The Conservation Requirements of New Zealand's Nationally Threatened Invertebrates

THREATENED SPECIES OCCASIONAL PUBLICATION NO. 20

Carl A. McGuinness

Published by
Biodiversity Recovery Unit
Department of Conservation
P.O. Box 10-420
Wellington
New Zealand

Cover Illustration: Northern pimelea cutworm moth *Meterana pictula*, Mangarakau area, north-west Nelson coast, 1998.

Photo: Brian Patrick.

ISSN 1170-3709
ISBN 0-478 22048-0

Cataloguing in Publication
McGuinness, Carl A.
The conservation requirements of New Zealand's nationally threatened invertebrates/ Carl A McGiunness.
Wellington, N.Z. : Dept. of Conservation, Biodiversity Recovery Unit, 2001.

1.v.; 30 cm (Threatened species occasional publication, 1170-3709; 20.)

Includes bibliographical references.

ISBN 0478220480

1. Invertebrates - New Zealand 2. Endangered species - New Zealand. I. Title.
Series: Threatened species occasional publication 20.

Acknowledgements

Many people have generously shared their knowledge, expertise, and time to enable completion of this document.

Thanks to the following for either discussions, initial information, comments on draft manuscripts, or all of the above:

Hilary Aikman, Mike Aviss, Gary Barker, Barbara Barratt, Paul Barrett, Jo Berry, Andrea Booth, Phil Bradfield, Pete Brady, Fred Brook, Barbara Brown, Fin Buchanan, John Buckeridge, Lindsay Chadderton, Ann Chapman, Rob Chappell, Frank Climo, Kevin Collier, Robin Craw, Trevor Crosby, Barry Donovan, John Dugdale, Kelly Duncan, John Early, Dave Eastwood, Greg Edgecombe, Eric Edwards, Murray Efford, Rowan Emberson, Larry Field, Mike Fitzgerald, Lyn Forster, Ray Forster, Reece Fowler, George Gibbs, Bruce Given, Chris Glasby, Dianne Gleeson, Dennis Gordon, Chris Green, James Griffiths, Grace Hall, Jon Harding, Tony Harris, Roy Harrison, John Heaphy, Rosa Henderson, Ian Henderson, Terry Hitchings, Robert Hoare, Beverley Holloway, Tim Holmes, Dick Hornabrook, Maree Hunt, Robert Jackson, Peter Johns, Michelle Kelly, Euan Kennedy, Sandy King, Guillermo (Willy) Kuschel, Marie-Claude Lariviere, Andre Larochelle, Rich Leschen, John Lyall, Rod Macfarlane, Karin Mahlfeld, John Marris, Paul McArthur, Mary McIntyre, Bruce McKinlay, Andrew McLachlan, Ian McLellan, Mike Meads, Ian Millar, Craig Miller, John Nunn, Keith Owen, Ricardo Palma, Richard Parrish, Brian Patrick, Don Ravine, Geoff Read, Aalbert Rebergen, Christine Reed, Jason Roxburgh, Eric Scott, Ray Scrimgeour, Phil Servid, Karen Shearer, Lisa Sinclair, Brian Smith, Franz Smith, Chris Smuts-Kennedy, Cam Speedy, John Stark, Rob Stone, Vida Stout, Ian Stringer, Bruce Thomas, Stephen Thorpe, Dave Towns, Jackie Townsend, Ian Townsend, Steve Trewick, Cor Vink, Kath Walker, Qiao Wang, John Ward, Graeme White, Chris Winks, Mike Winterbourn, Gregor Yeates.

For the loan of specimens thanks to:

Mark Walker (Canterbury Museum of New Zealand), Grace Hall (New Zealand Arthropod Collection), Leonie Clunie (New Zealand Arthropod Collection), Bruce Marshall (Museum of New Zealand Te Papa Tongarewa), Phil Servid (Museum of New Zealand Te Papa Tongarewa).

Lida Brinsteva for translation of the Russian text on *Latia climoi*. Jaap Jasperse for editing advice and translation of the German text on Scydmaenidae. Clare Miller for assistance in obtaining permission to reproduce many of the illustrations included. Olivia McHalick for numerous hours spent inputting data. Janet Owen for advice and letting me get on with the job. Suzan Dopson for advice on plant names and document preparation, having been there, done that, with the threatened plants document. Andrew Townsend for advice on plant names and for invertebrate photography.

CONTENTS

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 anenomes), 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, orogonies, glaciation, and vulcanism have all helped shape the composition of the fauna we have today (Klimaszewzki & 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 Millennial 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 invertebtrates 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

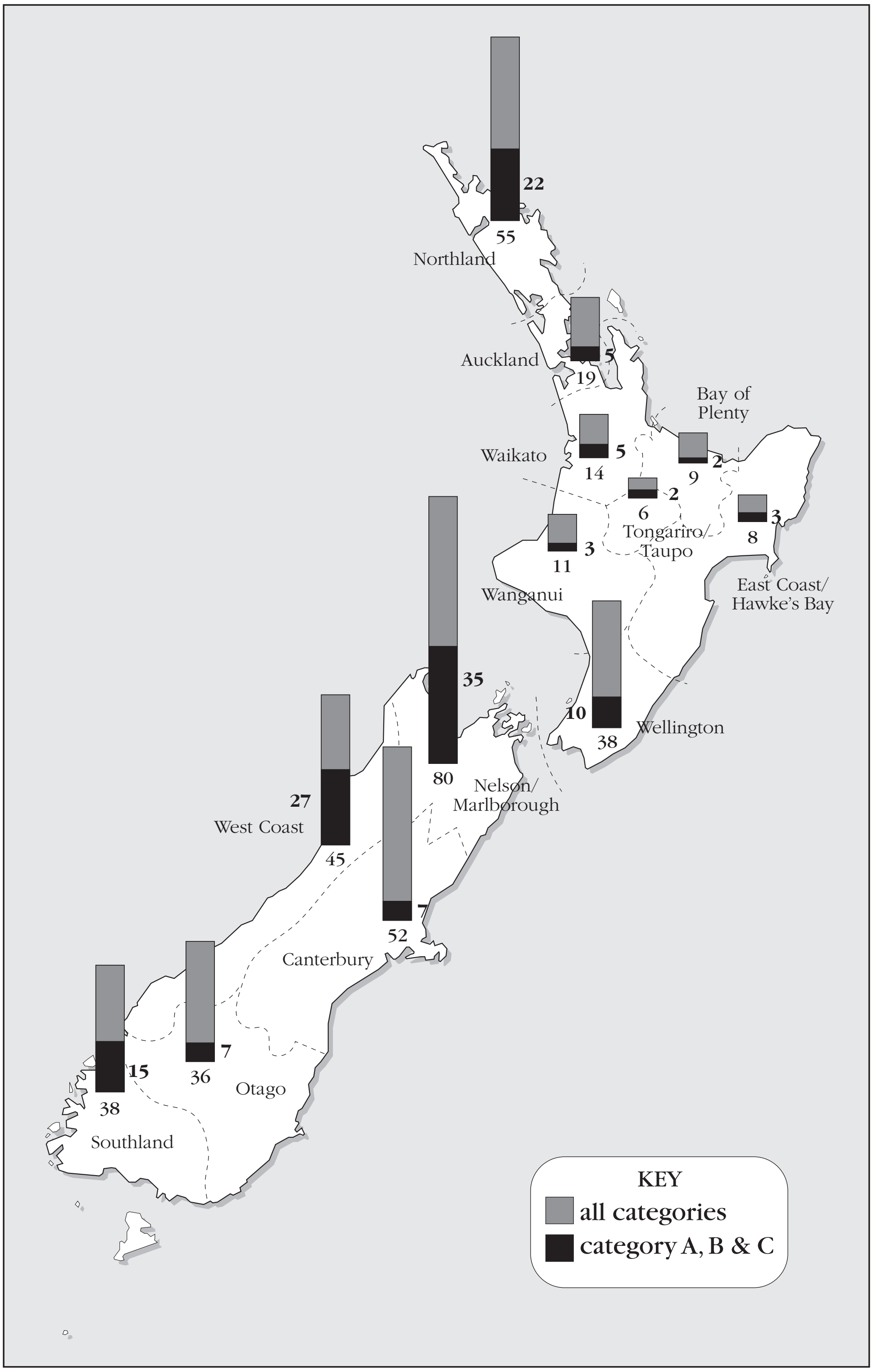

FIGURE 1. DISTRIBUTIONS OF RANKED INVERTEBRATES SHOWING THE COMBINED TOTALS IN THE 13 CONSERVANCIES OF THE DEPARTMENT OF CONSERVATION.

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	Cixiidae (planthoppers)	1
Lepidoptera (moths/butterflies)	2	Geometridae (looper moths)	2
Orthoptera	14	Acrididae (grasshoppers)	1
(weta, grasshoppers etc.)		Anostostomatidae (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

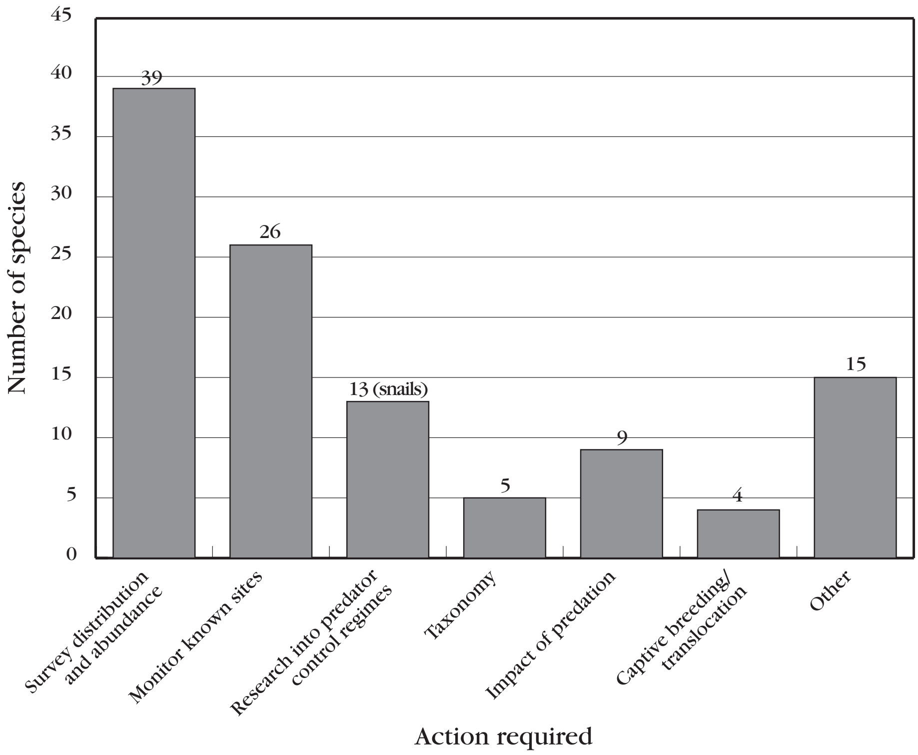

FIGURE 2. TYPE AND NUMBER OF TIMES A RESEARCH, MONITORING, OR SURVEYING REQUIREMENT IS IDENTIFIED IN THE SPECIES PROFILES

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

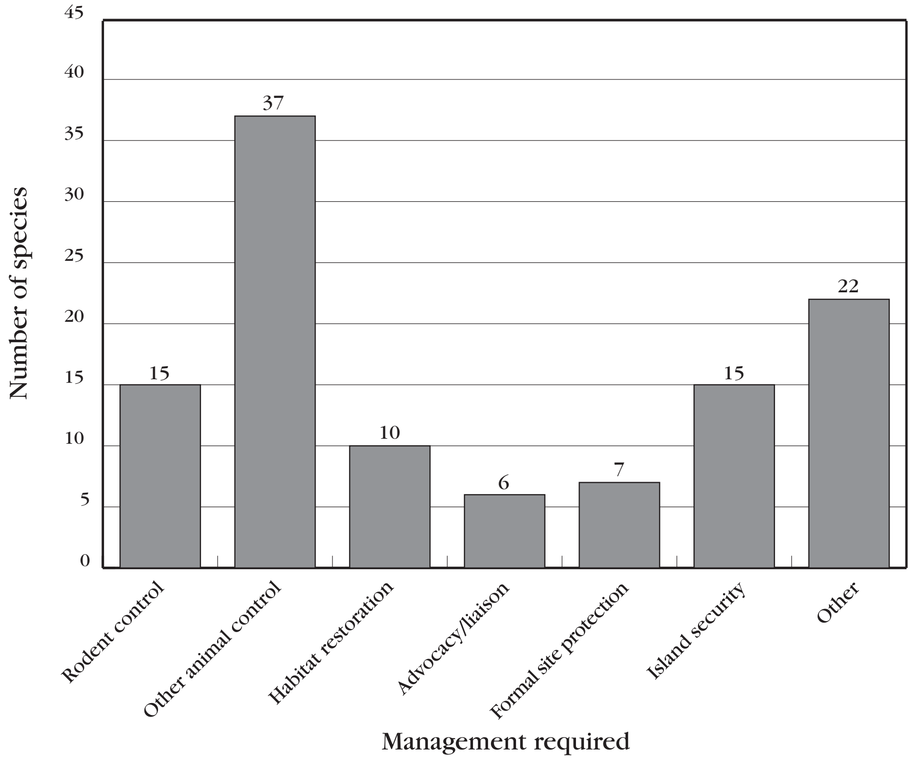

FIGURE 3. TYPE AND NUMBER OF MANAGEMENT REQUIREMENTS IDENTIFIED IN THE SPECIES PROFILES

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.

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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 m^2 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.

Family: Cerambycidae

Common name: **Longhorn beetles, longicorn beetles**

Order: Coleoptera

Family: Cerambycidae

Taxonomic Name: *Blosyropus spinosus* Redtenbacher, 1868

Common Names: Spiny longhorn (Scott & Emberson 1999), spined blosyropus, spiny silver-pine borer (Foord 1990)

Synonyms: -

M&D Category: I

Conservancy Office: NL, AU, WK, BP, EC/HB, TT, WG, WL, NM, WC, OT, SL

Area Office: Kerikeri, Auckland, Hauraki, Tauranga, Gisborne, Ruapehu, New Plymouth, Stratford, Palmerston North, Wairarapa, Kapiti, Golden Bay, Sounds, St. Arnaud, Buller, Greymouth, South Westland, Central Otago, Te Anau, Southern Islands

Body length: 46 mm

Description: A large, flightless, longhorn beetle, around 46 mm long (S. Thorpe pers. comm. 2000). The body is a deep chocolate-brown, with fine yellowish hairs (Hudson 1934). There are four spines present on the thorax (Broun 1880), including an extremely sharp, recurved spine situated on each side of the prothorax (Hudson 1934). There are two spines on the head (Broun 1880), one above each eye, and this is the key diagnostic feature (S. Thorpe pers. comm. 2000).

Type Locality: -

Specimen Holdings: AMNZ, CMNZ, MONZ, NZAC, RHNZ.

Distribution: Has been collected from scattered localities over most of New Zealand. Collection records include Deep Cove, Fiordland; Waitakere Ranges (C. Green pers. comm. 1999); Maud Island (Notman 1984); D'Urville Island (I. Millar pers. comm. 1999); summit of Mt Te Aroha (Owen 1991); Kaitoke; Te Horo; Bannockburn; Dusky Sound (Hudson 1934); Egmont National Park (Fox 1982); Coromandel Ranges; Corbyvale, Westland (AMNZ); Orongorongo Valley; Golden Bay; Gladstone ?Siding; Inglewood, New Plymouth; Ohau, Levin; Canaan; George Sound; Butterfly Creek (MONZ); Chateau Ruapehu 914 m & 1158 m; Ohakune; Tokomaru Gorge; Pokaka; Market Cross, Karamea; Lake Paringa, South Westland (remnants); near Okuri Bay, French Pass 305 m (NZAC); Lee Bay and Halfmoon Bay, Stewart Island; Gut Hut, Secretary Island; Mt Maung (as stated on specimen label); Reefton; Mamaku; Murchison; Purangi; Opouri; Fuchsia Creek, lower Buller Gorge; Glenhope; Westport; Otorohanga; Mt Arowhana 1231 m, Gisborne; Mt Te Aroha TV translator; Blythe Track, Ohakune 792 m; Okauia (records from specimens belonging to various institutions, currently held at Massey University for systematic research); Moerangi, Tokaanu-Taumaranui Rd (J. Dugdale pers. comm. 2000); Waitunga Saddle; Mt Holdsworth, Tararua Range; Mt Egmont (Taranaki); Mt Ruapehu; Whangamona Saddle (R. Hornabrook pers. comm. 2000). Possible specimen from Palmerston North (CMNZ).

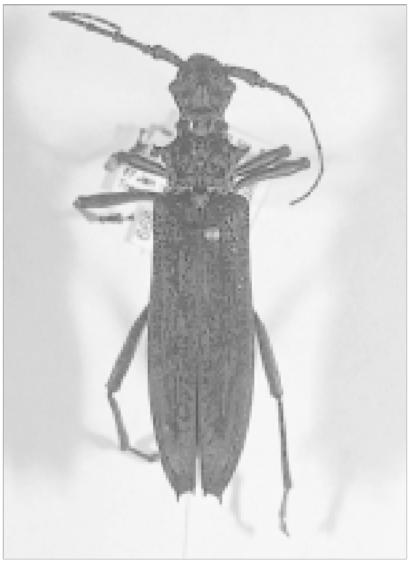


Photo: Andrew Townsend.

Habitat: Found in dead, decaying logs of *Dracophyllum*, beech, and tawa (*Beilschmiedia tawa*) (information from Morgan 1960; J. Dugdale pers. comm. 2000; C. Green pers. comm. 1999). It has been collected from beech and mixed podocarp forest (R. Hornabrook pers. comm. 2000), and in the Waitakere Ranges from broadleaf podocarp forest (C. Green pers. comm. 1999). Larvae have been found in the wood of thoroughly sodden logs, or in partly exposed roots (Milligan 1975). The adults are nocturnal and attracted to lights (Q. Wang pers. comm. 1999). Eggs have been found laid in the tops of dead 'grass trees' (*Dracophyllum traversii*). A large pupal chamber is constructed at the base of the stem sightly below ground level, with the entrance blocked by a loose plug of coarsely chewed wood. Appear to hibernate overwinter in the pupal chamber, after completing metamorphosis. Emergence begins in late August, though emergence from red beech (*Nothofagus fusca*) has been observed as late as February (Morgan 1960). Specimens have been collected from September through to June, most in summer and autumn (when people tend to collect), at altitudes between 305-1500 m.

Threats: None known at present. This species may be seldom encountered rather than threatened. Predation by rodents and stoats is a possible threat (C. Green pers. comm. 1999).

Work Undertaken to Date: None.

Priority Research, Survey, and Monitoring: -

Management Needs: 1) Probably secure and no action required unless threats are substantiated (C. Green pers. comm. 1999).

Contacts: John Dugdale, Qiao Wang.

See Plate 2, No. 19.

Order: Coleoptera

Family: Cerambycidae

Taxonomic Name: *Nesoptychias simpliceps* (Broun, 1880)

Common Names: -

Synonyms: *Blosyropus simpliceps* (Broun 1880), *Ptychopterus rugosus* (S.Thorpe pers. comm. 2000).

M&D Category: I

Conservancy Office: NL, AU, WK, BP, EC/HB

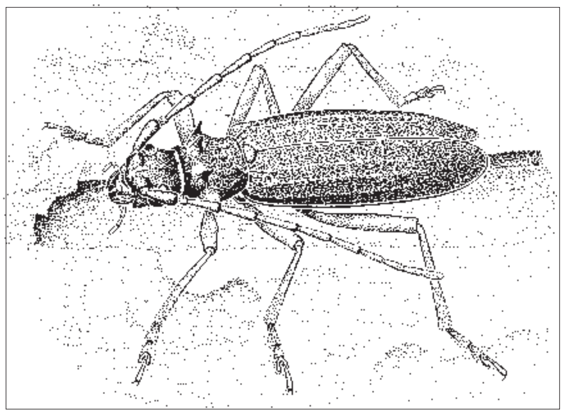
Area Office: Whangarei, Warkworth, Auckland, Waikato, Tauranga, Gisborne

Description: A large, flightless longhorn beetle, about 25 mm long. Similar in appearance to *Blosyropus spinosus* but not as heavy bodied and lacking the spines on the head. The body is dark chestnut-brown, with the antennae and tibiae ('feet') pale-red chestnut-brown (Broun 1880).

Body length: 25 mm

Type Locality: Wairoa, Auckland (Broun 1880).

Specimen Holdings: -



Drawing: Des Helmore.
Permission: Landcare Research (NZ) Ltd.

Distribution: Wairoa, Auckland (Broun 1880); East Cape (S. Thorpe pers. comm. 2000). Mt Te Aroha; Whangarei; Matakana; Upper Kaimai, Matamata; Titirangi. Specimens have been found recently at Mt Te Aroha (1983) and Matakana (1992) (records from specimens belonging to various institutions, currently held at Massey University for systematic research). Need to confirm whether Matakana refers to Matakana near Warkworth, or Matakana Island in the Bay of Plenty.

Habitat: Associated with stout dead branches or trunks on the forest floor (J. Dugdale pers. comm. 2000). It has been found in *radiata* pine logs north of Whangarei (Milligan 1975). It has been collected from under bark and in a house basement, and from altitudes between 609 m and 975 m on Mt Te ArohA.They have been collected between August and April (records from specimens belonging to various institutions, currently held at Massey University for systematic research). Adults usually emerge in spring and are nocturnal (J. Dugdale pers. comm. 2000).

Photo: Andrew Townsend.

Threats: Not known.

Work Undertaken to Date: -

Priority Research, Survey, and Monitoring: 1) Survey to obtain an estimate of distribution and abundance, and determine whether this species is of conservation concern.

Management Needs: -

Contacts: -

See Plate 2, No. 18.

Order: Coleoptera

Family: Cerambycidae

Taxonomic Name: *Xylotoles costatus* Pascoe, 1875

Common Names: Pitt Island longhorn (Scott & Emberson 1999)

Synonyms: -

M&D Category: A

Conservancy Office: WL

Area Office: Chatham Islands

Body length: 20 mm

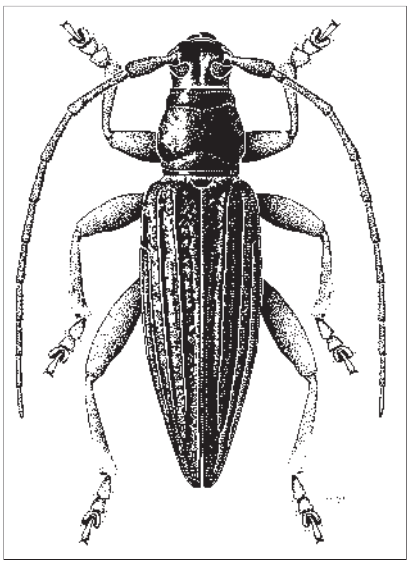
Description: A flightless, blackish longhorn beetle. They have a variable green-bronze sheen, and ridges on their wing-cases. The body is 15 - 20 mm long (Emberson & Marris 1993c, Emberson 1998a). They are very similar to, though generally smaller than, *Xylotoles traversi* which is found throughout the Chathams (J. Marris pers. comm. 2000). The antennae are long and able to fold back against the body.

Type Locality: Pitt Island, Chatham Islands (Pascoe 1875).

Specimen Holdings: NHML, NZAC, CMNZ, LUNZ (Emberson et al. 1996; Emberson 1998b).

Distribution: Has been collected from Pitt Island and South East (Rangatira) Island, in the Chatham Islands group (Early et al. 1991; Emberson et al. 1996; Emberson 1998b). All recent collections have been on South East Island, it has not been seen on Pitt Island since 1907 (R. Emberson pers. comm. 1999).

Habitat: Most species of *Xylotoles* are thought to be non-host specific, feeding as larvae on dead twigs (Emberson et al. 1996). They are usually found on Chatham Islands coprosma (*Coprosma chathamica*) at night, either on the tree trunks or dead branches (Emberson & Marris 1993c; Emberson 1998b; Emberson pers. comm. 1999). A specimen has also been found by beating a dead branch of ngaio (*Myoporum laetum*) caught up in a tangle of *Muehlenbeckia* (Emberson & Marris 1993c; Emberson et al. 1996).



Drawing: Des Helmore
Permission: Landcare Research (NZ) Ltd.

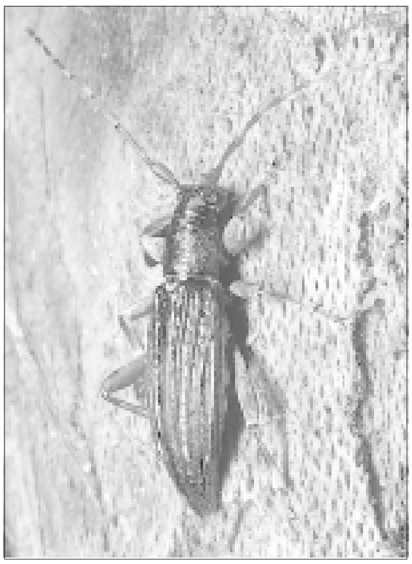


Photo: John Marris, Lincoln University.

Threats: Vulnerable to mouse predation on Pitt Island (Emberson & Marris 1993c).

Work Undertaken to Date: Not found on Pitt Island during a survey in 1990 (Early et al. 1991) or during several subsequent searches on the island (R. Emberson pers. comm.). Not seen on Pitt Island since 1907. South East Island has been searched four times since 1992. A specimen has been reared out of a *C. chathamica* branch (R. Emberson pers. comm. 1999).

Priority Research, Survey, and Monitoring: 1) Search Pitt Island to determine if still present, also search Mangere Island (Early et al. 1991).

2) Mark a variety of trees on South East Island, and search them for the beetle to determine whether the apparent relationship between *Xylotoles* and *C. chathamica* is true. Most searches have focussed on *C. chathamica* because this is where they have been known to be found. However, this may not necessarily be the main host. Set branch traps across South East Island and check in 6 weeks time for presence of the beetle. This will provide some idea of distribution and abundance. Wood borers are hard to sample, and the low numbers sampled make it difficult to obtain accurate population estimates (R. Emberson pers. comm. 1999).

3) Further taxonomic work is required to enable *X. costatus* to be clearly separated from *X. traversi* (J. Marris pers. comm. 2000).

Management Needs: 1) Maintain rodent quarantine procedures on South East Island.

Contacts: Rowan Emberson, John Marris.

See Plate 2, No. 20.