

Distribution and status of native carnivorous land snails in the genera *Wainuia* and *Rhytida*

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Abstract

This report describes the distribution and conservation status of species of carnivorous land snails in the endemic genera *Wainuia* Powell, 1930 and *Rhytida* Albers, 1860. A distribution database was compiled from specimens in museums and private collections, and by supplementary collecting. Distribution maps are presented for fifteen species or subspecies, the majority being from the northern South Island. Several species are known as subfossils well outside their present range (e.g., *Rhytida greenwoodi greenwoodi*, *R. oconnori*, *R. otagoensis*, *Wainuia urnula nasuta*). Others are represented in large parts of their extant range only by extremely localised relict populations. There is a need for conservation action to improve the outlook for some of these populations, particularly *W. edwardi* near Mt Cass in North Canterbury and *W. urnula nasuta* at the type locality on D'Urville Island. Distinctive new species remain to be described in each genus. Molecular methods may be required to resolve some persistent taxonomic problems.

1. Introduction

The distribution and status of species in two genera of carnivorous New Zealand land snails (*Wainuia* and *Rhytida*) were described by Manaaki Whenua for the Department of Conservation. *Wainuia* and *Rhytida* form a significant fraction of the total diversity of the family Rhytididae in New Zealand. The family shows an intriguing variety of carnivorous habits, including some behavioural adaptations that may be unique to New Zealand. Neither genus currently has protected status, although some species are large and they are vulnerable to many of the same introduced predators that attack related, protected genera (e.g., *Powelliphanta*). This report seeks to encourage a broader view of the conservation needs of the family in New Zealand.

2. Background

New Zealand has several genera of large carnivorous rhytidid snails, and species in *Paryphanta* and *Powelliphanta* have recently begun to receive substantial conservation attention (e.g., Meads *et al.* 1984; Department of Conservation 1994a,b). The family also occurs in southern Africa (van Bruggen 1980), Madagascar (Emberton 1990), Australia (Smith 1992), Indonesia, and other islands of the southwest Pacific (Solem 1959). However, rhytidids are most diverse in New Zealand both in terms of absolute number of species and as a percentage of the described land snail fauna (van Bruggen 1980). Much of their

diversity in New Zealand is contributed not by the conspicuous taxa (*Powelliphanta*, *Paryphanta*) but by several genera of smaller snails (*Rhytida*, *Wainuia*, *Rhytidarex*, *Delos*, *Delouagapia*) and the slugs of the genus *Schizoglossa* (Powell 1979). This report focuses on the two most accessible, numerous and widespread of these genera.

New Zealand rhytidid snails typically live under fern or leaf litter and in damp rock piles in unmodified native forest, and under tussock or scrub in the subalpine zone. All rhytidid snails are carnivores, as shown by their simple, elongated teeth, the lack of a jaw and the strong musculature around the mouth. Worms and other snails, the common prey of carnivorous snails the world over, are eaten also by New Zealand rhytidids (Dell 1949). Details of the feeding ecology of the various genera have been slow to emerge, and it has been recognised only in the course of the present study that some *Wainuia* species live largely on amphipods (Fig. 1b; Efford and Bokeloh 1990; M.G. Efford, in press), and that *Rhytida* species have prehensile tails with which they carry prey about (Fig 1e; M.G. Efford, pers. obs.).

Cannibalism has been suspected in some populations of *Rhytida perampla* and *Rhytida australis* (Dell 1949). M. J. Meads (pers. comm.) noted *R. stephenensis* eating a dead weta on Stephens Island, and carrion feeding is also suggested by the occurrence of *Rhytida* species inside shells of dead *Powelliphanta* (pers. obs.; K. Walker pers. comm.).

Wainuia includes four described species, all from eastern central New Zealand, an undescribed species from Fiordland and an enigmatic record from Westland¹. The shell of all *Wainuia* species is thin and almost black, although by transmitted light it appears dark olive or reddish brown, and it lacks any colour pattern (Fig. 1 a,c). The embryonic and early post-embryonic whorls² at the apex of the shell often weather to a yellow or tan colour. The shell usually contains little calcium carbonate and is therefore pliable when damp. Adult shell diameter is in the range 19 mm to 38 mm, and varies both between species and geographically within each species. The shells of all species are marked by oblique corrugations on the upper surface of the body whorl radiating from the suture *in the direction of growth*, although these can be faint in some species. In most species, the mucus secreted from the mantle lip contains a blue or purple pigment. The mantle pigment is bright yellow in the undescribed Fiordland species, while the mucus secreted by the Lake Waikaremoana population of *W. urnula* is colourless. White, calcareous-shelled eggs 4–6 mm long are laid in clusters of 2–5 in leaf litter. These are often the first indication that *Wainuia* occurs in an area.

Rhytida includes about ten described species distributed from Auckland to Stewart Island, with at least one further undescribed species from inland Marlborough. They range in adult size from about 14 mm (*R. meesoni*) to 33 mm (*R. oconnori*). *Rhytida* is endemic to New Zealand³, but appears to be

1. Solem's (1959) suggestion of a close relationship with the Tasmanian genus *Melavitrina* was refuted by Smith and Kershaw (1972) who synonymised the latter with *Victaphanta*.

2. Some technical terms are defined in Appendix 5.

3. New Caledonian species previously assigned to *Rhytida* (e.g., Solem 1959) have more recently been treated in the genus *Ptychorhytida* Moellendorf 1903 (*P. inaequalis*, *P. aulacospira*; Solem *et al.* 1984).



a. *Wainuia urnula*, Orongorongo Valley, Wellington.



b. Capture of a live amphipod by *Wainuia urnula*. Frames from a video sequence lasting about 1 second.



c. Undescribed *Wainuia* from Miller Peaks, Murchison Mountains, Fiordland.



d. *Rhytida greenwoodi greenwoodi* (Prouse Reserve, Levin) with eggs laid in captivity.



e. Newly hatched *Rhytida oconnori* (Canaan, Abel Tasman National Park) carrying a prey snail on its tail.



f. *Rhytida greenwoodi webbi* (Dry River, East Takaka) digesting prey snail (*Cbaropa coma*). The tail tip is inserted into the aperture of the prey shell.

FIGURE 1. PHOTOGRAPHS OF VARIOUS *Wainuia* AND *Rhytida* SNAILS.

closely related to the Australian genus *Austrorhytida* Smith 1987⁴. The shell of *Rhytida* species is more heavily calcified than that of *Wainuia* species. In life it is usually a translucent yellowish-brown, revealing blotches of black pigment on the mantle of the animal inside (e.g., Fig 1e). Except for *Rhytida oconnori*, which lays large eggs, the eggs are smaller than those of *Wainuia* spp. and some species (e.g., *Rhytida greenwoodi*, *R. stephenensis*) may lay more than 12 eggs in a cluster.

2.1 SYSTEMATICS

Climo (1977) radically revised the taxonomy of New Zealand Rhytididae on the basis of the degree of reduction of the reproductive system (Appendix 1). He treated *Wainuia* Powell 1930 as a subgenus of *Rhytida* Albers 1860, which he placed in the subfamily Rhytidinae. He transferred the North Auckland species of *Rhytida*, in which the shell has an angled rather than a rounded periphery, to *Rhytidarex* Powell 1948 in the subfamily Paryphantinae. Paryphantinae *sensu* Climo were defined as having a greatly reduced penis and lacking a sperm storage organ or spermatheca. Parkinson (1979) largely endorsed Climo's taxonomic treatment of *Rhytida* and *Wainuia*. This study deals with the species of *Rhytida* as that genus was delineated by Climo (1977). However, the ecological and morphological differences between *Wainuia* and *Rhytida* are considerable, and for present purposes they are treated as distinct at the generic level as in the classification of Powell (1979). F. Brook (pers. comm.) is collecting distribution records of species in the genus *Rhytidarex* from Northland and the Three Kings Islands. While the classification of New Zealand rhytidids of Climo (1977) purported to reflect relationships of taxa, there has been no robust analysis of phylogeny based on a suite of morphological or molecular characters.

Species-level taxonomy

The species and subspecies to be considered are listed in Table 1. Notes on some problematic taxa are provided here to support the species identifications used in this report. They represent hypotheses rather than final determinations. Several new species names are probably required, notwithstanding the considerable intraspecific variation (Parkinson 1979; pers. obs.).

Wainuia fallai Powell, 1946

Recent collecting has shown the distribution of *W. fallai* Powell from Kaikoura to be contiguous with that of *W. edwardi* (Suter) from Canterbury. Populations from both areas vary considerably in maximum size and shell coiling, which therefore cannot be used to separate them. Radula and diet are similar. As it was impossible to reliably assign any population to *W. fallai*, all are treated here as belonging to *W. edwardi*.

⁴. The radulae of *Austrorhytida capillacea* and *Rhytida* spp. are both of Smith's (1987) Type IV, but *R. greenwoodi*, the species most similar to *A. capillacea*, has much coarser and more irregular shell sculpture.

TABLE 1. AREA OF DISTRIBUTION OF EXTANT AND SUBFOSSIL TAXA OF *Rhytida* AND *Wainuia*.

TAXON	MAXIMUM SHELL DIAMETER (mm)	NUMBER OF 10 000 m GRID SQUARES	
		EXTANT	SUBFOSSIL ^a
<i>Wainuia clarki</i> Powell, 1936	30 ^b	5	0
<i>Wainuia edwardi</i> (Suter, 1899)	38 ^b	28	2
<i>Wainuia urnula nasuta</i> Powell, 1946	31 ^b	10	1
<i>Wainuia urnula urnula</i> (Pfeiffer, 1855)	28.5 ^b	38	2
<i>Wainuia</i> n.sp. (Fiordland)	28 ^b	6	0
All <i>Wainuia</i> spp.	38	87	5
<i>Rhytida australis</i> Hutton, 1883	13.5 ^c	16	1
<i>Rhytida greenwoodi greenwoodi</i> Gray, 1850	27 ^c	101	13
<i>Rhytida greenwoodi webbi</i> Powell, 1949	26.5 ^c	6	4
<i>Rhytida meesoni</i> Suter, 1891	11.5 ^c	62	1
<i>Rhytida oconnori</i> Powell 1946	33 ^c	2	6
<i>Rhytida otagoensis</i> Powell, 1930	18 ^c	21	1
<i>Rhytida patula</i> ^d Hutton, 1883	28 ^c	55	1
<i>Rhytida perampla</i> ^d Powell, 1946	15 ^c	80	5
<i>Rhytida stephenensis</i> Powell, 1930	34 ^b	17	4
<i>Rhytida</i> n.sp. (Wairau River)	24 ^b	3	0
All <i>Rhytida</i> spp.	34	302	21

a. Excluding grid squares from which live populations known.

b. M.G. Efford unpubl. data

c. Powell (1979)

d. Probably comprises several species (see Section 2.1)

Wainuia n.sp. Fiordland

Museum of New Zealand records and recent collecting document the presence in northern Fiordland of a new species of *Wainuia*. Its most distinctive characteristic is the bright yellow-orange colour of the mantle secretion, contrasting with the blue-purple coloration of all other *Wainuia* spp.

Wainuia cf. *edwardi* Mt Tuhua, Westland

Parkinson (1979) referred to an enigmatic Westland *Wainuia* collected by J.I. Townsend on Mt Tuhua near Lake Kaniere. Existing specimens from Mt Tuhua in J.I. Townsend's collection all resemble *R. perampla* as defined here, and do not support the notion of a Westland *Wainuia*. However, the glossy, black shell of a specimen collected alive on Mt Tuhua by K. Walker & G. Elliott clearly belongs to a *Wainuia* species. It may belong to an undescribed species, but it is treated here as belonging to an outlying population of *W. edwardi* (Suter).

Wainuia urnula nasuta Powell, 1946

Powell (1946) defined the subspecies *Wainuia urnula nasuta* from Mt Maude on D'Urville Island. Scattered populations of *W. urnula*-like snails from the Richmond Range and Marlborough, south to Kekerengu, share several characters with *W. urnula nasuta*, including a radula intermediate between North Island *W. urnula* and that of *W. edwardi*. The unusual shell outline,

thought by Powell to characterise the Mt Maude subspecies, is typical of only a few aged specimens (including the holotype); the shell outline of other specimens from the same site more resembles the typical subspecies. *Wainuia urnula nasuta* is used for both the D'Urville Island population and related populations on Arapawa Island and the South Island mainland. In future this taxon may be raised to full species rank.

Rhytida citrina Hutton 1883

The type locality of both *Rhytida citrina* and *Rhytida patula* Hutton 1883 is 'Greymouth'. Some authors have stressed differences of shell coloration and coiling, but I have been unable to detect these once allowance is made for age-related changes in shell shape. The type of *R. citrina* in Canterbury Museum is a shell from a juvenile animal which is inevitably more tightly coiled than that of an adult. Some previous records of *R. citrina* probably relate to *R. perampla* as defined below, but I have generally included records of '*R. citrina*' with *R. patula*.

"*Rhytida* n.sp.", Lewis Pass

Parkinson (1979) described but did not name a medium-large species from specimens collected by B.W. Thomas in the eastern Lewis Pass area. The specimens were lost in a filing cabinet at Auckland Institute and Museum until early 1993 (N. Gardner pers. comm.). Other specimens have since been collected in that area and in the western Lewis Pass. Shell morphology and microsculpture appear to grade into that of *R. patula* about the Maruia River, so the eastern records are here attributed to *R. patula*.

Rhytida stephenensis Powell, 1930

Powell (1979) recognised three subspecies of *Rhytida greenwoodi*: *R. g. greenwoodi* (North Island and subfossil in northern S.I.), *R. g. webbi* (East Takaka), and *R. g. stephenensis* (Stephens Island and subfossil near Takaka⁵). Parkinson (1979) treated *R. stephenensis* as a full species, which appears to make more sense, as its distribution (Appendix 4) intermingles with that of *R. g. webbi*, although there are no sympatric populations extant.

"*Rhytida meesoni perampla*" Powell, 1946

Powell (1946) distinguished a western variant of *Rhytida meesoni* as subspecies *R. m. perampla*. Parkinson (1979: 9) asserted, however, that "Apart from its small size there is little in common between [*R. perampla*] and *R. meesoni*", indicating that the taxa may be distinct at the species level. I follow Parkinson in treating *R. perampla* as a distinct species, but it must be acknowledged that some west Nelson shells, including the holotype of "*R. perampla*", have the general appearance of *R. meesoni* (flat, glossy, wide umbilicus). Others, including those from the well-known site of Mt Arthur (e.g., Dell 1949), more resemble shells of a small, undistinguished *Rhytida* species occurring at least as far south as Mt Greenland. It seems likely that there are at least two species involved, but all western records are mapped for the time being as *R. perampla*.

⁵ Powell (1949) refers to a specimen in Canterbury Museum and J.I. Townsend (pers. comm.) describes a large specimen from a pothole north of Kairuru, Takaka Hill.

2.2 PREVIOUS RESEARCH ON *Wainuia* AND *Rhytida*

Research on *Rhytida* and *Wainuia* this century has been restricted largely to the description of new taxa by Powell (1930, 1936, 1946, 1949) and Dell (1955), and subsequent revisions by Parkinson (1971, 1979) and Climo (1974, 1977; see also Climo 1975). O'Connor (1945) recorded egg measurements of several species.

Distribution data are crucial to the setting of conservation priorities (e.g., Sherley 1989; Department of Conservation 1994b). Published data on the distribution of *Wainuia* and *Rhytida* are scarce and incomplete, although there are extensive museum collections, and private collectors have recorded many other populations. For example, collecting over the past half century has considerably extended the distributions of *Wainuia edwardi* and *W. urnula* as mapped by Powell (1930). Te Punga (1953) re-presented Powell's records of *Wainuia urnula* from around Cook Strait to support his argument for a recent land bridge in the west. Fleming (1978) mapped the ranges of *Rhytidarex* spp. and *Rhytida greenwoodi* north of latitude 38°S from data in Powell (1949). Isolated distribution records have been published by Allan (1937), Gardner (1977), Forman (1978), Ogle (1981), Solem *et al.* (1981), Brook *et al.* (1982), Elliott (1985), Spurr (1985), Mason (1988), Worthy & Holdaway (1995) and others. Dell (1954) detailed the distribution of *Rhytida australis* and Elliott (1979) described the distribution of *Wainuia edwardi*. Preliminary results from the present study appeared in a report on possum-vulnerable species in the Nelson/Marlborough conservancy (Rose 1994, unpubl. Landcare Research contract report).

2.3 CONSERVATION STATUS

Five⁶ taxa considered here were assigned to 'Category I' in a recent revision of priority rankings for species conservation (Department of Conservation 1994b) (*Rhytida greenwoodi webbi*, *R. stephenensis*, *R. oconnori*, *R. "Wairau River"*, *Wainuia urnula nasuta*). None is listed in the schedule to the Wildlife Act 1953 as a protected species. Little evidence has previously been advanced on the conservation status of *Rhytida* or *Wainuia* species. The local distribution of *Rhytida greenwoodi greenwoodi* on Rakitu Island was considered by Brook *et al.* (1982) to be influenced by weka predation. An unpublished project by Bokeloh (1990) examined the evidence for predation by introduced predators on *Wainuia urnula* and showed that they were readily eaten by possums, rats, and hedgehogs in captivity. Solem *et al.* (1981) referred to a population of *R. greenwoodi greenwoodi* which apparently had been recently exterminated as a result of fire and habitat modification.

⁶. A sixth taxon (*Wainuia "Kekerengu"*) is listed in Department of Conservation (1994b), but this is not distinct from *Wainuia urnula nasuta* as used here.

3. Objectives

- To map the distributions of all extant species of *Wainuia* and *Rhytida*.
- To assess the conservation status of each species and identify need for urgent conservation management.

4. Methods

Distribution records were obtained from collections in the Museum of New Zealand (NMNZ), Auckland Institute and Museum (AIM), Canterbury Museum (CM) and Otago Museum (OM), supplemented by the personal records of Ian Townsend, David Roscoe, Jim Goulstone, Norm Gardner, Beverley Elliott, Bruce Hazelwood, Kath Walker (DOC Nelson), Richard Parrish (DOC Whangarei), Geoff Walls (DOC Napier), Brian Patrick and Bruce McKinlay (DOC Dunedin) and Peter Jamieson (the latter courtesy of Graeme Mason, Anthropology Department, Otago University). Richard Parrish and Kath Walker provided records from the NZ Wildlife Service Fauna Survey of Marlborough. Other individuals contributed additional records.

Fieldwork for parallel studies on diet and systematics provided additional records, particularly of *Wainuia* species. Searches were conducted particularly under deep leaf litter, among loosely piled rocks under vegetation, and under the dead skirts of the ferns *Blechnum discolor* and *Polystichum vestitum*. All empty shells were collected. Using a spotlight at night, live snails were also found crawling on moss, tree trunks and rocks (esp. *Rhytida* n.sp. Wairau River; also *R. patula*, Ohikinui Valley, B.W. Thomas, pers. comm.; *R. perampla*, Reefton, M.J. Meads pers. comm.).

Records were entered in a Paradox database with a grid reference to the nearest 100 m on the New Zealand Map Grid (NZMG). Distribution data have accumulated over a period of about 100 years, and no attempt was made to distinguish older from more recent records. However, the great majority of older site records have been confirmed in the last 25 years. A few significant exceptions are noted in the species accounts. The fields of a standard distribution record are listed in Appendix 2. Some grid references were provided by collectors on the New Zealand Yard Grid; these were translated to the NZMG using either Guyon Warren's program GRDCON or MAP (Pickard unpubl. 1994). If an original grid reference was lacking and the site description was reasonably specific then a grid reference was estimated from the appropriate map; these secondary grid references are distinguished by an 'inserted' code in the database.

Distribution maps were prepared using the ArcView 2 Geographic Information System (ESRI 1994). Scientific names of plants referred to in the text are given in Appendix 3.

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