 1999). If a similar percentage of endemic invertebrates are threatened, then there could be 16,000 threatened invertebrate species in New Zealand. A number of factors seem to bias a species towards being threatened. Physical attributes, such as flightlessness, large size, and being odorous, and behavioural adaptations like being ground dwellers, the use of temporary insecure refuges and 'playing dead' when discovered, bias invertebrates against survival in our current environment.

A number of changes have occurred in New Zealand ecosystems since the arrival of humans, most notably the modification of habitats and the introduction of exotic species. Major changes have occurred in the vegetation cover of New Zealand. The clearance of large tracts of native bush and scrub for urban development, rural farming, and forestry, has resulted in a number of habitats becoming greatly reduced in area, and fragmented in distribution. This can lead to the isolation of species populations, thereby reducing the gene pool available to the species. The maintenance of genetic diversity in a species is desirable because it provides the ability to adapt to environmental changes, thereby increasing the species' chance of long-term survival. The introduction of exotic species further compounds the problem faced by reduction in habitat. Introduced flora can displace our endemic flora, effectively reducing the resources available to host specific invertebrates, and introduced fauna increases pressures such as competition and predation on our endemic invertebrates.

Whilst habitat modification has contributed to the decline of many species, it is worth bearing in mind that many modified habitats now act as refuges for some species. It is not only the pristine native habitats that should be of interest to conservation. Nor should the advocacy of fencing or stock removal be proposed without thinking through the ecological implications. Often the continuation of current management of a system may be the best option because these practises are often those that have developed the habitat into what it is today. If a modified grazed site is where a species is now found, and the population is stable, then the current situation may suit the species. Change of management should not be recommended without adequate information. Until informed decisions can be reached, maintenance of the status quo should be the objective.

At present there are 280 species of invertebrates listed as being of priority for conservation (amended figures from Molloy and Davis 1994: 25 species in Category A, 55 species in Category B, 21 species in Category C, 11 species in Category X, 168 species in Category I. Figures amended owing to taxonomic changes.) This is less than 0.004% of the estimated number of invertebrates in New Zealand. The low figure is not necessarily an indication that few of our invertebrates are under threat, rather it is a reflection of the lack of knowledge available for many of the species. Basic information such as distribution, abundance, and preferred habitat is lacking. This will always be a problem when focusing conservation at the species level and dealing with so many species, and it is only by working also at the community or ecosystem level

that progress will be made in conserving many of the unknown threatened species. There is still a need for single species based work to continue, integrated with biodiversity monitoring of sites. Non-pristine or unaesthetic ecosystems such as regenerating scrubland or bogs cannot be overlooked in preference to pristine native bush because the species composition of these sites is quite different and unique.

3.7 THREATENED SPECIES RECOVERY PLANNING

The Department of Conservation has responsibility for protecting and conserving New Zealand's indigenous plants and animals (Native Plants Protection Act 1934, Wildlife Act 1953, Reserves Act 1977, Marine Mammal Protection Act 1977, National Parks Act 1980, Conservation Act 1987). Planning for the recovery of threatened plants and animals occurs through the production of species recovery plans as specified in the Department's Species Recovery Planning Standard Operating Procedure. These are 5 to 10 year plans that describe the course of action needed to meet stated recovery goals for a species, or group of species.

The Department's Strategic Business Plan (Department of Conservation 1998) requires planning or action documents to be prepared for all Category A, B, and C species by the year 2002 (Objective 1.1.2, Strategic Business Plan). This document, *The conservation requirements of New Zealand's nationally threatened invertebrates*, identifies the key conservation actions required for priority threatened invertebrates. These key conservation actions are prioritised to provide a clear mandate for management. Although this document focuses on the conservation management requirements of the invertebrates, most conservation recovery actions should be coordinated with ecosystem and habitat conservation initiatives.

4. Scope

4.1 INVERTEBRATES

This document only provides profiles for those invertebrates listed in *Setting priorities for the conservation of New Zealand's threatened plants and animals* (Molloy & Davis 1994), also known as the Department's Species Priority Ranking System. Additional invertebrates that may be of potential conservation interest are listed in Appendix 11. (N.B. For any undescribed species listed in any part of this document, the names used are hereby disclaimed according to Article 8.3 of the International Code of Zoological Nomenclature (Anon 1999) and thereby not available.)

4.2 PRIORITY INVERTEBRATES

The resource for this document was *Setting priorities for the conservation of New Zealand's threatened plants and animals* (Molloy & Davis 1994). A description of the species priority ranking system is given in Appendix 2. Invertebrates listed in that

document were considered eligible for scoring if there was reason to believe they were currently under threat, or, in the case of some island endemics, were highly vulnerable to catastrophes such as rodent invasion, owing to their restricted distribution.

Information on the status, habitat, past conservation efforts, and key recovery actions required is provided for each species in the form of 'invertebrate profiles'. Category A (25 invertebrates), Category B (55 invertebrates), Category C (21 invertebrates), and Category X (11 invertebrates) comprise full profiles. Category I (168 invertebrates), may have abbreviated profiles for some species owing to the lack of information on the invertebrates in this category (see Appendix 2 for category details). Whilst the key recovery actions for each species have been prioritised, the species themselves have not. For advice on priority species contact the Species Protection Officer: Invertebrates, Biodiversity Recovery Unit, Department of Conservation, Wellington.

4.2.1 High Priority Category I Species

Under the department's Species Priority Ranking System (Molloy & Davis 1994), invertebrates that are suspected to be under some form of threat are placed in Category I (Indeterminate) if there is insufficient information to place them in any of the other categories. In most of these cases, the invertebrate's taxonomic status requires clarification and/or field survey is required to establish distribution and abundance.

Further categorisation of Category I species was undertaken for this document. If a Category I species met any one of the criteria outlined in table 1, it was deemed to be of high priority. High priority Category I species could be considered to have equal priority as Category A species, because a lack of information should not correlate to a lack of priority when there is some basis for concern.

TABLE 1. CATEGORY I HIGH PRIORITY DETERMINANT

-
- a) Believed to be susceptible to known predators.
 - b) Believed to be susceptible to displacement by known competitors.
 - c) Believed to be dependent on a threatened host.
 - d) Believed to be dependent on a rare habitat type.
 - e) Believed to be restricted to a habitat which is undergoing major modification.
-

4.3 USERS OF THIS DOCUMENT

Although the primary users of this document will be Department of Conservation staff, it is hoped that others involved with invertebrate conservation will use the document during the planning phase of invertebrate conservation programmes. Examples of organisations who may find this document of use include universities, entomological societies, zoological gardens, non-government organisations, Crown Research Institutes, and district and regional councils.

5. Development of the invertebrate profiles

Information specified in objectives 1 and 2 is presented in the form of invertebrate profiles (Appendix 1). This information includes background information on each invertebrate (taxonomic details, common names, and synonyms; Department of Conservation Conservancy Office and Area Office; Department of Conservation rankings; species description; present day and historic distribution; general description of the habitat type(s) in which the species have been found; key threats; and conservation work undertaken), and priority actions required (survey and monitoring requirements; research questions that need to be answered to assist conservation work; key management tasks). For a more detailed explanation, see Appendix 1b. The information included in the profiles was obtained from a literature search and through consultation with people with a specialist knowledge of the invertebrate species in question (see Acknowledgements).

6. Basic analysis of data in invertebrate profiles

The invertebrate profiles provide information on the order, family, distribution, habitat, threats, and the survey, research, monitoring, and management requirements of the Category A, B, & C invertebrates. A basic analysis of some of the information has been undertaken. The information has been compiled from 101 profiles (25 Category A species, 55 Category B species, and 21 Category C species), apart from the conservancy distribution, which also utilised Category I (168 species) and Category X (11 species). A species may score more than once in each category, e.g. it may occur in more than one conservancy, have been found in more than one type of habitat, or be subject to more than one type of threat. Comparisons are made between this information and similar information obtained for threatened plants (Dopson et al. 2000), to identify any themes which may be present between the two groups.

When viewing these analyses, it is important to bear in mind the limited dataset from which this information has been obtained. Only 101 invertebrate species are used for the analyses, and these are not representative of the invertebrate fauna as a whole. One hundred and one invertebrates is little more than 0.001% of the estimated 80,000 terrestrial, freshwater, and marine invertebrates that occur within New Zealand's Exclusive Economic Zone (D. Gordon pers. comm. 2000). Analysis of this information will only highlight themes in the areas of focus, and may not reflect the true situation regarding threatened invertebrates in New Zealand.

6.1 DISTRIBUTION OF THREATENED INVERTEBRATE TAXA BY CONSERVANCY OFFICE

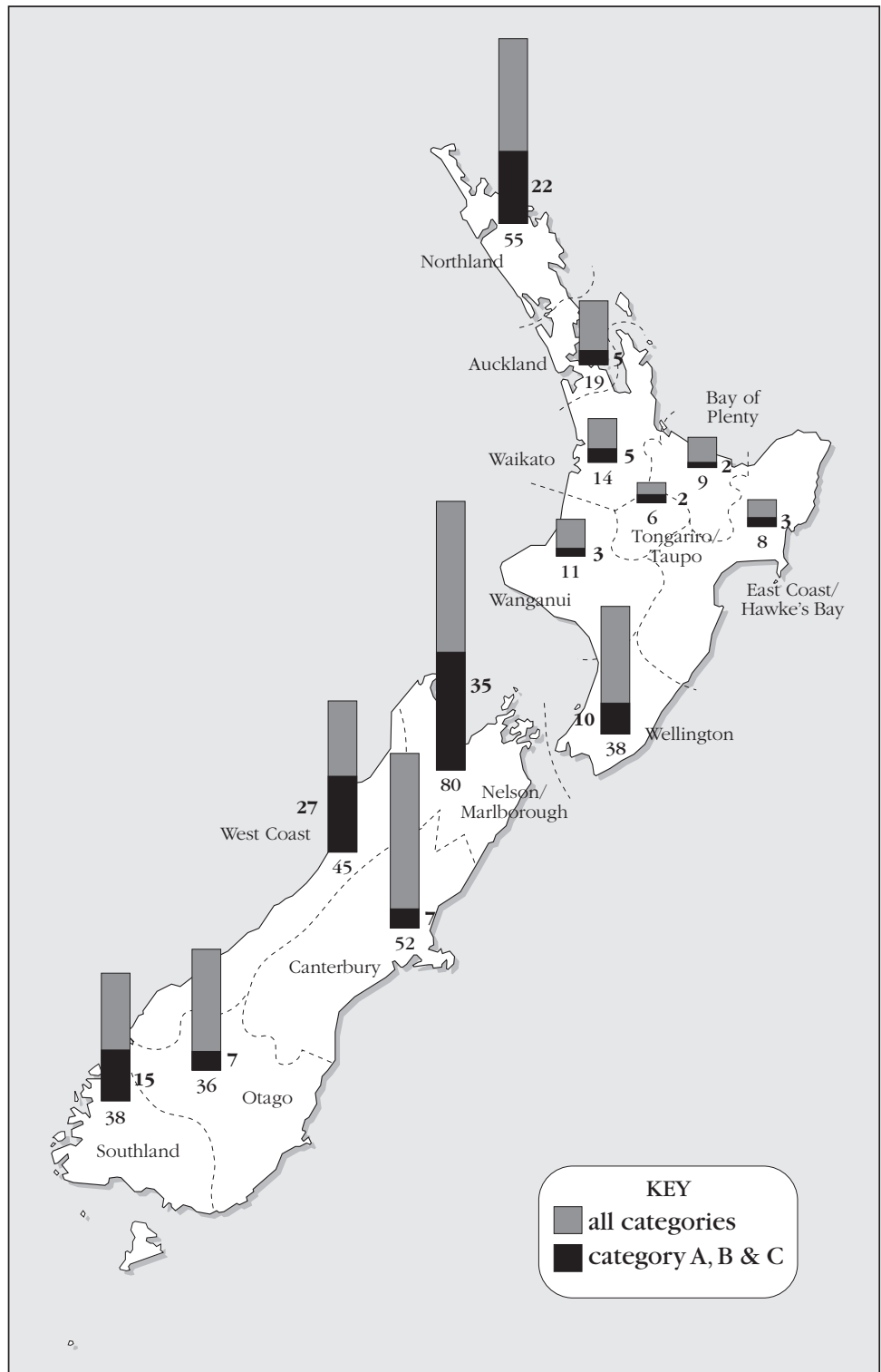


FIGURE 1. DISTRIBUTIONS OF RANKED INVERTEBRATES SHOWING THE COMBINED TOTALS IN THE 13 CONSERVANCIES OF THE DEPARTMENT OF CONSERVATION.

Nelson/Marlborough has a total of 80 invertebrates, just over 28% of the threatened invertebrates covered by this document. This is considerably more than any other conservancy, the next highest being Northland with 55 species (or just over 19%). There is a middle group containing totals ranging from 36-55. In order of decreasing numbers they are Northland, Canterbury, West Coast, Wellington & Southland (both equal), and Otago. The final group had the lowest combined totals ranging from 6-19. In order of decreasing numbers they are Auckland, Waikato, Wanganui, East Coast/Hawkes Bay, and Tongariro/Taupo. It should be noted that those values are based upon the 1994 rankings of the species. The next ranking of these species is likely to see a drop in the total numbers, due to less of the Category I species being considered threatened.

Compared with the plant data (see Dopson et al. 2000), a similar pattern emerges. Nelson/Marlborough comes out highest in both analyses. The middle group in the invertebrate analysis contains the same conservancies as the plant analysis, apart from the West Coast, which is replaced by Wanganui in the plant analysis. Similarly, the final group in the invertebrate analysis also contained the same conservancies as the plant analysis, apart from the transposition of Wanganui and the West Coast. It may be worth further investigating the invertebrate fauna associated with threatened plants because if these threatened plants have host specific invertebrates, then the invertebrates too will be threatened. If this line is to be followed, then Wanganui Conservancy would be a good place to start because it featured in the lower grouping for numbers of invertebrate species, but in the mid grouping for numbers of threatened plant species.

6.2 THREATENED INVERTEBRATE ORDERS AND FAMILIES

TABLE 2. NUMBERS OF THREATENED INVERTEBRATE ORDERS AND FAMILIES

ORDER	NUMBER	FAMILY	NUMBER
Araneae (spiders)	2	Gradungulidae	2
Arhynchobdella (leeches)	1	Hirudinidae	1
Coleoptera (beetles)	23	Carabidae (ground beetles)	6
		Cerambycidae (longhorn beetles)	1
		Curculionidae (weevils)	8
		Elateridae (click beetles)	2
		Lucanidae (stag beetles)	3
		Scarabaeidae (scarab beetles)	3
		Hemiptera (bugs)	1
Lepidoptera (moths/butterflies)	2	Geometridae (looper moths)	2
Orthoptera (weta, grasshoppers etc.)	14	Acrididae (grasshoppers)	1
		Anostomatidae (weta)	12
		Rhaphidophoridae (cave weta)	1
Stylommatophora (snails)	58	Bulimulidae	15
		Rhytididae	43

It is worth reiterating that little over 0.001% of the estimated number of invertebrates in New Zealand are represented in this analysis, therefore there are some major biases present.

Stylommatophora (land snails), Coleoptera (beetles), followed by Orthoptera (weta, grasshoppers, etc.) clearly dominate the Order groupings. This may reflect those orders that have had a lot of work done on them, and comprise a large number of species, as is the case with the beetles and snails. What is surprising, is that a well-studied group, the Lepidoptera (moths/butterflies), has only two representatives in this grouping. However, this is likely to change when the next species ranking occurs because the recent publication on the *Conservation status of New Zealand Lepidoptera* (Patrick & Dugdale 2000) lists an additional 102 species which are regarded as being 'at risk', with 27 of them in need of urgent conservation action.

The three main orders listed do not have a representative selection of their families covered. The families that are listed are generally large-bodied. This may reflect the susceptibility of large-bodied invertebrates to predation, or it may just reflect the preference of workers in these areas to focus on the larger, more charismatic species. Certainly the larger species are more conspicuous, and therefore easier to observe and gain information on their habitat and ecology. As more information is obtained on our smaller invertebrate species (e.g. many detritivores), a clearer picture will emerge regarding the threat status of invertebrates.

6.3 HABITAT TYPES

General categories of habitat were used for analysis purposes, as defined at the Department of Conservation invertebrate ecologists' meeting 1996. Three of these habitats dominated, those being forest (61 species), shrubland (29 species), and grasslands (15 species). Although there is no denying the importance of these habitats, they may be dominant in the analysis due to their being collected from more often than other habitats. This collecting leads to more information being available on the species, which in turn provides the level of confidence required to rank the species. Thus heavily collected areas end up being identified in the analysis.

Other habitats that had species present include sand dunes, caves, rocky shores, riverbed terraces, seepages, bluffs and screes. These habitats are less well known, possibly because they are less abundant, harder to access, or generally overlooked. The paucity of species listed as threatened from these habitats may be more a reflection of a lack of knowledge, rather than an indication that these are not important habitats for invertebrates.

Conversely, even though a species is present and apparently abundant in a particular habitat does not necessarily mean that the habitat is its optimal one. The habitat may be the last remaining safe refugia for the species. The species may have been formerly more widely distributed but is now represented only by relict populations confined to sub-optimal habitats.

The plant analysis had outcrops/bluffs/cliffs topping its list of threatened habitats. Wetlands, coastal herbfields/dunes, and riparian habitat types also featured highly. These areas were not prominent for invertebrates. However, because there is often a close association between invertebrates and plants, those habitats of importance to threatened plants should also be investigated in relation to their invertebrate fauna.

6.4 THREATS

The following table lists the type of threat facing the invertebrate and the number of times that threat is specifically identified in the profiles.

TABLE 3. THREAT TYPES AND NUMBER OF TIMES EACH THREAT IS IDENTIFIED IN THE PROFILES

GENERAL	NUMBER	SPECIFIC	NUMBER
Predation	79	Rodents	54
		Possum	39
		Pigs	24
		Thrushes	24
		Hedgehogs	22
		Other	41
Habitat modification	45	Land development	21
		Stock damage	20
		Exotic plant displacement	5
		Other	8
Other threats	7		
Not known or poorly known	2		

Predation is by far the biggest threat facing our endemic invertebrates, particularly from rodents. Possums, pigs, thrushes, and hedgehogs are also a threat, especially to snails. Habitat modification from land development and through stock damage (trampling, browsing, opening up of the understorey) is also a major concern. We must bear in mind that the identification of these threats is totally dependent on the invertebrates that are listed. The threats facing large-bodied invertebrates may be different to those facing small-bodied invertebrates.

Other issues such as habitat and behaviour also help determine the type of threat. Because most of the invertebrates listed are large-bodied, the major threat of predation is not a surprise. Larger species are more obvious, have greater difficulty in obtaining secure refuges, and would be a logical choice over smaller invertebrates when looking at the time and energy expenditure of the predator. It is far more efficient for a predator to capture and eat one large beetle than 10 small ones totalling the same amount of resource. Threat from thrushes would not feature so predominantly if it were not for the large number of snails listed as threatened. Similarly, if more freshwater invertebrates were listed, other threats such as pollution from farmland run-off, or the silting up of rivers owing to deforestation, may feature more highly.

Habitat loss, browsing, grazing and trampling are threats that also feature highly as threatened plant threats. Habitat loss is a particularly obvious threat because no habitat means no species.

6.5 RESEARCH, MONITORING, AND SURVEY REQUIREMENTS

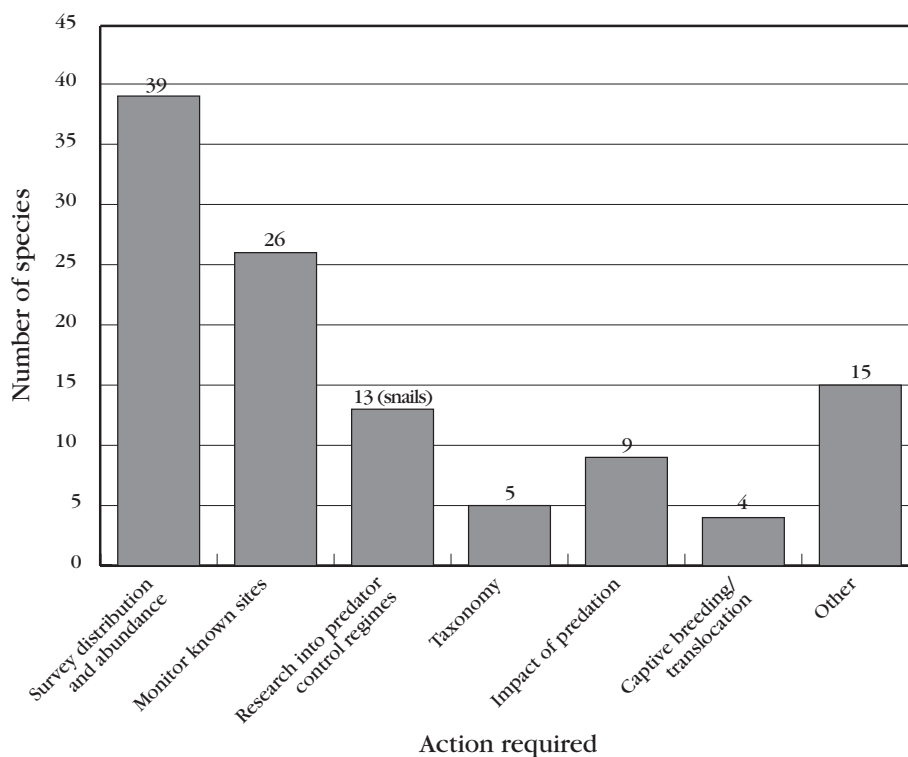


FIGURE 2. TYPE AND NUMBER OF TIMES A RESEARCH, MONITORING, OR SURVEYING REQUIREMENT IS IDENTIFIED IN THE SPECIES PROFILES

Thirty nine of the species listed require basic information on their distribution and abundance. This must be a priority, because only by obtaining this information can we state with any certainty that a taxon is threatened. Next is monitoring (26 species), which will allow for intervention to conserve the species if any trend indicating population decline is noticed. Monitoring enables us to evaluate the effectiveness of the current management. It must be conducted regularly in order to allow for seasonal variation in population numbers, and backed up with a good knowledge of the species' ecology, to help interpret fluctuations or trends observed. Research into predator control regimes (13 species) features highly owing mainly to the number of snails listed. However, this requirement is important, because in many cases, effective and sustained predator control is the only way the populations can be maintained.

6.6. MANAGEMENT REQUIREMENTS

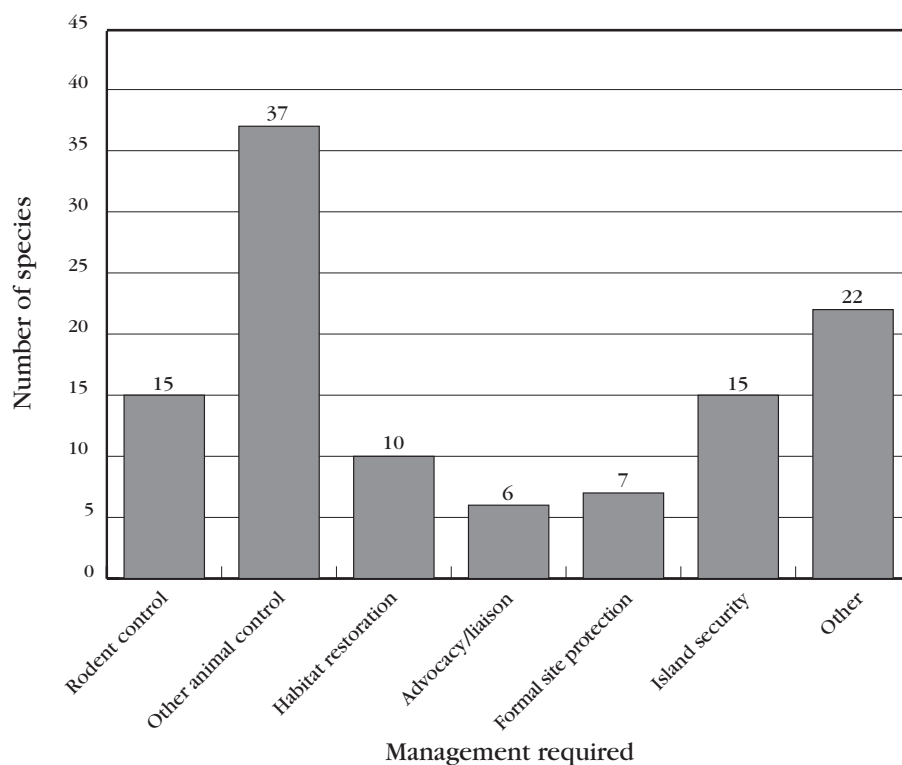


FIGURE 3. TYPE AND NUMBER OF MANAGEMENT REQUIREMENTS IDENTIFIED IN THE SPECIES PROFILES

Not surprisingly, the management requirements are closely related to the threats identified. Animal control is the main management requirement. Rodent control is required for 15 of the species listed, and other animal control for 37 species, although there is overlap between the two (i.e. some of the species require both rodent and other animal control). Island security ties in closely with this. For the majority of our island species, maintaining island security is all that is required to ensure their conservation (barring a natural disaster). The introduction of rodents to these islands is the major concern, although any disturbance to these islands is likely to be detrimental. Because habitat loss is one of our major threats, it is only fitting that habitat restoration should feature highly as a management action.

7. Bibliography

- Alexander, C.P. 1962. A new cave-inhabiting crane-fly (Tipulidae, Diptera) from New Zealand. *New Zealand Journal of Science* 5: 137-40.
- Anon. Island animal pest eradication database (last modified September 2000). Managed by the Biodiversity Recovery Unit, Department of Conservation, Wellington.
- Anon. 1953. Wildlife Act 1953. Government Printer, Wellington.
- Anon. 1991. Meetings of recovery groups for threatened wetas. Department of Conservation (unpub.).
- Anon. 1998. World Conservation Monitoring Centre. [online] viewed 12/11/98, available URL <http://www.wcmc.org.uk/cgi-bin/>
- Anon. 1999. *International code of zoological nomenclature*. 4th edn. International Trust for Zoological Nomenclature 1999, London.
- Anon. 2000a. World Conservation Monitoring Centre. [online] revised 4/2/00, available URL <http://www.wcmc.org.uk/species/animals/categories.ht>
- Anon. 2000b. *The New Zealand biodiversity strategy: February 2000*. Department of Conservation.
- Archey, G. 1924. The genus *Cryptops* (Chilopoda) in New Zealand. *Records of the Canterbury Museum* 2: 203-220.
- 1936. Revision of the Chilopoda of New Zealand. Part 1. *Records of the Auckland Institute and Museum* 2(1): 42-70.
- 1937. Revision of the Chilopoda of New Zealand. Part 2. *Records of the Auckland Institute and Museum* 2(2): 71-100.
- Armstrong, H. 1987. Ecology of the Cromwell chafer beetle. Final report, Department of Conservation, Wellington (unpub.).
- 1990. Results of Cromwell chafer beetle monitoring study. *The Weta* 13(2): 31.
- Armstrong, H.E. 1990. Reassessment of the Cromwell chafer beetle population. *Otago Conservancy Miscellaneous Series, No. 3*, Department of Conservation, Dunedin.
- Atkinson, I.A.E.; Taylor, R.H. 1992. Distribution of alien mammals on New Zealand Islands (2nd edn). *DSIR Land Resources Contract Report No. 92/59*.
- Balance, A.; Meads, M. 1989. Giant weta. *Ecology Notes 1*. Ecology Division Department of Scientific and Industrial Research, Lower Hutt.
- Balance, A.P. 1986. *Paryphanta* at Pawakatutu. *Tane* 31: 13-18.
- Barratt, B.I.P. 1993. *Mecodema chiltoni* Broun: an assessment of the priority for conservation. *Conservation Advisory Science Notes No. 14*, Department of Conservation, Wellington.
- 1994a. *Mecodema chiltoni* Broun: a rare and endangered species? *New Zealand Entomologist* 17: 1-2.
- 1994b. *Mecodema laeviceps* Broun: an assessment of the priority for conservation. *Conservation Advisory Science Notes No. 74*, Department of Conservation, Wellington.
- Barratt, B.I.P.; Patrick, B.H. 1987. Insects of snow tussock grassland on the East Otago Plateau. *New Zealand Entomologist* 10: 69-98.
- Beauchamp, A.J. 1988. The speargrass weevil *Lyperobius buttoni* on the Wellington south coast - preliminary report 24 November 1987, and additional comments from February 1988 - November 1988. Report, Department of Conservation, Wellington (unpub.).
- 1989. The status and management of the speargrass weevil *Lyperobius buttoni* on the Wellington south coast. Report, Department of Conservation, Wellington (unpub.).
- 1990a. Status of the giant weta *Deinacrida rugosa* on Mana Island. Progress report, Department of Conservation, Wellington (unpub.).
- 1990b. The current status and management of the speargrass weevil *Lyperobius buttoni* on the Wellington south coast. Report, Department of Conservation, Wellington (unpub.).
- Beauchamp, A.J.; Sherley, G.H. 1988. The status, research and management of the speargrass weevil *Lyperobius buttoni* on the Wellington south coast. Report, Department of Conservation, Wellington (unpub.).

- Bell, R.T.; Bell, J.R. 1978. Rhysodini of the world. Part 1. A new classification of the tribe, and a synopsis of *Omoglymmius* subgenus *Nitiglymmius*, new subgenus (Coleoptera: Carabidae or Rhysodidae). *Quaestiones Entomologicae* 14: 43-88.
- 1982 Rhysodini of the world. Part 3. Revision of *Omoglymmius ganglbauer* (Coleoptera: Carabidae or Rhysodidae) and substitutions for preoccupied generic names. *Quaestiones Entomologicae* 18: 127-259.
- Bellingham, M. 1991. Field observations on two species of tusked weta. *The Weta* 14: 30-32.
- Benham, W.B. 1904. On a new species of leech (*Hirudo antipodum*) recently discovered in New Zealand. *Transactions and Proceedings of the New Zealand Institute* 1903 36: 185-192.
- 1905. Some earthworms from the North Island of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 1904 37: 281-285.
- 1987. Observations on rearing *Karocolens pittospori* (Coleoptera: Curculionidae: Molytinae). *New Zealand Entomologist* 9: 34-37.
- Bergroth, E. 1927. Hemiptera, Heteroptera from New Zealand. *Transactions and Proceedings of the New Zealand Institute* 57: 671-684.
- Bigelow, R.S. 1967. The grasshoppers (Acrididae) of New Zealand. Their taxonomy and distribution. *University of Canterbury Publication No. 9*. University of Canterbury, Christchurch.
- Boyd, M. 1990. Conservation of New Zealand arthropods. *The Weta* 13(2): 43-44.
- Brignall-Theyer, M.E. 1998. Potential vertebrate predators of the Cromwell chafer beetle, *Prodontria lewisi*. Unpublished MSc thesis, Otago University, Dunedin.
- Britton, E.B. 1940. The Carabidae (Coleoptera) of New Zealand, Part 1, Pterostichini. *Transactions and Proceedings of the Royal Society of New Zealand* 69: 473-508.
- 1949. The Carabidae (Coleoptera) of New Zealand. *Transactions and Proceedings of the Royal Society of New Zealand* 77: 533-581.
- Brook, F.; McFadden, I. 1998. *Placostylus bongii* at the Mokohinau Islands. *Conservation Advisory Science Notes No. 194*, Department of Conservation, Wellington.
- Brook, F.J. 1999a. Changes in the landsnail fauna of Lady Alice Island, northeastern New Zealand. *Journal of the Royal Society of New Zealand* 29(2): 135-157.
- 1999b. Draft invertebrate report for Northland species. Department of Conservation, Whangarei (unpub.).
- 1999c. Draft: Uncommon and threatened landsnails (Mollusca: Gastropoda) in the Northland region, and priorities for conservation management. Department of Conservation, Whangarei (unpub.).
- 1999d. Invertebrate conservation in Northland. *Conservation Advisory Science Notes No. 225*, Department of Conservation, Wellington.
- 1999e. Stratigraphy and landsnail fauna of Late Holocene coastal dunes, Tokerau Beach, northern New Zealand. *Journal of the Royal Society of New Zealand* 29(4): 337-359.
- 1999f. Stratigraphy, landsnail faunas, and paleoenvironmental history of coastal dunefields at Te Werahi, northernmost New Zealand. *Journal of the Royal Society of New Zealand* 29(4): 361-393.
- Brook, F.J.; Goulstone, J.F. 1999. Prehistoric and present-day coastal landsnail faunas between Whananaki and Whangamumu, northeastern New Zealand, and implications for vegetation history following human colonisation. *Journal of the Royal Society of New Zealand* 29(2): 107-134.
- Brook, F.J.; Laursen, C.M. 1992. Ecology and morphological variation in *Placostylus bollonsi* (Gastropoda: Bulimulidae) at Three Kings Islands, New Zealand. *Records of the Auckland Institute and Museum* 29: 135-166.
- Brook, F.J.; McArdle, B.H. 1999. Morphological variation, biogeography and local extinction of the northern New Zealand landsnail *Placostylus bongii* (Gastropoda: Bulimulidae). *Journal of the Royal Society of New Zealand* 29(4): 407-434.
- Brook, F.J.; McCallum, J.; Cameron, E.K. 1982. A note on the occurrence of *Rhytida greenwoodi* Gray (Mollusca: Paryphantidae) at Rakitu Island, northern New Zealand. *Tane* 28: 137-139.
- Brookes, A.E. 1927. A new genus and three new species of Coleoptera. *Transactions and Proceedings of the New Zealand Institute* 57: 563-566.

- 1944. Descriptions of two new genera and species of New Zealand beetles, and notes on other described species. *Transactions and Proceedings of the Royal Society of New Zealand* 73(4): 262-266.
- 1951. The Coleoptera of the Auckland and Campbell Islands. *Cape Expedition Series Bulletin No. 5*, Department of Scientific and Industrial Research, Wellington.
- Broun, T. 1880. *Manual of the New Zealand Coleoptera, Part 1*. Wellington, Published by Command, pp 1-651.
- 1881. *Manual of the New Zealand Coleoptera, Part 2*. Wellington, Published by Command, pp 653-744.
- 1886. *Manual of the New Zealand Coleoptera, Parts 3 and 4*. Wellington, Published by Command, pp 745-973.
- 1893. *Manual of the New Zealand Coleoptera, Parts 5, 6, and 7*. Wellington, Published by Command pp 975-1504.
- 1902. The beetles of the Auckland Islands: Descriptions. *Transactions and Proceedings of the New Zealand Institute* 1901 34: 175-179.
- 1904. Descriptions of new genera and species of New Zealand Coleoptera. *Annals and Magazine of Natural History* 7(14): 41-59, 105-127.
- 1910. Descriptions of new genera and species of Coleoptera. *New Zealand Institute Bulletin No. 1*. Wellington, John MacKay, Government Printer.
- 1911. Additions to the Coleopterous fauna of the Chatham Islands. *Transactions of the New Zealand Institute* 1910 43: 92-115.
- Brown, B.; Townsend, J. 1994. A distribution survey of *Hemideina ricta* on Banks Peninsula. Contract report for Department of Conservation (unpub.).
- Browne, G.H. 1980. A note on *Placostylus bongii* (Lesson) from Fanal Island. *Tane* 26: 61-62.
- Buckley, T. 1998. New Zealand cicadas collected on Department of Conservation lands 1997-98. Unpublished report, Department of Conservation, Wellington.
- Bull, R.M. 1959. A note on the occurrence of *Brullea antarctica* Castelnau (Coleoptera: Carabidae) at Otaki Beach. *New Zealand Entomologist* 2(4): 9.
- 1967. A study of the large New Zealand weevil, *Lyperobius buttoni* Pascoe 1876 (Coleoptera: Curculionidae, Molytinae). Unpublished MSc Thesis, Victoria University Wellington.
- Buller, W. 1871. Notes on the genus *Deinacrida* in New Zealand. *Transactions and Proceedings of the New Zealand Institute* 1870 3: 34-37.
- Buller, W.L. 1895. On the wetas, a group of orthopteran insects inhabiting New Zealand; with descriptions of two new species. *Transactions and Proceedings of the New Zealand Institute* 1894 27: 143-147.
- Butcher, M.R. 1984. A revision of the genus *Holcaspis* (Coleoptera: Carabidae). *Journal of the Royal Society of New Zealand* 14(1): 47-99.
- Butcher, M.R.; Emberson, R.M. 1981. Aspects of the biology of carabid beetles of Ahuriri Bush Scenic Reserve, Banks Peninsula. *Mauri Ora* 9: 59-70.
- Calder, A.A. 1976. The New Zealand genus *Metablax* (Coleoptera: Elateridae) and its relationships to the Campsosterninae. *New Zealand Journal of Zoology* 3(4): 313-325.
- Cameron, W.L. 1996. A study of the taxonomic status of *Deinacrida parva* and *D. rugosa* (Orthoptera: Stenopelmatidae), two giant weta from central New Zealand. Unpublished MSc Honours thesis, Victoria University Wellington.
- Chadderton, W.L. 1990. The ecology of Stewart Island freshwater communities. Unpublished MSc thesis, University of Canterbury, Christchurch.
- Chapman, M.A.; Lewis, M.H. 1976. *An introduction to the freshwater crustacea of New Zealand*. William Collins (New Zealand) Ltd.
- Chapman, R.B.; Simeonidis, A.S.; Smith, J.T. 1997. Evaluation of metallic green ground beetle as a predator of slugs. *Proceedings of the 50th NZ Plant Protection Conference 1997*: 51-55.
- Choat, J.H.; Schiel, D.R. 1980. Population structure of *Placostylus bongii* (Gastropoda: Paryphantidae) on the Poor Knights Islands. *New Zealand Journal of Zoology* 7(2): 199-205.
- Clarke, C. E. 1933. The Lepidoptera of the Te Anau-Manapouri Lakes districts. *Transactions and Proceedings of the New Zealand Institute* 63(2): 112-132.

- Climo, F.M. 1971. A new species of *Paryphanta* (Mollusca: Paryphantidae) from south-west Fiordland, New Zealand. *Records of the Dominion Museum* 7(15): 147-150.
- 1973. The systematics, biology, and zoogeography of the land snail fauna of Great Island, Three Kings Group, New Zealand. *Journal of the Royal Society of New Zealand* 3(4): 565-628.
- 1975. Large land snails. *New Zealand's Nature Heritage* 5(67): 1862-1866.
- 1977. A new higher classification of New Zealand Rhytididae (Mollusca: Pulmonata). *Journal of the Royal Society of New Zealand* 7(1): 59-65.
- 1978. The *Powelliphanta gilliesi - traversi - hochstetteri - rossiana - lignaria - superba* ring species (Mollusca: Pulmonata). *New Zealand Journal of Zoology* 5(2): 289-294.
- Climo, F.M.; Roscoe, D.J. & Walker, K.J. 1986. Research on land snails of New Zealand. *Wildlife Research Liaison Group Research Review No. 9*.
- Close, I. 1997. A tale of two fiord. *Forest and Bird* 283: 32-34.
- Coad, N. 1998. The kauri snail (*Paryphanta busbyi busbyi*), its ecology and the impact of introduced predators. MSc, University of Auckland.
- Collier, K.J. 1991. Aquatic invertebrates of lower Mohaka River, Hawkes Bay. *Science and Research Internal Report No. 108*, Department of Conservation, Wellington.
- 1992a. Aquatic invertebrates of lower Mangahao and Mangatainoka Rivers, Wairarapa. *Science and Research Internal Report No. 123*, Department of Conservation, Wellington.
- 1992b. Freshwater macroinvertebrates of potential conservation interest. *Science and Research Series No. 50*, Department of Conservation, Wellington.
- 1993a. A bibliography of some New Zealand riparian literature. *Science and Research Internal Report No. 139*, Department of Conservation, Wellington.
- 1993b. Review of the status, distribution and conservation of freshwater invertebrates in New Zealand. *New Zealand Journal of Marine and Freshwater Research* 27(3): 339-356.
- Collier, K.J.; Henriques, P. 1991. Aquatic invertebrates of Ngaruroro River, Hawkes Bay. *Science and Research Series No. 40*, Department of Conservation, Wellington.
- Collier, K.J.; Smith, B.J. 1995. Sticky trapping of adult mayflies, stoneflies and caddisflies alongside three contrasting streams near Hamilton, New Zealand. *New Zealand Natural Sciences* 22: 1-9.
- 1996. Riparian vegetation use by adult Ephemeroptera, Plecoptera and Trichoptera alongside some central North Island streams. *NIWA Science and Technology Series No. 34*.
- 1998. Dispersal of adult caddisflies (Trichoptera) into forests alongside three New Zealand streams. *Hydrobiologia* 361: 53-65.
- Collier, K.J.; Wakelin, M.D. 1990. Invertebrate fauna and ecological value of Ohutu Stream, Ruahine Ranges. *Science and Research Internal Report No. 81*, Department of Conservation, Wellington.
- Collier, K.J.; Wakelin, M.D. 1992. Drift of aquatic macroinvertebrate larvae in Manganuiateao River, central North Island, New Zealand. *New Zealand Natural Sciences* 19: 15-25.
- Collier, K.J.; Winterbourn, M.J.; Jackson, R.J. 1989. Impacts of wetland afforestation on the distribution of benthic invertebrates in acid streams of Westland, NZ. *New Zealand Journal of Marine and Freshwater Research* 23(4): 479-490.
- Cooper, R.A.; Millener, P.R. 1993. The New Zealand biota: historical background and new research. *Tree* 8(12): 429-433.
- Cooper, W.; Edwards, E.; Roberts, A. 1999. Pig Island, report and recommendations following a visit in December 1998. Southland Conservancy, Department of Conservation.
- Cowley, D.R. 1978. Studies on the larvae of New Zealand Trichoptera. *New Zealand Journal of Zoology* 5(4): 639-750.
- Craig, D.A. 1969. A taxonomic revision of New Zealand Blepharoceridae and the origin and evolution of the Australasian Blepharoceridae (Diptera: Nematocera). *Transactions of the Royal Society of New Zealand Biological Sciences* 11(9): 101-151.
- Craw, R.C. 1986. Review of the genus *Notoreas* (sensu auctorum) (Lepidoptera: Geometridae: Larentiinae). *New Zealand Journal of Zoology* 13(1): 131-140.
- 1987. Revision of the genus *Helastia* sensu stricto with description of a new genus (Lepidoptera: Geometridae: Larentiinae). *New Zealand Journal of Zoology* 14(2): 269-293.

- 1988. Panbiogeography: method and synthesis in biogeography. Pp 405-435 in Myers, A.A.; Giller, P.S. (eds): *Analytical biogeography an integrated approach to the study of animal and plant distributions*.
- 1989. Continuing the synthesis between panbiogeography, phylogenetic systematics and biogeography as illustrated by empirical studies on the biogeography of New Zealand and the Chatham Islands. *Systematic Zoology* 37: 291-310.
- 1999. Molytini (Insecta: Coleoptera: Curculionidae: Molytinae). *Fauna of New Zealand* 39.
- Crosby, T.K.; Dugdale, J.S.; Watt, J.C. 1998. Area codes for recording specimen localities in the New Zealand subregion. *New Zealand Journal of Zoology* 25(2): 175-183.
- Crosby, T.K.; Ramsay, G.W. 1994. BUGS on-disc: index to information on New Zealand terrestrial invertebrates 1775-1993 [47 MB]. In: *Spectrum: New Zealand science and technology databases*. J.A. Jaasperse (ed), Wellington, SIR Publishing.
- CSIRO. 1991. The insects of Australia, volume 1 (2nd edn). Melbourne University Press, Carlton.
- Daniel, L.J. 1992. *Powelliphanta marchantii* on Manuoha in Te Urewera National Park: a simple management strategy. Department of Conservation, Gisborne (unpub.).
- Daniel, M.J. 1979. The New Zealand short-tailed bat, *Mystacina tuberculata*; a review of present knowledge. *New Zealand Journal of Zoology* 6(2): 357-370.
- Daniels, G. 1987. A revision of *Neoratus* Ricardo, with the description of six allied new genera from the Australian region (Diptera: Asilidae: Asilini). *Invertebrate Taxonomy* 1: 473-592.
- de la Torre-Bueno, J.R. 1978. *A glossary of entomology*. New York Entomological Society, New York.
- Dell, R.K. 1955. A contribution to the study of rates of growth in *Paryphanta busbyi* (Gray), (Mollusca, Pulmonata). *Records of the Dominion Museum* 2(3): 145-146.
- Dendy, A. 1895. Notes on New Zealand land planarians. Part 1. *Transactions and Proceedings of the New Zealand Institute* 1894 27: 177-189.
- Department of Conservation. 1998. *Restoring the dawn chorus: Department of Conservation Strategic Business Plan*. Department of Conservation, Wellington.
- Department of Lands and Survey. 1985. Cromwell chafer beetle nature reserve management plan. *Management Plan Series No. NR14*. Department of Lands and Survey, Dunedin.
- Di Castri, F. & Younes, T. (eds). 1996. *Biodiversity, science and development towards a new partnership*. University Press, Cambridge.
- Dopson, S.R.; de Lange, P.J.; Ogle, C.C.; Rance, B.D.; Courtney, S.P.; Molloy, J. 2000. The conservation requirements of New Zealand's nationally threatened vascular plants. *Threatened Species Occasional Publication No. 13*, Department of Conservation, Wellington.
- Dugdale, J.S. 1971a. Genera of New Zealand Cicadidae (Homoptera). *New Zealand Journal of Science* 14: 856-882.
- 1971b. Lepidoptera, excluding non-Crambine Pyralidae. In: Gressitt, J.L. Entomology of the Auckland Islands and other islands south of New Zealand. *Pacific Insects, Monograph* 27(1-4): 55-172.
- 1988. Lepidoptera - annotated catalogue, and keys to family-group taxa. *Fauna of New Zealand* 14.
- 1994. Hepialidae (Insecta: Lepidoptera). *Fauna of New Zealand* 30.
- Dugdale, J.S.; Fleming, C.A. 1978. New Zealand cicadas of the genus *Maoricicada* (Homoptera: Tibicenidae). *New Zealand Journal of Zoology* 5(2): 295-340.
- Dugdale, J.S.; Hutcheson, J. 1997. Invertebrate values of kanuka (*Kunzea ericoides*) stands, Gisborne region. *Science for Conservation No. 55*, Department of Conservation, Wellington.
- Duncan, K.W. 1994. Terrestrial Talitridae (Crustacea: Amphipoda). *Fauna of New Zealand* 31.
- Early, J.W.; Emberson, R.M.; Muir, C.A.; Barratt, B.I.P. 1991. Lincoln University entomological expedition to Pitt Island: 10-24 January 1990. Report to Lincoln University and Department of Conservation, Christchurch (unpub.).
- Edwards, E. 1999. Draft: Southland invertebrate conservation strategy. Department of Conservation, Invercargill (unpub.).
- Edwards, F.W. 1923a. New species of crane-flies collected by Mr G.V. Hudson in New Zealand. *The Annals and Magazine of Natural History* 9(11): 625-631.
- 1923b. Preliminary revision of the crane-flies of New Zealand (Anisopodidae, Tanyderidae, Tipulidae). *Transactions and Proceedings of the New Zealand Institute* 54: 265-352.

- 1924. New species of crane-flies collected by Mr G.V.Hudson in New Zealand. Part 2. *The Annals and Magazine of Natural History* 9(13): 159-163.
- Efford, M. 1998. Distribution and status of native carnivorous land snails in the genera *Wainuia* and *Rhytida*. *Science for Conservation No. 101*, Department of Conservation, Wellington.
- Efford, M.; Bokeloh, D. 1991. Some results from a study of the land snail *Wainuia urnula* (Pulmonata : Rhytididae) and their implications for snail conservation. *DSIR Land Resources Contract Report No. 387*.
- Emberson, R.M. 1995. The Chatham Islands beetle fauna and the age of separation of the Chatham Islands from New Zealand. *New Zealand Entomologist* 18: 1-7.
- 1998a. Preliminary report of a visit to the Chatham Islands, January 1998: Invertebrate monitoring and research on endangered invertebrates. Report to Department of Conservation (unpub.).
- 1998b. The beetle (Coleoptera) fauna of the Chatham Islands. *New Zealand Entomologist* 21: 25-64.
- Emberson, R.M.; Early, J.W.; Marris, J.W.M.; Syrett, P. 1996. Research into the status and distribution of Chatham Islands endangered invertebrates. *Science for Conservation No. 36*, Department of Conservation, Wellington.
- Emberson, R.M.; Marris, J.W.M. 1993a. *Amychus candezei* Chatham Islands click beetle: a manual with aids to identification and suggestions for simple population monitoring. Contract report, Department of Conservation.
- 1993b. *Hadramphus spinipennis* coxella weevil: a manual with aids to identification and descriptions of plant damage. Contract report, Department of Conservation.
- 1993c. *Xylotoles costatus* Pitt Island longhorn: a manual with aids to identification. Contract report, Department of Conservation (unpub.).
- Emerson, B. 1994. Conservation status of chafer beetles *Prodontria bicolorata* and *P.modesta*: distribution and ecological observations. *New Zealand Entomologist* 17: 3-6.
- Emerson, B.C.; Barratt, B.I.P. 1997. Descriptions of seven new species of the genus *Prodontria* Broun (Coleoptera: Scarabaeidae: Melolonthinae). *The Coleopterists Bulletin*, 51(1): 23-36.
- Emerson, B.C.; Wallis, G.P. 1994. Species status and population genetic structure of the flightless chafer beetles *Prodontria modesta* and *P.bicolorata* (Coleoptera: Scarabaeidae) from South Island, New Zealand. *Molecular Ecology* 3: 339-345.
- European Community. 1986. *European charter for invertebrates*. Council for Europe, Strasbourg.
- Evenhuis, N.L. (ed). 1989. *Catalogue of the Diptera of the Australasian and Oceanian regions*. Bishop Museum Press & E.J. Brill, Honolulu.
- Fairburn, E. 1945. A new beetle of the genus *Mecodema*. *Transactions and Proceedings of the Royal Society of New Zealand* 74(4): 408-410.
- Fennah, R.G. 1975. New cavernicolous cixiid from New Zealand (Homoptera: Fulgoroidea). *New Zealand Journal of Zoology* 2(3): 377-380.
- Ferreira, S.M., McKinlay, B. 1999a. Morphological variation in adult Cromwell chafer beetles *Prodontria lewisi*. *Conservation Advisory Science Notes No. 227*, Department of Conservation, Wellington.
- 1999b. Conservation monitoring of the Cromwell chafer beetle (*Prodontris lewisii*) between 1986 and 1997. *Science for Conservation No. 123*, Department of Conservation, Wellington.
- Ferreira, S.M.; Ravenscroft, N.O.M.; McKinlay, B. 1999. Activity patterns and population characteristics of the New Zealand endemic Cromwell chafer, *Prodontria lewisii* (Scarabaeidae: Melolonthinae). *New Zealand Journal of Zoology* 26(3): 229-241.
- Field, L. H. 1993. Structure and evolution of stridulatory mechanisms in New Zealand wetas (Orthoptera: Stenopelmatidae). *International Journal of Insect Morphology and Embryology* 22(2-4): 163-183.
- 1993. Observations on stridulatory, agonistic, and mating behaviour of *Hemideina ricta* (Stenopelmatidae: Orthoptera), the rare Banks Peninsula weta. *New Zealand Entomologist* 16: 68-74.
- Fleming, C.A. 1971. A new species of cicada from rock fans in southern Wellington, with a review of three species with similar songs and habitat. *New Zealand Journal of Science* 14: 443-479.
- Foord, M. 1988. A nocturnal spree in the alcohol tree. *The Weta* 11(1): 18-19.

- 1990. *The New Zealand descriptive animal dictionary*. M.R.R. Foord, Dunedin.
- 1994. *The New Zealand descriptive animal dictionary: index of scientific names*. M.R.R. Foord, Dunedin.
- Forster, L. 1993. Additional notes: *Pianoa isolata*, a Gondwana spider relic. Draft grant application, Department of Conservation, Wellington (unpub.).
- Forster, R.R. 1948. A new genus and species of the family Acropsopilionidae (Opiliones) from New Zealand. *Transactions and Proceedings of the Royal Society of New Zealand* 77(1): 139-141.
- 1962. A key to the New Zealand Harvestmen - part 1. *Tuatara* 10(3): 129-137.
- 1963. A key to the New Zealand Harvestmen - part 2. *Tuatara* 11(1): 28-40.
- Forster, R.R.; Platnick, N.I.; Gray, M.R. 1987. A review of the spider superfamilies Hypochiloidea and Austrochiloidea (Aranea: Araneomorphae). *Bulletin of the American Museum of Natural History* 185(1): 1-116.
- Forster, R.R.; Forster, L.M. 1999. *Spiders of New Zealand and their world-wide kin*. University of Otago Press (in association with Otago Museum), Dunedin. 270pp.
- Fowler, R.T. 2000. Linking hyporheic and benthic invertebrate communities in New Zealand gravel bed rivers. Unpublished PhD thesis, Massey University, Palmerston North.
- Fowler, R.T.; Henderson, I.M. 1999. Biomonitoring survey for benthic invertebrates in the upper Manawatu River. A report prepared for Horizons MW (unpub.).
- 2000. Survey of the benthic invertebrate communities in six tributaries of the Manawatu River: a baseline biomonitoring survey of biotic integrity. A report prepared for Horizons MW (unpub.).
- Fox, K.J. 1982. Entomology of the Egmont National Park. *New Zealand Entomologist* 7(3): 286-289.
- Franz, H. 1975. Revision der scydmaeniden von Australien, Neuseeland und den benachbarten Inseln (Revision of the scydmaenids of Australia, New Zealand and the neighbouring islands). Springer-Verlag, Wein/New York.
- 1977. Neue scydmaeniden (Coleoptera) aus Neuseeland, von Samoa den Tonga-Inseln und Cook-Inseln (New scydmaenids (Coleoptera) from New Zealand, of Samoa, the Tonga Islands and Cook Islands). *Koleopterologische Rundschau* 55: 15-25.
- 1980. Weiterer Beitrag zur Kenntnis der scydmaeniden-fauna Neuseelands. (Further contribution to the knowledge of the scydmaenid fauna of New Zealand.) *Osterreichische Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse. Denkschriften* 189(810): 249-313.
- 1985. 4. Beitrag zur Kenntnis der scydmaeniden fauna Neuseelands. (Contribution to the knowledge of the scydmaenid fauna of New Zealand.) *Sitzungsberichte der Osterreichischen Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse, Abteilung* 194: 197-246.
- Fraser, I. 1999. Robust grasshopper (*Brachaspis robustus*) sightings database and monitoring methods trial. Project River Recovery Report 99/01, Department of Conservation, Twizel.
- Fyfe, M.L. 1947. The classification and reproductive organs of New Zealand land planarians. Part III. *Transactions and Proceedings of the Royal Society of New Zealand* 76(4): 517-523.
- Gaskin, D.E. 1975. Revision of the New Zealand Crambini (Lepidoptera: Pyralidae: Crambinae). *New Zealand Journal of Zoology* 2(3): 265-363.
- 1987. Supplement to New Zealand Crambinae (Lepidoptera: Pyralidae) - corrections, description of females of two species, and notes on structure, biology, and distribution. *New Zealand Journal of Zoology* 14(1): 113-121.
- Gibbs, G.W. 1992. Giant weta in Price's Basin, Whitcombe Catchment. Report to West Coast Conservancy, Department of Conservation (unpub.).
- 1998a. *New Zealand weta*. Reed Books, Reed Publishing (NZ) Ltd, Auckland.
- 1998b. Why are some weta (Orthoptera: Stenopelmatidae) vulnerable yet others are common? *Journal of Insect Conservation* 2: 1-6.
- 1999a. Four new species of giant weta, *Deinacrida* (Orthoptera: Anostomatidae: Deinacridinae) from New Zealand. *Journal of the Royal Society of New Zealand* 29(4): 307-324.
- 1999b. Insects at risk. *Forest & Bird* 29(4): 32-35.

- Gibbs, G.W.; Allen, J. 1990. *Conservation status of Stephens Island invertebrates*. Contract report, Section B, File SC0147. Department of Conservation, Wellington.
- Gibbs, G.W.; McIntyre, M. 1997. Abundance and future options for wetapunga on Little Barrier Island. *Science for Conservation No. 48*, Department of Conservation, Wellington.
- Gibbs, G.W.; Richards, M. 1991. An assessment of the taxonomic and conservation status of the South Island giant scree weta *Deinacida connectens*. Contract report Department of Conservation, Wellington (unpub.).
- 1994. How many species of giant weta are there? Pp 40-45 in Creswell, M.; Veitch, D. (comps): *Threatened terrestrial insects: a workshop to advance. Threatened Species Occasional Publication No. 6*, Department of Conservation, Wellington.
- Gibson, R.; Moore, J. 1981. The *Geonemertes* problem (Nemertea). *Journal of Zoology, London 194*: 175-201.
- Gill, B.J. 1998. *Powell's native animals of New Zealand*. 4th ed. Original text by A.W.B. Powell, updated by W.O. Cernohorsky, B.J. Gill, A.B. Stephenson, and K.A.J. Wise. Bateman, Auckland.
- Given, B.B. 1952. A revision of the Melolonthinae of New Zealand. Part I: the adult beetles. *New Zealand Department of Scientific and Industrial Research Bulletin 102, Entomological Research, Station Publication 10*. Department of Scientific and Industrial Research, Wellington.
- 1955. A preliminary note on the genus *Pericoptus* (Scarabaeidae, Dynastinae). *New Zealand Entomologist 1*(5): 13-18.
- 1960. The Melolonthinae (Coleoptera) of New Zealand, descriptions of new species, notes on types, and a catalogue. *New Zealand Journal of Science 3*(3): 363-381.
- 1964. A new species of the genus *Prodontria* (Melolonthinae: Coleoptera). *New Zealand Journal of Science 7*: 38-40.
- Glasby, C.; Read, G. 1998. Polychaete worms: a diverse yet poorly known group. *Water and Atmosphere 6*(4): 7-9.
- Glasby, C.J. 1999. The Namanereidinae (Polychaeta: Nereididae). Part 1, taxonomy and phylogeny. *Records of the Australian Museum, Supplement 25*: 1-129.
- Gleeson, D.M. 1996. Onychophora of New Zealand; past, present and future. *New Zealand Entomologist 19*: 51-55.
- Goodman, A.J. 1997. A preliminary study of the terrestrial amphipod *Tara taranaki*. Internal report, Department of Conservation, Stratford.
- 1998. Survey of the giant terrestrial amphipod *Tara taranaki*. Internal report, Department of Conservation, Stratford.
- Goulstone, J.E.; Brook, F.J. 1999. Description of five species of terrestrial molluscs (Gastropoda: Stylommatophora: Punctidae, Charopidae, Rhytididae) discovered in the Three Kings Islands, northern New Zealand. *Journal of the Royal Society of New Zealand 29*(1): 23-39.
- Goulstone, J.E.; Mayhill, P.C.; Parrish, G.R. 1993. An illustrated guide to the land Mollusca of the Te Pahi ecological region, Northland, New Zealand. *Tane 34*: 1-32.
- Gourlay, E.S. 1931. A new and important flax-infesting weevil. *The New Zealand Journal of Science and Technology 13*(3): 163-169.
- 1950. Auckland Island Coleoptera. *Transactions and Proceedings of the Royal Society of New Zealand 78*(2-3): 171-202.
- Gray, J.E. 1840. New land shells from New Zealand. *The Annals and Magazine of Natural History 1*(6): 317.
- Green, C.J. 1997. Management of *Geodorcus itabginis* (Lucanidae), New Zealand's most endangered stag beetle? (abstract) P 34 in *Biodiversity Now Conference Book* (unpub.).
- Grehan, J.R. 1990. Invertebrate survey of Somes Island (Matiu) and Mokopuna Island, Wellington Harbour, New Zealand. *New Zealand Entomologist 13*: 62-75.
- Grehan, J.R.; Patrick, B.H. 1984. Notes on bog inhabiting Hepialidae (Lepidoptera) of New Zealand. *New Zealand Entomologist 8*: 63-67.
- Hamilton, A. 1913. On *Deinacrida rugosa* Buller. *Transactions and Proceedings of the New Zealand Institute for the Year 1912 45*: 210.
- Hamilton, H. 1921. Occurrence of a rare tineoid moth (*Titanomis sisyrota* Meyr.). *The New Zealand Journal of Science and Technology 4*(3): 141.

- Hamilton, W.J. 1999. Potential threat of hedgehogs to invertebrates with a restricted range, Otago region. *Conservation Advisory Science Notes No. 254*, Department of Conservation, Wellington.
- Hann, S.W. 1990. Evidence for the displacement of an endemic New Zealand spider, *Latrodectus katipo* Powell by the South African species *Steatoda capensis* Hann (Aranea, Theridiidae). *New Zealand Journal of Zoology* 17(3): 295-307.
- Harris, A.C. 1978. The larvae of *Brullea antarctica* (Coleoptera: Carabidae: Broscinae). *New Zealand Entomologist* 6(4): 401-405.
- 1980. The larvae of *Brullea antarctica* (Coleoptera: Carabidae: Broscinae): note. *New Zealand Entomologist* 7(2): 174-175.
- 1991. A large aggregation of *Peripatoides novaezealandiae* (Hutton, 1876) (Onychophora: Peripatopsidae). *Journal of the Royal Society of New Zealand* 21(4): 405-406.
- 1992. A note on *Maoripamborus fairburni* (Coleoptera: Carabidae: Cychrini). *The Weta* 15 (2): 42-44.
- Hayward, B.W.; Brook, F.J. 1981. Exploitation and redistribution of flax snail (*Placostylus*) by the prehistoric Maori. *New Zealand Journal of Ecology* 4: 33-36.
- Helmore, D.W. 1982. Drawings of New Zealand insects. *Bulletin of the Entomological Society of New Zealand* 8.
- Henderson, I.M. 1980. Weevil in peril. *The Weta* 3(2): 19.
- 1983. A contribution to the systematics of New Zealand Philopotamidae (Trichoptera). *New Zealand Journal of Zoology* 10(2): 163-176.
- 1985. Systematic studies of New Zealand Trichoptera and critical analysis of systematic methods. Unpublished PhD thesis, Victoria University, Wellington.
- 1995. Freshwater polychaete rediscovered. *New Zealand Limnological Society Newsletter* 30: 13.
- Hollingsworth, R.; Sherley, G. 1998. Weta, peaceful giants of the insect world. Fact sheet, Department of Conservation, Wellington.
- Holloway, B.A. 1961. A systematic review of the New Zealand Lucanidae (Insecta: Coleoptera). *Dominion Museum Bulletin No.20*.
- 1963. A new species of *Lissotes* Westwood from New Zealand, and a description of the female of *L. oconnori* Holloway (Coleoptera: Lucanidae). *Transactions of the Royal Society of New Zealand Zoology* 3(7): 77-80.
- 1976. A new bat-fly family from New Zealand (Diptera: Mystacinobiidae). *New Zealand Journal of Zoology* 3(4): 279-301.
- 1996. Two new genera of New Zealand stag beetle previously treated as *Dorcus* MacLeay and *Lissotes* Westwood (Coleoptera: Lucanidae). *New Zealand Journal of Zoology* 23(1): 61-66.
- 1997. Elytral surface structures as indicators of relationships in stag beetles, with special reference to the New Zealand species (Coleoptera: Lucanidae). *New Zealand Journal of Zoology* 24(1): 47-64.
- 1998. A re-evaluation of the genera of New Zealand aesaline stag beetles (Coleoptera: Lucanidae). *Journal of the Royal Society of New Zealand* 28(4): 641-656.
- Howarth, F.G.; Ramsay, G.W. 1989. The conservation of insects and their habitats. Pp 71-107 in Collins, N.M.; Thomas, J.A. (eds): *The conservation of insects and their habitats*. Academic Press, London.
- Howe, P. 1998. Big backyard beetles: survival in highly-modified habitats. *The Weta* 21(1): 16-18.
- Howes, W.G. 1946. Lepidoptera collecting at the Homer, with descriptions of new species. *Transactions and Proceedings of the New Zealand Institute* 76(2): 139-147.
- Hudson, G.V. 1923. An index of New Zealand beetles. *Transactions and Proceedings of the New Zealand Institute* 54: 353-399.
- 1928. *The butterflies and moths of New Zealand*. Ferguson & Osborn Ltd, Wellington.
- 1934. *New Zealand beetles and their larvae. An elementary introduction to the study of our native Coleoptera*. Ferguson & Osborn Ltd, Wellington.
- 1939. *A supplement to the butterflies and moths of New Zealand*. Ferguson & Osborn Ltd, Wellington.

- 1951. *Fragments of New Zealand entomology. A popular account of all the New Zealand cicadas. The natural history of the New Zealand glow-worm. A second supplement to the butterflies and moths of New Zealand and notes on many other native insects.* Ferguson & Osborn Ltd, Wellington.
- Hudson, L. 1974. Peripatus. *New Zealand's Nature Heritage* 2(17): 461-462.
- Hughey, K.E.D.; Fraser, B.R.; Hudson, L.G. 1989. Aquatic invertebrates in two Canterbury rivers related to bird feeding and water development impacts. *Science and Research Series 12*. Department of Conservation, Wellington.
- Hunt, D. 1998. Monitoring of the Cromwell chafer beetle (*Prodontria lewisii*) by pitfall trapping and night searches. Report, Department of Conservation, Dunedin (unpub.).
- Hunt, M.R. 1996. The distribution and habitat requirements of the large speargrass weevil (*Lyperobius buttoni*) and characteristics of host speargrass plants (*Aciphylla squarrosa*) and their vegetation associations. Unpublished MSc thesis, Victoria University, Wellington.
- Hurley, D.E. 1954. Studies on the New Zealand amphipodan fauna No 7. The family Corophiidae, including a new species of *Paracorophium*. *Transactions of the Royal Society of New Zealand* 82(2): 431-460.
- Husheer, S. 1999. The impact of predators on *Powelliphanta marchanti* in Kaimanawa Forest Park. *Ecological Management* 7. Department of Conservation, Wellington: 17-21.
- Hutcheson, J. 1989. Impacts of 1080 on weta populations. Report for Department of Conservation, Wellington.
- Hutton, F.W. 1895. On a new species of weta (Locustidae) from Bounty Islands. *Transactions and Proceedings of the New Zealand Institute* 1894 27: 174-176.
- 1897. The Stenopelmatidae of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 1896 29: 208-242.
- 1898. The grasshoppers and locusts of New Zealand and the Kermadec Islands. *Transactions and Proceedings of the New Zealand Institute* 1897 30: 135-150.
- 1900. Note on *Paryphanta lignaria*. *Transactions and Proceedings of the New Zealand Institute* 1899 32: 22.
- 1901. Synopsis of the Diptera brachycera of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 1900 33: 1-95.
- 1904. On a new weta from the Chatham Islands. *Transactions and Proceedings of the New Zealand Institute* 1903 36: 154.
- Jamieson, C.D. 1996. The grasshopper *Sigauss minutus* in central Otago: a pilot study. *Science for Conservation No. 42*, Department of Conservation, Wellington.
- 1999a. Conservation management of *Prodontria* species in the Alexandra area. Report, Department of Conservation, Dunedin.
- 1999b. Distribution and abundance of *Sigauss childi* Jamieson (Orthoptera: Acrididae), a Central Otago endemic grasshopper. *Science for Conservation No. 110*, Department of Conservation, Wellington.
- 1999c. Existing records of the caribid beetle *Oregus inaequalis* Castelnau in coastal Otago. *Conservation Advisory Science Notes No. 244*. Department of Conservation, Wellington.
- Johns, P.M. 1966. The cockroaches of New Zealand. *Records of the Canterbury Museum* 8(2): 93-136.
- 1974. Cockroaches. *New Zealand's Nature Heritage* 2(23): 635-636.
- 1980. Hanmer State Forest Park arthropod survey. Report to the Park Advisory Committee September 1980.
- 1986. Arthropods of Banks Peninsula reserves. Report to the Commissioner of Crown Lands, Christchurch, August 1986.
- 1991. Distribution of cave species of northwest Nelson, Westland and Canterbury. *The Weta* 14: 11-21.
- 1997. The Gondwanaland weta: family Anostomatidae (formerly in Stenopelmatidae, Henicidae or Mimmermidae): nomenclatural problems, world checklist, new genera and species. *Journal of Orthoptera Research* 6: 125-138.
- Johns, P.M.; Deacon, K.J.; Herron, S.; Homewood, B.; Little, G.; Notman, P.; Rapley, M.; Wilson, K. 1980. Ground beetles (Carabidae) of Arthurs Pass National Park. *Mauri Ora* 8: 55-67.

- Jones, J. 1994. *Giant weta*. Auckland, Heinemann Education.
- Jowett, C.; Plant, A. 1989. Interim management and recovery plan for the Mahoenui giant weta *Deinacrida* sp (Orthoptera : Stenopelmatidae). Internal report, Department of Conservation, Hamilton (unpub.).
- Jowett, C.R. 1990. Predators and the Mahoenui giant weta. Interim report, Department of Conservation, Hamilton (unpub.).
- 1996. A predation study of the Mahoenui giant weta. Unpublished MSc thesis, Auckland University, Auckland.
- Judd, W. 1990. Slow, slimy and surprising. *New Zealand Geographic* 7: 84-111.
- Karaman, G.S. 1979. Revision of the genus *Paracorophbium* Stebb. With description of *P. Cbelatum*, n. sp. and genus *Chaetocorophbium*, n. gen. (Fam. Corophiidae) (contribution to the knowledge of Amphipoda 100). *Glas. Republ. Zavoda Zast. Prirode - Prirodnjackog Muzega Titograd* 12: 87-100.
- Kingsley, R.I. 1895. Zoological notes: (1) Arboreal nests of bush-rat (*Mus maorium*); (2) *Paryphanta hochstetteri* found at low levels at west Wanganui. *Transactions and Proceedings of the New Zealand Institute* 1894 27: 238-239.
- Klimaszewski, J.; Watt, J.C. 1997. Coleoptera: family review and keys to identification. *Fauna of New Zealand* 37.
- Kuschel, G. 1964. Coleoptera: Curculionidae of the subantarctic islands of New Zealand. In Gressitt, J. L. Insects of Campbell Island. *Pacific Insects Monograph* 7: 416-493.
- 1971. Coleoptera: Curculionidae. In Gressitt, J. L. Entomology of the Aucklands and other islands south of New Zealand. *Pacific Insects Monograph* 27(1-4): 225-260.
- 1982. Apionidae and Curculionidae (Coleoptera) from the Poor Knights Islands, New Zealand. *Journal of the Royal Society of New Zealand* 12(3): 273-282.
- 1987. The subfamily Molytinae (Coleoptera: Curculionidae): General notes and descriptions of new taxa from New Zealand and Chile. *New Zealand Entomologist* 9: 11-29.
- 1990. Beetles in a suburban environment: a New Zealand case study. *DSIR Plant Protection Report*, New Zealand Department of Scientific and Industrial Research.
- Kuschel, G.; Worthy, T. H. 1996. Past distribution of large weevils (Coleoptera: Curculionidae) in the South Island, New Zealand, based on Holocene fossil remains. *New Zealand Entomologist* 19: 15-22.
- La Porta, K. 1988. The natural diet of the Mahoenui giant weta (*Deinacrida heteracantha*) as revealed by leaf cuticles in the faeces. Report? Department of Conservation (unpub.).
- Laidlaw, W.B.R. 1956. A note on *Hemiandrus monstrosus* Salmon (Orthoptera, Stenopelmatidae, Anostostominae). *New Zealand Entomologist* 2(1): 3-7.
- Lariviere, M-C. 1997. Composition and affinities of the New Zealand heteropteran fauna (including Coleorrhyncha). *New Zealand Entomologist* 20: 37-44.
- 1995. Cydnidae, Acanthosomatidae, and Pentatomidae (Insecta: Heteroptera): systematics, geographical distribution, and bioecology. *Fauna of New Zealand* 35.
- 1999. Cixiidae (Insecta: Hemiptera: Auchenorrhyncha). *Fauna of New Zealand* 40.
- Lariviere, M-C.; Hoch, H. 1998. The New Zealand planthopper genus *Semo* White (Hemiptera: Cixiidae): taxonomic review, geographical distribution and biology. *New Zealand Journal of Zoology* 25(4): 429-442.
- Lee, K.E. 1952. Studies on the earthworm fauna of New Zealand - 2. *Transactions and Proceedings of the Royal Society of New Zealand* 79(3-4): 556-573.
- 1959a. A key for the identification of New Zealand earthworms. *Soil Bureau Publication No. 172*.
- 1959b. The earthworm fauna of New Zealand. *New Zealand Department of Scientific and Industrial Research Bulletin* 130.
- Lyal, C.H.C. 1993. Cryptorhynchinae (Insecta: Coleoptera: Curculionidae). *Fauna of New Zealand* 29.
- Lyneborg, L. 1992. Therevidae (Insecta: Diptera). *Fauna of New Zealand* 24.
- MacFarlane, R.P. 1992. Asilidae of interest for conservation. Report, Department of Conservation, Wellington (unpub.).
- MacFarlane, R.P.; Millar, I.; Patrick, B.H. 1997. Nelson upland insects: conservation status of a predatory robber fly and ground beetle and associated beech forest insect ecology. Report, Department of Conservation, Nelson (unpub.).

- Madison, P.A. 1991. Comments on: Northland Kauri National Park proposal. Public Discussion Paper (unpub.).
- Maloney, R. 1992. *Brachaspis robustus* surveys in the MacKenzie Basin: a report on project river recovery robust grasshopper sightings in the MacKenzie Basin - 1991 & 1992. Report, Department of Conservation (unpub.).
- Mark, A.F. 1985. The botanical component of conservation in New Zealand. *New Zealand Journal of Botany* 23(4): 789-810.
- Mark, A.F.; Dickenson, K.J.M.; Patrick, B.H. Barratt, B.I.P.; Loh, G.; McSweeney, G.D.; Meurk, C.D.; Timmins, G.M.; Simpson, N.C.; Wilson, J.B. 1989. An ecological survey of the central part of the Eyre ecological district, northern Southland, New Zealand. *Journal of the Royal Society of New Zealand* 19(4): 349-384.
- Marris, J. 1996a. Beetles (Coleoptera) of the Three Kings Islands. Report for Department of Conservation, Whangarei.
- Marris, J. 1996b. The conservation status of the Cook Strait click beetle, *Amychus granulatus* (Broun) (Coleoptera: Elateridae): with comments on other threatened insects of the Marlborough Sounds. Report to Department of Conservation.
- Marshall, G. 1932. Notes on the Hylobiinae (Col., Curc.). *The annals and magazine of natural history* 10(9): 341-355.
- Marshall, G.A.K. 1937. New Curculionidae (Col.) from New Zealand. *Transactions and Proceedings of the Royal Society of New Zealand* 1937 67(3): 316-340.
- Marshall, J.W. 1974. A biological investigation of the Leeston drain, Canterbury, New Zealand. Unpublished MSc thesis, University of Canterbury, Christchurch.
- Martin, G. 1999. Weta transferred. Waikato Conservancy Status Report: 16 March 1999. (unpub.)
- May, B. M. 1963. Revision of the genus *Megacolabus* Broun 1893 (Coleoptera: Curculionidae: Rhyparosominae). *Transactions of the Royal Society of New Zealand Zoology* 3(15): 151-164.
- 1973. A new species of *Megacolabus* and descriptions of the immature stages of *M. decipens* (Coleoptera: Curculionidae). *Journal of the Royal Society of New Zealand* 3(2): 255-262.
- 1981. Immature stages of Curculionoidea - the weevils of the Snares Islands, New Zealand. *New Zealand Journal of Zoology* 8(2): 255-280.
- 1987a. Immature stages of Curculionidae (Coleoptera): rearing records 1964-1986. *New Zealand Entomologist* 9: 44-56.
- 1987b. Immature stages of Curculionidae (Coleoptera): the larva and pupa of *Karocolens pittospori* (Molytinae). *New Zealand Entomologist* 9: 29-34.
- 1993. Larvae of Curculionoidea (Insecta: Coleoptera): a systematic overview. *Fauna of New Zealand* 28.
- McColl, H.P. 1981. Collecting data for osoriine Staphylinid beetles in New Zealand up to 1979. *New Zealand Soil Bureau Scientific Report* 46.
- McColl, H.P. 1982. Osoriinae (Insecta: Coleoptera Staphylinidae). *Fauna of New Zealand* 2.
- 1984a. Five new species of *Paratrochus* (Staphylinidae: Osoriinae), with a redescription of *P. anophthalmus* (Fauvel). *New Zealand Journal of Zoology*, 11(1): 23-34.
- 1984b. *Nototorchus* nom. nov. and *Paratorchus* nom. nov., replacement names for *Nototorchus* McColl, 1982 and *Paratorchus* McColl, 1982 (Coleoptera: Staphylinidae: Osoriinae). *New Zealand Journal of Zoology* 11(4): 355-356.
- McFarlane, A.G. 1956. Additions to the New Zealand Trichoptera (Part 3). *Records of the Canterbury Museum* 7(1): 29-41.
- 1964. A new endemic subfamily, and other additions and emendations to the Trichoptera of New Zealand (Part 5). *Records of the Canterbury Museum* 8(1): 55-79.
- 1990. A generic key to late instar larvae of the New Zealand Trichoptera (caddis flies). *Records of the Canterbury Museum* 10(3): 25-38.
- McIntyre, M.E. 1992a. Dispersal and preliminary population estimates of the giant weta, *Deinacrida rugosa*, following the eradication of mice from Mana Island. Report, Department of Conservation, Wellington (unpub.).
- 1992b. The status and habitat of the Middle Island (Mercury Group) tussock wetas, with implications for management. Interim Expedition Report, Department of Conservation (unpub.).

- 1998. Monitoring the release of giant weta, *Deinacrida rugosa*, on Mātū-Somes Island March 1998. Report to Department of Conservation, Wellington (unpub.).
- McLachlan, A.R.G. 1993. Biology of *Spelungula cavernicola* Forster (Gradungulidae), a New Zealand cave-dwelling spider. Unpublished MSc thesis, University of Canterbury, Christchurch.
- Meads, M.J. 1987a. The giant weta (*Deinacrida heteracantha*) at Mahoenui, King Country: present status and strategy for saving the species. *Ecology Division Report No. 7*, Department of Scientific and Industrial Research.
- 1987b. The giant weta (*Deinacrida parva*) at Puhi Puhi, Kaikoura: present status and strategy for saving the species. *Ecology Division Report No. 8*, Department of Scientific and Industrial Research.
- 1989a. An evaluation of the conservation status of the giant weta *Deinacrida parva* at Kaikoura. *Ecology Division Report No. 20*, Department of Scientific and Industrial Research.
- 1989b. The conservation status of the giant weta *Deinacrida tibiospina* in northwest Nelson: report on a field visit, and notes on other invertebrates. *Ecology Division Report No. 21*, Department of Scientific and Industrial Research.
- 1990a. *Forgotten fauna, the rare, endangered and protected invertebrates of New Zealand*. DSIR Publishing, Wellington.
- 1990b. *The weta book: a guide to the identification of weta*. Lower Hutt: Department of Scientific and Industrial Research Land Resources.
- 1990c. Threatened weta recovery plan technical draft. *Contract Report 90/25*. Department of Scientific and Industrial Research Land Resources.
- 1994. Translocation of New Zealand's endangered insects as a tool for conservation. Pp 5-56 in Serena, M. (ed): *Reintroduction biology of Australian and New Zealand fauna*. Chipping, Norton, Surrey, Beatty & Sons.
- Meads, M.J.; Ballance, A. 1990. Report on a visit to Little Barrier Island. *Ecology Division Report No. 27*. Department of Scientific and Industrial Research.
- Meads, M.J.; Notman, P. 1991. A survey of the giant wetas (*Deinacrida parva* and *Deinacrida* sp.) in the north branch of the Hapuku River Kaikoura, 29 April - 3 May. *Department of Scientific and Industrial Research Land Resources Technical Record 43*.
- 1992a. Resurvey for giant wetas (*Deinacrida rugosa*) released on Maud Island, Marlborough Sounds. *Department of Scientific and Industrial Research Land Resources Technical Record 90*.
- 1992b. Survey of the status of three species of giant wetas (*Deinacrida*) on the Seaward and Inland Kaikoura Ranges. *Department of Scientific and Industrial Research Land Resources Technical Record 89*.
- 1995a. Giant weta (*Deinacrida carinata*) on Pig Island, Foveaux Strait. In: Surveys of giant weta. *Science for Conservation No. 16*, Department of Conservation, Wellington.
- 1995b. Giant weta (*Deinacrida heteracantha*) survey of Little Barrier Island October 1992. In: Surveys of giant weta. *Science for Conservation No. 16*, Department of Conservation, Wellington.
- 1995c. The giant weta species (*Deinacrida* "talpa" and *Deinacrida* "occidentalis") in the Southern Alps. In: Surveys of giant weta. *Science for Conservation No. 16*, Department of Conservation, Wellington.
- Meads, M.J.; Walker, K.J.; Elliott, G.P. 1984. Status, conservation, and management of the land snails of the genus *Powelliphanta* (Mollusca: Pulmonata). *New Zealand Journal of Zoology 11*(3): 277-306.
- Messenger, G. 1991. Notes on the Hokianga weta (*Hemiandrus monstrosus* Salmon, 1950). *The Weta 14*: 10-11.
- 1992. A further record and notes on the Hokianga tusked weta. *The Weta 15*(2): 33-35.
- Meyrick, E. 1884. A monograph of the New Zealand Geometrina. *Transactions and Proceedings of the New Zealand Institute 1883 16*: 49-113.
- Millar, I. 1993. Report on an initial attempt to set up a monitoring programme for the 'Marlborough' giant weta (*Deinacrida parva*) in the north branch Hapuku River, Seaward Kaikoura Range, 25-29 January 1993. File note, 16 March 1993, Department of Conservation, Nelson (unpub.).

- Millener, P.R. 1981. The Quaternary avifauna of the North Island of New Zealand. Unpublished PhD thesis, Auckland University, Auckland.
- Millener, P.R.; Templer, C.J. 1981. The subfossil deposits of *Paryphanta* (Mac's Quarry) Cave, Waitomo. *Journal of the Royal Society of New Zealand* 11(3): 157-166.
- Miller, C. 1997. Occurrence and ecology of the Open Bay Islands leech, *Hirudobdella antipodium*. *Science for Conservation No. 57*, Department of Conservation, Wellington.
- 1999a. Conservation of the Open Bay Islands leech, *Hirudobdella antipodium*. *Journal of the Royal Society of New Zealand* 29(4): 301-306.
- 1999b. Serendipity: or the art of rediscovering species. *Conservation Science Newsletter* 30 & 31: 8.
- Milligan, R.H. 1975. Wood-borers (2). *New Zealand's Nature Heritage* 4(59): 1634-1640.
- Mischewski, K.D. 1993. Assessment of estuarine amphipods for use in toxic bioassays. New Zealand Marine Sciences Society Conference (1992: University of Otago) abstract. *New Zealand Marine Sciences Review* 35: 24.
- Moeed, A.; Meads, M.J. 1982. Report of an invertebrate survey of Kapiti Island and Blumine, Long, Motuara, and Pickersgill Islands of Queen Charlotte Sound. *Ecology Division File Report*, Department of Scientific and Industrial Research.
- Molloy, J.; Davis, A. 1994. Setting priorities for the conservation of New Zealand's threatened plants and animals, 2nd edn, comp. A. Tisdall. Department of Conservation, Wellington.
- Monaghan, J.M. 1999. Effect of burning on bark invertebrates. P 46 in Ponder, W.; Lunney, D. (eds): The other 99% - the conservation and biodiversity of invertebrates. *Transactions of the Royal Zoological Society of New South Wales*.
- Montefiore, R. 1995. Report on kauri snails *Paryphanta busbyi busbyi* in the Waitakere Ranges. Report, Department of Conservation, Auckland (unpub.).
- Moore, J. 1973. Land nemertines of New Zealand. *Zoological Journal of the Linnean Society* 52: 293-313.
- 1989. A record of the behaviour and distribution of New Zealand land nemertines. *New Zealand Natural Sciences* 16: 79-86.
- Morgan, F.D. 1960. The comparative biology of certain New Zealand Cerambycidae. *New Zealand Entomologist* 2(5): 26-34.
- Morgan, D.R.; Wright, G.R.; Spurr, E.B. 1996. Environmental effects of rodent Talon baiting. Part 1: monitoring for toxic residues. Part 2: impacts on invertebrate populations. *Science for Conservation No. 38*, Department of Conservation, Wellington.
- Morgan-Richards, M. 1996. Colour, allozyme and karyotype variation show little concordance in the New Zealand giant scree weta *Deinacrida connectens* (Orthoptera: Stenopelmatidae). *Hereditas* 125: 265-276.
- 1997. Intraspecific karyotype variation is not concordant with allozyme variation in the Auckland tree weta of New Zealand, *Hemideina thoracica* (Orthoptera: Stenopelmatidae). *Biological Journal of the Linnean Society* 60: 423-442.
- Morgan-Richards, M.; Townsend, J.A. 1995. Hybridisation of tree weta on Banks peninsula, New Zealand, and colour polymorphism within *Hemideina ricta* (Orthoptera: Stenopelmatidae). *New Zealand Journal of Zoology* 22(4): 393-399.
- Mudford, C.R. 1997. Further monitoring of the Cromwell chafer beetle (*Prodontria lewisi*) population. *Otago Conservancy Miscellaneous Series No. 37*, Department of Conservation, Dunedin.
- New, T.R. 1990. Directory of Lepidoptera conservation projects. IUCN/SSC Lepidoptera Specialist Group report (unpub.).
- 1995. *Introduction to invertebrate conservation biology*. Oxford University Press, Melbourne.
- Newman, D.G. 1980. Proposed legislation to protect certain rare species of terrestrial and freshwater invertebrates. *The Weta* 3(2): 14-15.
- 1994. Effects of a mouse, *Mus musculus*, eradication programme and habitat change on lizard populations of Mana Island, New Zealand, with special reference to McGregor's skink, *Cyclodina macgregori*. *New Zealand Journal of Zoology* 21(4): 443-456.
- Nicholls, G.E. 1937. On the freshwater Idoteidae of New Zealand (Crustacea, Isopoda). *The Annals and Magazine of Natural History* 10(19): 113-116.

- Norrie, P.H. 1969. The flight activity of Ephemeroptera and Trichoptera in a Waitakere stream. Unpublished MSc thesis, Auckland University, Auckland.
- Notman, P.R. 1984. An invertebrate survey of some Pelorus Sound Islands with reference to their predator status. Unpublished thesis, Victoria University, Wellington.
- Ogle, C.C. 1990. Land snails of Motuhora (Whale Island), Bay of Plenty, New Zealand. *Tane* 32: 87-91.
- Ohms, P.G. 1948. Some aspects of the anatomy of *Paryphanta busbyi*. Unpublished MSc thesis, Auckland University, Auckland.
- Owen, K. 1991. A survey of stag beetle (*Dorcus auriculatus*) on Mount Te Aroha. *Technical Report Series No. 8*, Department of Conservation, Rotorua (unpub.).
- Palma, R.L.; Lovis, P.M.; Tither, C. 1989. An annotated list of primary types of the phyla Arthropoda (except Crustacea) and Tardigrada held in the National Museum of New Zealand. *National Museum of New Zealand Miscellaneous Series Number 20*.
- Parrish, R. 1992. Weta collection trip to Poor Knights Islands. Report, file ISL 0013, Department of Conservation, Wellington (unpub.).
- 1998. Poor Knights Islands. Northland Conservancy Status Report: 7 Oct 1998 (unpub.).
- Parrish, R.; Sherley, G.; Avis, M. 1995. Giant land snail recovery plan *Placostylus* spp., *Paryphanta* sp. *Threatened Species Recovery Plan Series No. 13*, Department of Conservation, Wellington
- Parry, F.J.S. 1873. Characters of seven nondescript lucanoid Coleoptera, and remarks upon the genera *Lissotes*, *Nigidius* and *Figulus*. *The Transactions of the Entomological Society of London* 12(3): 335-344.
- Pascoe, F.P. 1876. Descriptions of new genera and species of New Zealand Coleoptera. Part 2. *Annals and Magazine of Natural History* 4(17): 48-60.
- 1875. Descriptions of new genera and species of New Zealand Coleoptera. Part 1. *The Annals and Magazine of Natural History* 4(16): 210-223.
- 1877. Descriptions of new genera and species of New Zealand Coleoptera. Part 4. *Annals and Magazine of Natural History* 4(19): 140-147.
- Patrick, B.; Matthews, M. 1998. A new diurnal species of Heliethinae (Lepidoptera: Noctuidae) endemic to New Zealand. *Journal of Natural History* 32: 263-271.
- Patrick, B.H. 1982. Lepidoptera of Dansey's Pass, Otago. *New Zealand Entomologist* 7(3): 333-336.
- 1989a. Lepidoptera, Cicadidae, Acrididae of the Manorburn Ecological District. *Science and Research Internal Report No. 60*, Department of Conservation, Wellington.
- 1989b. Survey of Lepidoptera at Tara Hills Research Station. *New Zealand Entomologist* 12: 42-48.
- 1989c. The Lepidoptera of Central Otago salt-pans. *Scientific Series No. 3*, Department of Conservation, Dunedin.
- 1990a. Lepidoptera of the Auckland Islands. *Otago Conservancy, Miscellaneous Series No. 5*, Department of Conservation, Dunedin.
- 1990b. Lepidoptera type localities in Otago-Southland and Sub-Antarctic New Zealand. Report, Department of Conservation, Dunedin (unpub.).
- 1991. Insects of Dansey Ecological District. *Science and Research Series 32*, Department of Conservation, Wellington.
- 1992a. Antipodes Island Lepidoptera. Report, Department of Conservation, Invercargill (unpub.).
- 1992b. Supplement to the Lepidoptera of the Mackenzie Country with recommendations for their conservation. *New Zealand Entomologist* 15: 48-58.
- 1993. Conservation of key sites for southern coastal moths. Part 2: Shag River Mouth south cliffs. *The Weta* 16(1): 5-7.
- 1994a. A reassessment of the status of *Olinga fumosa* Wise, 1958 (Trichoptera: Conoesucidae) as a valid species. *New Zealand Entomologist* 17: 78-80.
- 1994b. Hawkdun Ecological District invertebrate survey. *Science and Research Series 64*, Department of Conservation, Wellington.
- 1994c. Lepidoptera of Kaitorete Spit, Canterbury. *New Zealand Entomologist* 17: 52-63.
- 1994d. Lepidoptera of the southern plains and coast of New Zealand 1990. *Otago Conservancy Miscellaneous Series 17*, Department of Conservation, Dunedin.

- 1994e. The importance of invertebrate biodiversity: an Otago Conservancy review. *Conservation Advisory Science Notes No. 53*, Department of Conservation, Wellington.
- 1994f. Valley floor Lepidoptera of Central Otago. *Otago Conservancy Miscellaneous Series 19*, Department of Conservation, Dunedin.
- 1995. Conservation of southern moths. Part 4: Aramoana saltmarsh. *The Weta 18*(1): 7-9.
- 1996a. Invertebrates of Moutohora. *Technical Series 24*, Department of Conservation, Rotorua.
- 1996b. The status of the bat-winged fly, *Exsul singularis* Hutton (Diptera: Muscidae: Coenosiinae). *New Zealand Entomologist 19*: 31-33.
- 1997a. Codfish Island moths. *The Weta 20*(1): 17-20.
- 1997b. Insects of Macraes Ecological District. *Otago Conservancy Miscellaneous Series No. 30*, Department of Conservation, Dunedin.
- 1998. Coastal moths: in place of butterflies. *Forest and Bird 289*: 24-27.
- 2000. Conservation status of two rare New Zealand Geometrid moths. *Science for Conservation No. 145*, Department of Conservation, Wellington.
- Patrick, B.H.; Archibald, R.D. 1988. Lepidoptera light-trapped at Owaka, South Otago. *New Zealand Entomologist 11*: 70-72.
- Patrick, B.H.; Barratt, B.; Heads, M.; Child, J. 1984. Entomological survey of Mt Pye-Ajax Bog, Catlins State Forest Park 1984. Report to New Zealand Forest Service (unpub.).
- Patrick, B.H.; Barratt, B.I.P.; Heads, M. 1985. Entomological survey of the Blue Mountains. Report to New Zealand Forest Service.
- Patrick, B.H.; Barratt, B.I.P.; Rance, B.; Heads, M.; Tangney, R. 1986. Entomological survey of the Slopedown Range. Report to New Zealand Forest Service.
- Patrick, B.H.; Barratt, B.I.P.; Ward, J.B.; McLellan, I. 1993. Insects of Waipori Ecological District. *Otago Conservancy Miscellaneous Series 16*, Department of Conservation, Dunedin.
- Patrick, B.H.; Chisholm, W.P. 1989. Lower Waitaki hydro-electric investigations. Entomology survey report. Report to Works Consultancy Services, Dunedin (unpub.).
- Patrick, B.H., Dugdale, J.S. 2000. Conservation status of the New Zealand Lepidoptera. *Science for Conservation No. 136*, Department of Conservation, Wellington.
- Patrick, B.H.; Lyford, B.M.; Ward, J.B.; Barratt, B.I.P. 1992a. Lepidoptera and other insects of the Rastus Burn Basin, The Remarkables, Otago. *Journal of the Royal Society of New Zealand 22*(4): 265-278.
- Patrick, B.H.; Rance, B.D.; Barratt, B.I.P. 1992b. Alpine insects and plants of Stewart Island. *Otago Conservancy Miscellaneous Series 9*, Department of Conservation, Dunedin.
- Patrick, B.H.; Rance, B.D.; Barratt, B.I.P.; Tangney, R. 1987a. Entomological survey of the Longwood Range, Longwood ecological district, Te Wae Wae ecological region. Report, Department of Conservation, Invercargill.
- Patrick, B.H.; Rance, B.D.; Chisholm, W.P.; Barratt, B.I.P. 1989. Mason Bay. Entomological and botanical survey. *Southland Conservancy Technical Series No. 2*, Department of Conservation, Invercargill.
- Patrick, B.H.; Rance, B.D.; Lyford, B.; Barratt, B.I.P. 1987b. Entomological survey Snowden Peak State Forest, Livingston ecological district, Mauora ecological region. Report, Department of Conservation, Invercargill.
- Peat, N.; Patrick, B. 1995. *Wild Dunedin*. University of Otago Press, Dunedin.
- 1999. *Wild Central*. University of Otago Press, Dunedin.
- Penniket, A.S.W. 1981. Population studies of land snails of the genus *Placostylus* in the north of New Zealand. Unpublished MSc thesis, Auckland University, Auckland.
- Philpott, A. 1901. A catalogue of the Lepidoptera of Southland. *Transactions and Proceedings of the New Zealand Institute 1900 33*: 167-185.
- 1904. Notes on southern Lepidoptera. *Transactions and Proceedings of the New Zealand Institute 1903 36*: 161-170.
- Philpott, A. 1907. Notes on protective resemblance in New Zealand moths. *Transactions and Proceedings of the New Zealand Institute 1906 39*: 212-219.
- 1917a. A list of the Lepidoptera of Otago. *Transactions and Proceedings of the New Zealand Institute 1916 49*: 195-238.

- 1917b. Descriptions of a new species of Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 1916 49: 239-245.
- 1930. Descriptions of Lepidoptera in the Canterbury Museum. *Records of the Canterbury Museum* 3: 247-250.
- Pierce, R.J.; Montgomery, P.J. 1992. The fate of birds and selected invertebrates during a 1080 operation. *Science and Research Internal Report No. 121*, Department of Conservation, Wellington.
- Platnick, N.I. 1992. Patterns of biodiversity. Pp 15-24 in Eldredge, N. (ed): *Systematics, ecology, and the biodiversity crisis*. Columbia University Press, New York.
- Poore, G.C.B.; Lew Ton, H.M. 1993. Idoteidae of Australia and New Zealand (Crustacea: Isopoda: Valvifera). *Invertebrate Taxonomy* 7, 197-278.
- Powell, A.W.B. 1930. The Paryphantidae of New Zealand: their hypothetical ancestry, with descriptions of new species and a new genus. *Records of the Auckland Institute and Museum* 1(1): 17-56.
- 1932. The Paryphantidae of New Zealand. Descriptions of further new species. *Records of the Auckland Institute and Museum* 1(3): 155-162.
- 1936. The Paryphantidae of New Zealand 3. Further new species of *Paryphanta* and *Wainuia*. *Records of the Auckland Institute and Museum* 2(1): 29-41.
- 1938. The Paryphantidae of New Zealand 4, and the genus *Placostylus* in New Zealand. *Records of the Auckland Institute and Museum* 2(3): 133-150.
- 1946. The Paryphantidae of New Zealand 5. Further new species of *Paryphanta*, *Wainuia*, and *Rhytida*. *Records of the Auckland Institute and Museum* 3(2): 99-136.
- 1947. Distribution of *Placostylus* land snails in northernmost New Zealand. *Records of the Auckland Institute and Museum* 3(3): 173-188?
- 1948. Land Mollusca of the Three Kings Islands. *Records of the Auckland Institute and Museum* 3(4&5): 273-290.
- 1949. The Paryphantidae of New Zealand 6. Distribution, hybrids and new species of *Paryphanta*. *Records of the Auckland Institute and Museum* 3(6): 347-370.
- 1951a. Land Mollusca from four islands of the Three Kings Group: with descriptions of three new species. *Records of the Auckland Institute and Museum* 4(2): 127-133.
- 1951b. On further colonies of *Placostylus* land snails from northernmost New Zealand. *Records of the Auckland Institute and Museum* 4(2): 134-140.
- 1952. Four new species of New Zealand land snails and the systematic position of *Gerontia cordelia* Hutton. *Records of the Auckland Institute and Museum* 4(3): 163-168.
- 1979. *New Zealand Mollusca, marine, land, and freshwater shells*. Auckland, William Collins Publishers Ltd.
- Ramsay, G.W.; Bigelow, R.S. 1978. New Zealand wetas of the genus *Hemideina*. *The Weta* 1(2): 32-34.
- Ramsay, G.W.; Gardner, N.W. 1977. Endangered and rare New Zealand invertebrate species. *The Weta* 1(1): 3-5.
- Rance, B.D. 1990. Cromwell chafer beetle national reserve - scientific monitoring and vegetation. *Otago Conservancy Miscellaneous Series* 7, Department of Conservation, Dunedin.
- Rance, B.D.; Patrick, B.H. 1988. Botany and Lepidoptera of the Snares. Report, Department of Conservation, Invercargill.
- Richards, A.M. 1958. Revision of the Rhaphidophoridae (Orthoptera) of New Zealand Part 1.-The Rhaphidophoridae of the Chatham Islands 1954 Expedition. *Transactions of the Royal Society of New Zealand* 85(2): 263-274.
- 1962. Revision of the Rhaphidophoridae (Orthoptera) of New Zealand. Part 11 - a new species belonging to the genus *Gymnoplectron* Hutton, 1897, from the Poor Knights Islands. *Transactions of the Royal Society of New Zealand Zoology* 2(24): 203-207.
- 1973. A comparative study of the biology of the giant wetas *Deinacrida heteracantha* and *D. fallai* (Orthoptera : Hemicidae) from New Zealand. *Journal of Zoology, London*. 169: 195-236.
- 1974a. Arthropoda of the subantarctic islands of New Zealand 7. Orthoptera: Rhaphidophoridae. *New Zealand Journal of Zoology* 1(4): 495-499.
- 1974. Wetas. *New Zealand's Nature Heritage* 2(20): 554-558.

- Richards, G.E. 1994. Ecology and behaviour of the Mahoenui giant weta (*Deinacrida* nov. sp.). Unpublished MSc thesis, Massey University, Palmerston North.
- Rufaut, C. 1993. Potential threats to *Pianoa isolata*, Waikaia Forest, Southland. *University of Otago Wildlife Management Report; No. 48*. Department of Zoology, University of Otago.
- Rufaut, C.G.; Clearwater, S.G. 1997. Chetwode Islands recovery, the response of lizards and invertebrates following eradication of kiore and weka from the Chetwode Islands. *Nelson/Marlborough Conservancy Occasional Publication No. 41*, Department of Conservation, Nelson.
- Ryan, P.A. 1982. Energy content of some New Zealand freshwater animals. *New Zealand Journal of Marine and Freshwater Research* 16: 283-287.
- Ryan, P.A. 1986. Seasonal and size-related changes in the food of the short-finned eel, *Anguilla australis* in Lake Ellesmere, Canterbury, New Zealand. *Environmental Biology of Fishes* 15(1): 47-58.
- Salmon, J.T. 1950. A revision of the New Zealand wetas. *Dominion Museum Records in Entomology* 1(8): 121-177.
- Salmon, J.T. 1956. A male specimen of *Deinacrida tibiospina* Salmon. *New Zealand Entomologist* 2(1): 8-10.
- Schops, K. 1998. Metapopulation dynamics and behaviour of the endangered weevil, *Hadramphus spinipennis* in relation to its host plant *Aciphylla dieffenbachii* on the Chatham Islands, New Zealand. Unpublished PhD thesis, Lincoln University, Lincoln.
- 2000. Metapopulation dynamics of the coxella weevil, *Hadramphus spinipennis* on the Chatham Islands. *Science for Conservation No. 134*, Department of Conservation, Wellington.
- Schops, K.; Emberson, R.M.; Wratten, S.D. 1998. Population and community ecology for insect management and conservation. Pp 119-123 in Baumgartner, J.; Brandmayr, P.; Manly, B.J.F. (eds): *Proceedings of the ecology and population dynamics section of the 20th international congress of entomology Florence, Italy 25-31 August 1996*. Rotterdam, A.A. Balkema Publishers.
- Scott, R.R. 1984. *New Zealand pest and beneficial insects*. Canterbury, Lincoln University College of Agriculture.
- Scott, R.R.; Emberson, R.M. 1999. Handbook of New Zealand insect names: common and scientific names for insects and allied organisms. *Bulletin of the Entomological Society of New Zealand* 12.
- Sharell, R. 1982. *New Zealand insects and their story*. William Collins Publishers Ltd, Auckland.
- Sherley, G.H. 1990a. Important conservation research topics on terrestrial arthropod species in New Zealand. *Science and Research Internal Report No. 53*, Department of Conservation, Wellington.
- 1990b. Mahoenui giant weta. *Fact Sheet*, Department of Conservation, Wellington.
- 1994a. Monitoring giant weta at Mahoenui Reserve, King Country: March 1994. Report, Department of Conservation, Wellington (unpub.).
- 1994b. Translocations of the Mahoenui giant weta *Deinacrida* n. sp. and *Placostylus* land snails in New Zealand: what have we learnt? Pp 57-63 In: *Reintroduction biology of Australian and New Zealand fauna*. Serena, M. (ed), Chipping.
- 1996. Morphological variation in the shells of *Placostylus* species (Gastropoda: Bulimulidae) in New Zealand and implications for their conservation. *New Zealand Journal of Zoology* 23: 73-82.
- 1998a. Threatened weta recovery plan. *Threatened Species Recovery Plan No. 25*, Wellington, Department of Conservation.
- 1998b. Translocating a threatened New Zealand giant orthopteran, *Deinacrida* sp. (Stenopelmatidae): some lessons. *Journal of Insect Conservation* 2: 195-199.
- Sherley, G.H.; Green, C.; Owen, K. 1994. Distribution, conservation status and some features of the natural history of *Dorcus* stag beetles (Coleoptera: Lucanidae). *Science and Research Series 75*, Department of Conservation, Wellington (unpub.).
- Sherley, G.H.; Hayes, L. Interim report on habitat selection of *Deinacrida* n. sp. weta at Mahoenui, King Country. Study commissioned by Waikato Regional Office, Department of Conservation, Hamilton (unpub.).
- Sherley, G.H.; Hayes, L.M. 1993. The conservation of a giant weta (*Deinacrida* n. sp. Orthoptera: Stenopelmatidae) at Mahoenui, King Country: habitat use, and other aspects of its ecology. *New Zealand Entomologist* 16: 55-68.

- Sherley, G.H.; Parrish, R. 1989. *Placostylus* survey, management and research in Te Pahi, Northland. *Science and Research Internal Report No. 61*, Department of Conservation, Wellington.
- Singh, P. 1977. Artificial foods for the bat-fly *Mystacinobia zelandica* Holloway (Diptera: Mystacinobiidae). *New Zealand Journal of Zoology* 4(3): 331.
- Smith, W.W. 1887. Notes on New Zealand earth-worms. *Transactions and Proceedings of the New Zealand Institute* 1886 25: 129-139.
- 1893 Further notes on New Zealand earthworms, with observations on the known aquatic species. *Transactions and Proceedings of the New Zealand Institute* 1892 25: 111-139.
- 1894. Further notes on New Zealand earthworms. *Transactions and Proceedings of the New Zealand Institute* 1893 26: 155-175.
- Spiller, D. 1942. A giant weevil *Phaeophanus turbotti* n. sp. from the Poor Knights Islands. *Records of the Auckland Institute and Museum* 2(6): 265-267.
- Springett, J.A.; Gray, R.A.J. 1998. Short communication. Burrowing behaviour of the New Zealand indigenous earthworm *Octochaetus multiporus* (Megascolecidae: Oligochaeta). *New Zealand Journal of Ecology* 22(1): 95-97.
- Springett, J.A.; Gray, R.A.J.; Barker, D.J.; Lambert, M.G.; Mackay, A.D.; Thomas, V.J. 1998. Population density and distribution of the New Zealand indigenous earthworm *Octochaetus multiporus* (Megascolecidae: Oligochaeta) in hill pastures. *New Zealand Journal of Ecology* 22(1): 87-93.
- Starobogatov, Y.I. 1986. On the taxonomy of the gastropod molluscan genus *Latia* (Gastropoda, Pulmonata, Lattiidae). *Proceeding of the Zoological Institute, Leningrad* 148: 93-96.
- Stringer, I.; Montefiore, R. 1997. Conservation status, distribution, habitat use and ecology of an endangered kauri snail *Paryphanta busbyi watti*. Final Report Investigation No. 1939. Department of Conservation, Wellington (unpub.).
- Stringer, I.A.N.; Grant, E.A. 1994. Report number 4 on an attempt to rear *Placostylus* in the laboratory (Period covered 1 February 1993 to 15 September 1994). Report, Department of Conservation (10 December 1994). Department of Conservation, Wellington (unpub.).
- Suter, H. 1908. A new *Placostylus* from New Zealand. *Transactions and Proceedings of the New Zealand Institute* 1907 40: 340-343.
- Tait, N.N. 1992. Report on collection of Onycophora (peripatus) in New Zealand. Report ? Department of Conservation (unpub.).
- Tait, N.N.; Briscoe, D.A. 1995. Genetic differentiation within New Zealand Onycophora and their relationships to the Australian fauna. *Zoological Journal of the Linnean Society* 114: 103-113.
- Taylor, G. 2000. Action plan for seabird conservation in New Zealand. Part A: Threatened Seabirds. *Threatened Species Occasional Publication No. 16*, Department of Conservation, Wellington.
- Tennyson, A. 1998. Large carabid beetles Stephens Island 30 April - 3 May 1996. *Conservation Advisory Science Notes No. 172*, Department of Conservation, Wellington.
- Thomas, B. 1996. Working with weevils. *New Zealand Science Monthly* 7(10): 10-11.
- Thomas, B.W.; Meads, M.J.; Notman, P.R. 1992. A report on the restoration of knobbed weevils (*Hadramphus stilbocarpae*) and flax weevils (*Anagotus fairburni*) to Breaksea Island, Breaksea Sound, Fiordland. *Department of Scientific and Industrial Research Land Resources Technical Record* 79.
- Towns, D.R. 1978. Some little known benthic insect taxa from a northern New Zealand river and its tributaries. *New Zealand Entomologist* 6(4): 409-419.
- 1987. The mayflies (Ephemeroptera) of Great Barrier Island, New Zealand: macro- and micro-distributional comparisons. *Journal of the Royal Society of New Zealand* 17(4): 349-361.
- Towns, D.R.; Peters, W.L. 1979. New genera and species of Leptophlebiidae (Ephemeroptera) from New Zealand. *New Zealand Journal of Zoology* 6(3): 439-452.
- 1996. Leptophlebiidae (Insecta: Ephemeroptera). *Fauna of New Zealand* 36.
- Townsend, J.A. 1995. Distribution and ecology of the Banks Peninsula tree weta, *Hemideina ricta*. Unpublished MSc thesis, Massey University, Palmerston North.
- Townsend, J.I. 1965. Notes on the genus *Mecodema* (Coleoptera: Carabidae) with descriptions of new species from the South Island of New Zealand. *New Zealand Journal of Science* 8: 301-318.

- 1974. Life in caves. *New Zealand's Nature Heritage* 2(16): 425-432.
- 1995. A search for *Mecodema laeviceps* Broun. *Conservation Advisory Science Notes No. 123*, Department of Conservation, Wellington.
- 1997a. An insect survey of Paengaroa Scenic Reserve, Mataroa. *Conservation Advisory Science Notes No. 152*, Department of Conservation, Wellington.
- 1997b. Checklist of Nelson, Marlborough and West Coast Carabidae: an annotated list of Carabidae recorded from Nelson/Marlborough and West Coast conservancies. *Nelson/Marlborough Conservancy Occasional Publication No. 29*, Department of Conservation, Nelson.
- 1998. Carabidae of Maud, Stephens and Titi Islands. *Nelson/Marlborough Conservancy Occasional Publication No. 28*, Department of Conservation, Nelson.
- Travers, W.T.L. 1895. Notes on the larger species of *Paryphanta* in New Zealand, with some remarks on the distribution and dispersal of land-snails. *Transactions and Proceedings of the New Zealand Institute* 1894 27: 224-228.
- Trewick, S.A. 1998. Sympatric cryptic species in New Zealand Onycophora. *Biological Journal of the Linnean Society* 63: 307-329.
- 1999a. A new weta from the Chatham Islands (Orthoptera: Rhaphidophoridae). *Journal of the Royal Society of New Zealand* 29(2): 165-173.
- 1999b. Molecular diversity of Dunedin peripatus (Onycophora: Perpatopsidae). *New Zealand Journal of Zoology* 26(4): 381-393.
- Triggs, S.J.; Sherley, G.H. 1993. Allozyme genetic diversity in *Placostylus* land snails and implications for conservation. *New Zealand Journal of Zoology* 20(1): 19-33.
- Turbott, E.G. 1948. Effects of goats on Great Island, three Kings, with descriptions of vegetation quadrats. *Records of the Auckland Institute and Museum* 3(4&5): 253-272.
- Van Wyngaarden, F. 1995. The ecology of the Tekapo ground weta (*Hemiandrus* new sp., Orthoptera, Anastostomatidae) and recommendations for the conservation of a threatened close relative. Unpublished MSc thesis, University of Canterbury, Christchurch.
- Veitch, C.R. 1991. Threatened species database. Draft report, Department of Conservation (unpub.).
- Walker, K. 1982a. A survey of the distribution and density of *Powelliphanta annectens* in north-west Nelson. *New Zealand Wildlife Service, Fauna Survey Unit Report No. 31*. Wellington.
- 1982b. Distribution and status of *Powelliphanta* land snails in the Mokihinui State Forest, and recommendations for conservation reserves. *New Zealand Wildlife Service, Fauna Survey Unit Report No. 34*, Wellington.
- 1996. *Powelliphanta* land snail recovery: a threatened species NPP bid. File SNA 0004, Biodiversity Recovery Unit, Department of Conservation, Wellington (unpub.).
- 1999. Draft *Powelliphanta* recovery plan. Department of Conservation (unpub.).
- 2000. Recovery Plans for *Powelliphanta* land snails 2002 - 2012. Draft, Department of Conservation (unpub.).
- Ward, J.B. 1991. Two new species of New Zealand caddisflies (Trichoptera: Hydrobiosidae). *New Zealand Entomologist* 14: 15-21.
- 1994. The New Zealand marine caddisflies (Trichoptera). *The Weta* 17(1): 18-19.
- 1995. Nine new species of New Zealand caddis (Trichoptera). *New Zealand Journal of Zoology* 22(1): 91-103.
- 1997. Twelve new species in the New Zealand caddis (Trichoptera) fauna, corrected type localities and new synonyms. *New Zealand Journal of Zoology* 24(2): 173-191.
- 1999. An annotated checklist of the caddis (Trichoptera) of the New Zealand subregion. *Records of the Canterbury Museum* 13: 75-95.
- Ward, J.B.; McKenzie, J.C. 1997. Synopsis of the genus *Olinga* (Trichoptera: Conoesucidae) with a comparative SEM study of the male forewing androconia and the description of a new species. *New Zealand Natural Sciences* 23: 1-11.
- Watt, J.C. 1963. The rediscovery of a giant weta, *Deinacrida heteracantha*, on the North Island mainland. *New Zealand Entomologist* 3(2): 9-13.
- 1974. A revised subfamily classification of Tenebrionidae (Coleoptera). *New Zealand Journal of Zoology* 1(4): 381-452.

- 1976. A biological survey of New Zealand? *New Zealand Entomologist* 6(2): 138-143.
- 1977. Conservation and type localities of New Zealand Coleoptera, and notes on collectors 1770-1920. *Journal of the Royal Society of New Zealand* 7(1): 79-91.
- 1979a. A record of *Mecodema atrox* (Coleoptera: Carabidae). *The Weta* 3(1): 7.
- 1979b. Conservation of the Cromwell chafer, *Prodontria lewisi* (Coleoptera: Scarabaeidae). *New Zealand Journal of Ecology* 2: 22-29.
- 1980. New Zealand Rhysodidae (Coleoptera). *The Weta* 3(3): 31-32.
- 1982a. New Zealand beetles. *New Zealand Entomologist* 7(3): 213-221.
- 1982b. Terrestrial arthropods from the Poor Knights Islands, New Zealand. *Journal of the Royal Society of New Zealand* 12(3): 283-320.
- 1983a. Beetles (Coleoptera) of Auckland. *Tane* 29: 31-50.
- 1983b. New generic names for Rhysodidae (Coleoptera): a note. *The Weta* 6(2) 61-62.
- 1984. A review of some New Zealand Scarabaeidae (Coleoptera). *New Zealand Entomologist* 8: 4-24.
- 1988. A revision of the genus *Mimopeus* (Tenebrionidae). *Records of the Auckland Institute and Museum* 25: 95-146.
- 1992. Tenebrionidae (Insecta: Coleoptera): catalogue of types and keys to taxa. *Fauna of New Zealand* 26.
- Wells, S.M.; Pyle, R.M.; Collins, N.M. 1983. *The IUCN invertebrate red data book*. Gland, IUCN Switzerland.
- White, E.G. 1994. Ecological research and monitoring of the protected grasshopper *Brachaspis robustus* in the Mackenzie Basin. *Science & Research Series* 77, Department of Conservation, Wellington.
- Wingham, E.J. (comp) 1994. A draft status list for New Zealand's marine flora and fauna, ed A. McCrone. Department of Conservation, Wellington.
- Winks, C. 1999. Captive rearing of the Middle Island tusked weta (*Motuweta isolata*). *Conservation Science Newsletter* 35: 7-9. Department of Conservation, Wellington.
- Winks, C.J.; Ramsay, G.W. 1998. Captive rearing of the Middle Island tusked weta. Landcare Research Contract Report, to Department of Conservation, Wellington (unpub.).
- Winterbourn, M.J. 1969. A freshwater nereid polychaete from New Zealand. *New Zealand Journal of Marine and Freshwater Research* 3(2): 281-285.
- Winterbourn, M.J.; Gregson, K.L.D. 1989. Guide to the aquatic insects of New Zealand. *Bulletin of the Entomological Society of New Zealand* 9.
- Wise, K.A.J. 1958. Trichoptera of New Zealand. *Records of the Auckland Institute and Museum* 5(1&2): 49-63.
- 1962. A new genus and three new species of Trichoptera. *Records of the Auckland Institute and Museum* 5(5&6): 247-250.
- 1977. A synonymic checklist of the Hexapoda of the New Zealand sub-region. The smaller orders. *Bulletin of the Auckland Institute and Museum* 11: 1-176
- 1990. Lacewings and aquatic insects of New Zealand 5. Trichoptera of North Auckland. *Records of the Auckland Institute and Museum* 27: 185-194.
- 1991. Further records of the same two species of Orthoptera. *The Weta* 14: 26-27.
- Worthy, T.H.; Holdaway, R.N. 1996. Quaternary fossil faunas, overlapping taphonomies, and palaeofaunal reconstruction in North Canterbury, South Island, New Zealand. *Journal of the Royal Society of New Zealand* 26(3): 275-361.
- Wygodzinsky, P. 1979. A note on *Empicoris seorsus* Bergroth (Hemiptera: Reduviidae: Emesinae). *New Zealand Journal of Zoology* 6(1): 53-56.

Appendix 1a

EXPLANATION OF FIELDS IN THE INVERTEBRATE PROFILES

- i. Order: The order the invertebrate is ascribed to.
- ii. Family: The family the invertebrate is ascribed to.
- iii. Taxonomic Name: The currently utilised name of the invertebrate, and the author if it is a described species. The year following the author's name indicates the date of first publication. Brackets are included if the species name has been changed from that originally attributed to it at the date of publication (note that an author reference has a comma between the author's name and the year, e.g. (Spiller, 1942) whereas publication citations do not, e.g. (Kuschel 1982)). A tag name is a name applied to an invertebrate that has not been formally described. Double quotes are used to identify tag names for invertebrates whose taxonomic status is not formally recognised, but where present evidence suggests the invertebrate is sufficiently distinct to warrant some level of taxonomic rank. Tag names are not italicised and only begin with a capital letter if they relate to a place name (e.g. Cromwell), not a description (e.g. striped). When known, the surname of the person who allocated the tag name to the specimen is included. (Note: For any undescribed species listed in this document, the names used are hereby disclaimed according to Article 8.3 of the International Code of Zoological Nomenclature (Anon 1999) and thereby not available.)
- iv. Common Name: Any common name the invertebrate is known by. If there is more than one name, the one most widely used is listed first. Common names are only included in the species profile if it is a name which relates directly to the species. Common names for higher levels of taxonomy are included on the separate pages which list phyla, class, order, family and genus. A common name applied to a higher level of taxonomy (e.g. phylum) may also, but not always, apply to levels occurring underneath it (e.g. class, order). For example, the common name 'beetles' used for the order Coleoptera, also applies to all the families that occur in that order. However, caution must be exercised, for with the order Lepidoptera both 'butterfly' and 'moth' are listed as common names, but these names are applied to different families. If a common name is not suitable for application to levels of taxonomy below it, then this can usually be ascertained by checking the common names listed for those lower taxonomic levels. If no name is listed, then the last listed common name can be applied to all lower levels. Similarly, if the lower level taxonomic name is just a refinement of a higher level common name (e.g. 'darkling beetle' following on from 'beetle'), then the broader higher level common name is also applicable to the lower level. However, if a higher level common name appears to be replaced at the lower level (e.g. for the phylum Platyhelminthes, the common names flatworms, flukes and tapeworms are applicable, but only the term flatworms is applied to the class Turbellaria), then use the lower level common name only.
- v. Synonyms: These include any other scientific or tag names that the species has been known by. The reference included after the names indicates the publication from which the information was obtained, not the species' author and date.

- vi. MD Category: The Molloy and Davis Category (A, B, C, X, or I) that the species has been assigned to by the department's species priority ranking system (Molloy & Davis 1994).
- vii. Conservancy Office: Present and past distributions in conservancies are listed. Often there is not sufficient information to determine whether the distribution is historic in a conservancy or not. If a conservancy is deemed to have an historic distribution only, then this is indicated by an *. This is an update of the distributions as reported in Molloy and Davis (1994). During the Department's restructuring in 1997 changes were made to conservancy areas and boundaries. The most important changes were: the Chatham Islands were removed from the Canterbury Conservancy and became part of the Wellington Conservancy; and the East Coast and Hawke's Bay Conservancies were amalgamated, with some slight changes to conservancy boundaries that also affected Wanganui Conservancy. Conservancy addresses can be found on the DoC website at <http://www.doc.govt.nz/about/contact.htm>
- viii. Area Office: The Area Office in which the invertebrate occurs or did occur. Visitor Centre addresses can be found on the DoC website at <http://www.doc.govt.nz/about/contact.htm>.
- ix. Description: A basic description of the invertebrate.
- x. Type Locality: The place from which the Holotype specimen was collected.
- xi. Specimen Holdings: Collections that house species specimens.
- xii. Distribution: The known distribution of the species. Includes locality records from which the species has been collected. Records obtained from museum collections and private collections must be treated with caution because many of the identifications have not been checked for some time. Heights originally recorded in feet have been converted to metres in this document as follows: feet were multiplied by 0.3048, and then rounded to the nearest metre (0.1-0.4 rounded down, 0.5-0.9 rounded up). Some species only have generalised localities listed to ensure the security and protection of the species.
- xiii. Habitat: A general description of the habitat type/s the species can be found in. The habitat is listed as specifically as possible, based on currently available knowledge.
- xiv. Sign of Presence: Diagnostic signs of species' presence, includes feeding sign but generally excludes the presence of fragments of dead individuals, except in some cases (e.g. snails).
- xv. Threats: Key threats to the species.
- xvi. Work undertaken to date: A brief summary of recent management, research, survey, and monitoring undertaken. May include work that has an impact on the species but was not undertaken specifically for that species (e.g. possum control).
- xvii. Priority Research, Survey & Monitoring: A prioritised list of the key recommendations for research, survey, and monitoring.

Distribution: For area m² means square metres not metres squared. Miles have been converted to km by multiplying by 1.6.

- xviii. Management Needs: A prioritised list of the key management practices recommended to reverse the trends of decline in those populations at risk. For the purpose of this document, management is defined as any action which is not deemed to be research, survey or monitoring. (Note: The term 'maintain habitat' is often used in the profiles. This may not always imply that active management is required. In many cases, the best 'management' option may be maintenance of the status quo.)
- xix. Contacts: Contact people with specialist or general knowledge of the species.

Appendix 1b

SPECIES PROFILES

Species listed in this appendix have been grouped taxonomically, according to Phyla, Class, Order, Family, Genus and then Species. Phyla and Class have been roughly ordered, starting with the 'simply' developed taxa, and progressing through to the more 'complex' taxa. Basically they are ordered from those taxa with no legs through to taxa with many legs, although there are some exceptions, notably the placement of spiders before insects, and Onychophora (velvetworms) before snails. This is purely to help when searching for taxa, and is not intended to represent a systematic relationship between Phyla in any way. Order, Family, Genus and Species are then listed alphabetically within the Class, the only exception being the Ephemeroptera (mayflies) which are placed next to the Trichoptera (caddisflies) because they share a freshwater association.

A line indicating the actual size of the invertebrate has been included with some of the illustrations. This line is based on the maximum size that has been recorded for the species. Where sexual dimorphism occurs, the largest measurement was used. For most species this represents the length from the front of the head to the end of the abdomen, excluding the antennae and ovipositor (unless stated otherwise in the text). The exceptions are as follows:

- Moths (Lepidoptera), width of wings.
- Caddisflies (Trichoptera), length of forewing.
- Snails (Placostylus), height of shell, i.e. equals the maximum length of the shell.
- Snails (other than Placostylus), width of shell, i.e. the maximum shell diameter.