

THE ISOPOD FAUNA OF SOME AUCKLAND RESERVES AND AREAS OF NATIVE VEGETATION

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SUMMARY

The isopod fauna of a number of reserves and other sites in the Auckland Province is described and compared. The effects of the stage of plant succession, from dense manuka scrub through to climax mixed kauri rain forest, and the openness of the undergrowth on the isopod fauna are discussed.

INTRODUCTION

As part of a study on the biology of some native terrestrial isopods (Scott 1966), a survey of various areas of native bush from the Auckland area was undertaken. This survey was an attempt to see if the vegetation composition had any significant effect on the isopod fauna. The reserves and other areas sampled were selected to give a wide representation of Cockayne's (1928) three stages of the manuka (*Leptospermum scoparium*) succession. These stages were defined as:-

1. Young *L. scoparium* and/or *L. ericoides* in such numbers that other species are prevented from entering and the low light intensity prevents the development of undergrowth.
2. Many *Leptospermum* trees fail to survive and the remainder open out allowing the germination of seeds of other species.
3. The species entering at stage 2 outgrow the *Leptospermum* and, by cutting off the light, finally oust it.

Additional samples from the Department of Zoology collection were also examined to widen the geographical range of the material considered so that the results presented cover sites from the Central Volcanic Plateau to offshore islands.

METHODS

At each site sampled by the author four 0.25 m² quadrats were selected at random and marked off with a metre rule. Since it was not possible to use a frame as used by Hatchett (1947) at the Scenic Drive site because of the density of the manuka trunks it was decided, in order to be consistent, that a frame would not be used. Working inwards from the perimeter of the marked quadrat the area was cleared and the litter

placed in the plastic trays of the extracting apparatus.

These trays consisted of plastic bowls, approximately 25 cm diameter at the bottom, from which the bottoms had been cut. Across the hole was placed a 20 mm square plastic mesh on top of which rested two circular pieces of 1 mm² mesh nylon net. These pieces of net were placed so that the diagonals of the squares on one layer were at an angle of 45° to the diagonals on the other layer. This arrangement reduced the effective size of the mesh and helped to minimise the amount of debris falling into the collecting liquid. The full trays were placed in plastic bags and transported back to the extraction apparatus.

The extraction was carried out by using the apparatus designed by Kempson, Lloyd and Ghelardi (1963). This apparatus is a more sophisticated version of the Tullgren funnel employing both negative (heat and light above) and positive (high humidity and dark below) stimuli to effect the extraction. The trays in which the litter was collected in the field were placed on top of bowls containing picric acid. They were kept tightly in place by rubber bands passing under the bowl and this prevented the escape of animals from the litter. Tests by the designers and by the author (Scott 1966) showed that this apparatus extracts at least 95% of the microarthropods present. During the latter tests it became obvious that isopods left the litter relatively quickly during the extraction so it was possible to reduce the time required to increase the 'simmerstat' from 'ON' to 'FULL' to 4 days instead of 8 days as suggested by Kempson *et al.* (1963).

After extraction the animals were filtered from the picric acid of the extraction apparatus and washed into a petri dish with 70% alcohol. The isopods were then removed, identified and measured, when possible on the same day but numbers sometimes prevented this, and preserved in 70% alcohol.

Other than date and place no details are known of the collection methods for the leaf litter samples in the Department of Zoology collection. Extraction was by a large Berlese-type funnel and it might be argued the faunal composition produced would differ from that of the Kempson *et al.* (1963) apparatus. However, because the isopods are relatively mobile and leave the litter easily and because of the similarity between the isopod faunas of the Dingle Dell samples extracted by the two methods (see below) suggest that such an objection cannot be sustained. Isopods in these departmental samples were identified and counted.

SAMPLE SITES

The location and other relevant details about the sites sampled during the course of this work are as follows. Except where otherwise indicated each site was sampled once.

Scenic Drive: On the north side of the Scenic Drive 4.2 km from the Titirangi shopping centre. The site had a 29 m frontage and sloped upwards from the road. It was densely covered with manuka (*Leptospermum scoparium*) 3-4.5 m tall with a few specimens of *Phormium tenax* and *Cyathea dealbata* near the roadside, i.e. Cockayne's first stage. This site was sampled monthly from January 1965 to May 1966.

Swanson: The site of the University of Auckland field station at the end of Tram Valley Road. The stream divides this site into two areas and with one exception all samples from this site were taken from the flat area on the Swanson side of the stream on the southern side of the hut. When this work was carried out the area sampled represented the late second stage in Cockayne's (1928) description of the succession - the manuka was 4.5-6 m high, and because many plants had died the bush had opened out allowing ground cover to become established and trees of the eventual climax vegetation to be quite common but not yet dominant. This site was also sampled monthly from January 1965 to May 1966. The area on the northern side of the stream more closely representing Cockayne's final stage, i.e. the climax vegetation, was sampled on 1 August, 1965. The botany of this site has been described by Trevarthen (1952).

Pakiri 'A': An area of mixed manuka and kanuka (*L. ericoides*) 22.5 km north-west of the University of Auckland Marine Laboratory at Leigh. The bushes were approximately 3 m tall. This site was sampled by K.G. Somerfield on 10 May, 1966.

Pakiri 'B': Tomorata Domain is about 27 km north-west of the University of Auckland Marine Laboratory at Leigh and is an example of mixed kauri (*Agathis australis*) rain forest. The sample was also collected by K.G. Somerfield, on 10 May 1966.

Hunua 'A': On the true left bank of the river alongside the Hunua Falls. Botanically it is similar to the Swanson site, being an example of the late second stage of the succession. The manuka bushes were about 4.5 m tall. Sampled 29 August 1965.

Hunua 'B': A dense patch of bush of climax rain forest on the left hand side of the road to the Hunua Falls about 0.75 km before the falls and alongside the Presbyterian Camp site. Sampled 29 August 1965.

Omana: A small (0.5 ha) area of mixed shrubland alongside the road 1.6 km north of Maraetai. The ground cover included more grass than at either Swanson or Hunua 'A'.

Kauri Knoll: On the Scenic Drive about 6 km from the Titirang shopping centre this site is a typical example of mixed kauri. Sampled 15 August 1965.

Whitford Gorge: This site is 5.8 km from Whitford on the road to Maraetai. The patch of mixed forest is on the south side of the road straddling a small stream that runs down to the estuary. Sampled 11 September and 31 December 1965. On the second occasion two samples were collected, one from the gully and one near the top of the gorge.

Piha Road: The samples were taken at a point about 3 km from the Piha turnoff on the Scenic Drive. The vegetation is mixed third stage and the litter was quite deep. Sampled 12 September 1965.

Shaw Road: This road runs roughly north-south intersecting the Scenic Drive about 3.2 km from Titirangi. Two different patches of bush were sampled, one on the eastern side of the road and the second on the western side of the intersection of Shaw Road and Carter Road. The former comprised dense third stage vegetation with a thick litter layer and while the second also had a thick litter layer, it probably should not be placed within the Cockayne succession because of human interference. Both sites sampled 10 January 1966.

Auckland Domain: The samples were taken from litter mainly of oak (*Quercus* spp.) in the area between the Domain Drive and Carlaw Park. This area was chosen because it is the least disturbed by human activity. Sampled 20 July 1965.

Kauri Park: On the North Shore this reserve is about 5 km along Victoria Road from the Northcote shopping area. While experiencing some human interference it is nominally in its natural mixed kauri forest condition. Sampled 26 September 1975.

Dingle Dell: This 6.5 ha reserve in St Heliers according to Millener (1965) is much modified, but well-maintained. The botanical composition has been described by Esson (1960). Sampled 5 June 1966.

In addition leaf litter samples in the Department of Zoology collection were examined and the following sites were therefore included in the investigation (one sample on one occasion unless otherwise specified): Bream Head, Whangarei, May 1961; Cascades Kauri Forest, April 1961; Cuvier Island, February 1964; Dingle Dell, 5 August, 1956; Glen Ness Valley, 20 August 1964; Piha Valley, 20 August 1964; Rangitoto Island, 14 May 1959 (two samples), July 1961 and August 1961; Tongariro National Park, 13 samples over a number of years.

RESULTS AND DISCUSSION

A total of 8 species of isopod was identified, three species were each only obtained from one site. The species were identified using Hurley's (1950) key and, for the 5 commonly occurring species, the identity was confirmed by Green (pers.comm. and 1971). The species, all native except for the last named, were *Styloniscus phormianus*, *S. otakensis*, *S. ?thomsoni* (Piha Rd sample only), undetermined styloniscid near *S. otakensis* (Tongariro National Park) *Philoscia brevicornis*, *Paraphiloscia pubescens*, undetermined oniscid (Tongariro National Park) and the cosmopolitan *Armedillidium vulgare*.

In order to compare the results from the different sites and at different times of the year the raw data were converted to percentages where the number of isopods recovered was sufficient to make this meaningful (greater than or equal to 30). The percentage occurrences were then classified as dominant (D) - greater than 40%, sub-dominant (S) - 10-40%, and present (P) - less than 10%. The results of this analysis are given in Table 1. Where the calculation of percentages was not

Table 1. Composition of the isopod fauna of some reserves and areas of bush sampled during 1956-1966.

Sample Site	Isopod Species					Other
	<i>Styloniscus phormianus</i>	<i>Styloniscus otakensis</i>	<i>Philoscia brevicornis</i>	<i>Paraphiloscia pubescens</i>	<i>Armedillidium vulgare</i>	
Scenic Drive	D	D	P	P	P	.
Swanson - south of stream	S	S	D	P	P	.
- north of stream	D	S	S	P	P	.
Pakiri 'A'	D	.	.	P	.	.
Pakiri 'B'	✓	✓	.	.	✓	.
Hunua 'A'	.	.	✓	✓	.	.
Hunua 'B'	.	✓	.	✓	.	.
Omana	S	.	D	.	S	.
Kauri Knoll	S	S	S	.	P	.
Whitford Gorge						
- bottom	D	S	S	.	P	.
- top	P	D	D	.	P	.
Piha Road	.	.	✓	.	.	✓*
Shaw Road - east	D	D	P	.	P	.
- west	P	D	P	.	P	.
Auckland Domain	.	.	.	D	P	.
Kauri Park	✓	✓	✓	✓	.	.
Dingle Dell	.	.	.	D	.	.

*Probably *Styloniscus thomsoni*

considered valid the species found are indicated in Table 1 as being present by a tick. The calculations for the Scenic Drive and Swanson (south of stream) sites were for mean annual values as determined from the monthly sampling.

The pattern emerging from this analysis is that *S. phormianus* and/or *S. otakensis* were the dominant species in the first stage of the succession (Scenic Drive and Pakiri 'A') with *P. brevicornis* assuming dominance in the second stage (Swanson South, Hunua 'A' and Omana). This dominance would be even more obvious if biomass rather than numbers had been used in the analysis since adult males of the two styloniscids averaged about 2.5 mm long and 0.8 mm wide while adult male *P. brevicornis* averaged 5.0 mm long and 1.3 mm wide. Adult female sizes showed similar differences. In the third or climax stage there are two alternatives. The first alternative is that *Ph. pubescens* becomes dominant with few, if any, other species present (Auckland Domain, Dingle Dell). The second is that an even occurrence of species occurs with no one species consistently dominant (Kauri Knoll, Kauri Park). The vegetation differences which might produce these differences

Table 2. Composition of the isopod fauna of some samples in the Department of Zoology collection.

Sample site and date collected.	Isopod Species					Other
	<i>Styloniscus phormianus</i>	<i>Styloniscus otakensis</i>	<i>Philoscia brevicornis</i>	<i>Paraphiloscia pubescens</i>	<i>Armadillidium vulgare</i>	
Dingle Dell						
5 August 1956	-	-	P	D	P	-
Cascades Kauri						
Forest April 1961	S	S	S	P	S	-
Bream Head						
May 1961	P	-	-	D	P	-
Cuvier Island						
February 1964	P	P	P	D	-	-
Glen Ness Valley						
20 August 1964	S	D	-	S	-	-
Piha Valley						
20 August 1964	P	D	P	S	S	-
Rangitoto Island-						
4 samples, various dates	-	-	-	✓	✓	-
Tongariro National Park - 13 samples, various dates	✓	-	✓	✓	✓	✓ *

* Specimens of an undetermined Styloniscid similar to *otakensis* in that it lacked spines and also specimens of an Oniscid.

seem to relate to the density of the bush and hence the shade offered: more open stands produce the first result and tight dense stands the second. The openness of the stand would obviously affect the ease with which the leaf litter dried out during good weather. Laboratory experiments (Scott 1966) showed that *Ph. pubescens* was the most resistant native species to water losses by transpiration and hence more likely to survive as leaf litter dried out. The only exception to the pattern was the Piha Road sample. This sample produced only 4 specimens; two *P. brevicornis* and two styloniscid specimens, probably *S. thomsoni*.

The results from the samples in the Departmental collection were also analysed (Table 2). The pattern discussed above is repeated in that sites with *Ph. pubescens* dominant (Bream Head, Cuvier Island and Dingle Dell again) consisted of more open bush than those like Cascades Kauri Forest which had all species present but none comprising greater than 40% of the fauna. The tolerance of *Ph. pubescens* is further emphasised by its presence in samples from Rangitoto Island (with *A. vulgare*) where there is relatively sparse litter and humus.

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