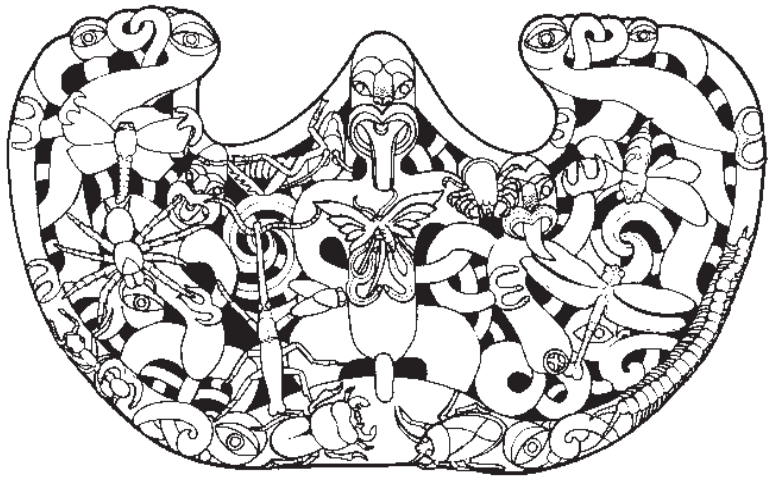

Fauna of New Zealand

Ko te Aitanga Pepeke o Aotearoa

Vink, C. J.; Dupérré, N.; Malumbres-Olarte, J. 2013. Periegopidae (Arachnida: Araneae). *Fauna of New Zealand 70*: 41 pp.

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Ko te Aitanga Pepeke o Aotearoa

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Front cover: Female *Periegops suterii* Urquhart from Kennedys Bush Reserve, MC (LUNZ 00012718) (Photographer: Bryce McQuillan).

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POPULAR SUMMARY **HE WHAKARĀPOPOTOTANGA**

Class **Periegopidae**
Order **Arachnida**
Family **Araneae**

Periegopid spiders

There are only three species known in the family Perigopidae and all are in one genus, *Periegops*. These rare spiders have only ever been found in relict forests at limited locations in New Zealand (Banks Peninsula, Riccarton Bush, the Aldermen Islands, and East Cape) and Queensland, Australia. Periegopids are only found in forest with a deep leaf litter layer and well-drained soil. They do not build a web, but hunt on the forest floor. Periegopids can be most readily distinguished from other spiders found in New Zealand by having six eyes arranged in three widely spaced diads.

Contributor **Cor Vink** was born and educated in Christchurch, New Zealand. He completed a Ph.D. at Lincoln University on the taxonomy and systematics of New Zealand Lycosidae, a major part of which was published as a revision in *Fauna of New Zealand 44*. After completing his thesis he spent nine months at AgResearch as a postdoctoral research fellow investigating the genetics of hymenopteran parasitoids of weevil pests. From 2003 to 2005, Cor was a postdoctoral associate at San Diego State University, U.S.A., where he worked on developing new molecular markers for inferring deep phylogenetic relationships in spiders. At the end of 2005 he returned to New Zealand and joined the Biosecurity Group at AgResearch, Lincoln as a scientist. Cor is especially interested in the systematics of New Zealand spiders and is the adjunct curator of spiders at the Entomology Research Museum at Lincoln University. In 2013, Cor was appointed as Curator Natural History at Canterbury Museum, Christchurch.

(continued overleaf)

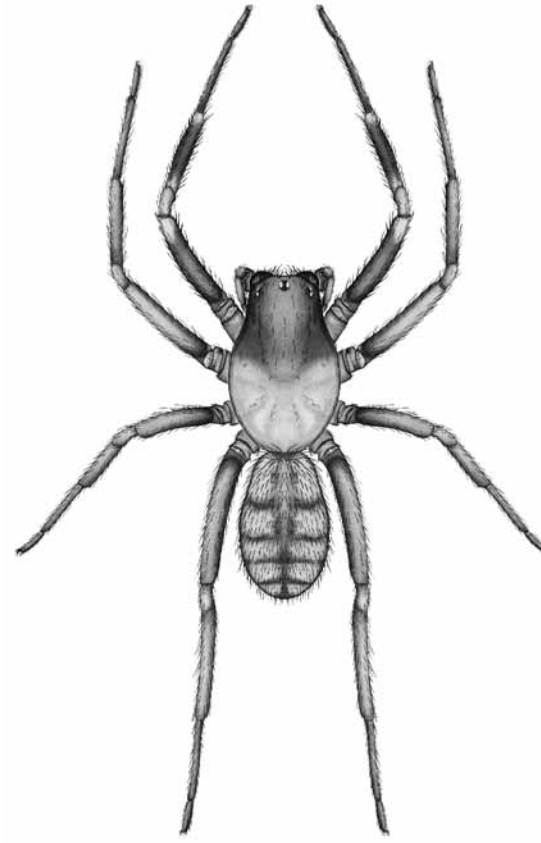

Illustration / Whakaahua: *Periegops suterii*, female (Illustrator / Kaiwhakaahua: N. Dupérré).

Ngā pūngāwere Periegopid

E toru anake ngā momo e mōhiotia ana o te whānau Perigopidae, ā, nō te huinga kotahi, arā, a *Periegops*. Kua kitea ēnei pūngāwere onge tonu i ngā toenga ngahere i ngā wāhi ruarua nei i Aotearoa (i Horomaka, i te ngahere o Riccarton, i ngā moutere Aldermen, me Te Koringa-a-Paoa) me Queensland, i Ahitereiria. Kitea ai ēnei Periegopid i te ngahere he hōhonu nei ōna pūranga rau-rākau, i ngā one āhua pai te mimititanga wai. Kāore e hanga tukutuku mō rātou, engari ka whakangau i ā rātou kai i te papa tonu o te ngahere. Ka mōhiotia wawetia te Periegopid, ina whakaritea ki ētahi katoa o ngā pūngāwere o Aotearoa, nā te noho mai o ngā karu e ono, he tawhiti tonu te takoto o ia pūruatanga karu i ētahi atu.

Translation by **Piripi Walker**
Whakatiki

Contributor **Nadine Dupérré** is from Québec, Canada. She completed a Bachelor of Science at Université de Montréal in 1997. She began illustrating spiders in 1998 and to date has produced over 5000 illustrations. Nadine is probably best known amongst arachnologists for her illustrations in the book "Spiders of North America: an Identification Manual". Nadine has published on the taxonomy of spiders and has also produced illustrations for publications on beetles and harvestmen. Nadine was a research assistant at the American Museum of Natural History, New York from 2008–2012 where she worked on Oonopidae with Norman Platnick. She is now living in Quito, Ecuador, working on a revision of the genus *Agyneta* (Linyphiidae) from North America, and is planning to continue her work on Linyphiidae in South America.

Contributor **Jagoba Malumbres-Olarte** is from the Basque Country, Spain. He completed a Ph.D. at Lincoln University on the ecology and diversity of spider communities in New Zealand native tussock grasslands in 2011. After he completed his thesis, he worked as a teaching assistant at Lincoln University and Imperial College London, UK. In the last six years Jagoba has been involved in numerous research projects on diverse topics, including the ecology of spider communities in sand dunes, conservation genetics of the Chatham Islands coxella weevil, the systematics of the New Zealand *Clubiona*, and the invasibility of spiders and plants in New Zealand. Jagoba is particularly interested in ecological and environmental processes that drive speciation and shape the diversity and composition of communities, and is currently developing new projects in this field.

Cor Vink

Jagoba Malumbres-Olarte

Nadine Dupérré

ABSTRACT

Two species of Periegopidae, both in the genus *Periegops* Simon, 1893, are found in New Zealand; *P. suterii* (Urquhart, 1892) and *P. keani* sp. nov. The genus and both species are described or redescribed, with information on synonymy, type data, material examined, and geographical distribution. Habitus images of adults, illustrations of important morphological features, and distribution maps are provided. A key is given.

The mitochondrial gene cytochrome *c* oxidase subunit 1 (COI) and the nuclear gene 28S ribosomal RNA were sequenced for both species. COI divergence between some specimens of *P. suterii* was unexpectedly high (8.6%, uncorrected distance), but there was no morphological differentiation or 28S sequence divergence between those specimens. A molecular phylogenetic analysis examining the relationships between eight specimens of *P. suterii* and three specimens of *P. keani* using COI data is presented.

Keywords. Arachnida, Araneae, Periegopidae, New Zealand, Haplogynae, classification, distribution, ecology, biology, new species, key, phylogeny.

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CHECKLIST OF TAXA

Genus ***Periegops*** Simon, 1893 15
suterii (Urquhart, 1892) 15
keani new species 17

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Mike Bowie (Lincoln University) kindly supplied specimens that have been valuable in this study. Mike Fitzgerald and Grace Hall shared information on the locations where *Periegops* specimens had been collected. Thanks to John Kean (AgResearch) for collecting assistance on Ruamahuanui Island, to Rob Chappell (Department of Conservation) for logistics support and to Kristine Grayson (Victoria University of Wellington) for sharing her charter to the Aldermen Islands. Henry Hudson Vink and Lucy Hudson Vink helped collect specimens at Kennedys Bush Reserve. We thank Bryce McQuillan for his excellent photographs of *Periegops suterii*.

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INTRODUCTION

Periegopidae Simon, 1893 is a family of six-eyed spiders comprising only three species, all in the genus *Periegops* Simon, 1893. Two species are endemic to New Zealand and the other is endemic to Queensland, Australia (Forster 1995). Periegopids can be distinguished from other families found in New Zealand by a combination of characters. The six eyes are arranged in three, widely spaced diads. The chelicerae have a lamina on the ventral surface and the maxillae are slender and are more than twice as long as wide and directed across the labium. The anterior two pairs of legs have asymmetrical superior claws; the proclaw of legs I and II has a double row of teeth whereas the retroclaw has a single row (Forster 1995: fig. 11–13). There is also a field of spicules on the median surface of the posterior median spinnerets (Labarque & Ramírez 2012; fig. 21F, 22E) and the venom outlet is anterior on the fang (Labarque & Ramírez 2012; fig. 18A); both of these characters require high microscope magnification to see them.

Periegops suterii (Urquhart, 1892) was first described from a female and two immature males collected by the early New Zealand zoologist, Henry Suter, at Dyer's Pass on the Port Hills near Christchurch (Urquhart 1892; Forster 1995). Urquhart placed his new species in a Northern Hemisphere genus and family; *Segestria* Latreille, 1804, and Dysderidae C.L. Koch, 1837, respectively. Shortly after, Simon (1893) erected the genus *Periegops* for his new species *P. hirsutus*, which he described from a female specimen sent to him at the Muséum national d'Histoire naturelle, Paris, from New Zealand. Although Simon (1893) did not specify the location where the specimen was collected from, it was likely that it was from Banks Peninsula (Forster 1995). The generic description was of a female and Simon (1893: 267) noted that the male was unknown; however, the description of *P. hirsutus* was listed as male although no male characteristics appear to be described (Simon 1893: 268). Bryant (1935a: 54) and Forster (1995: 92) noted that the listing as a male appears to be in error. Dalmas (1917: 338) also noted the specimen was female and this was the specimen seen by Chamberlain (1946). It is unlikely that Simon realised he had described the same species as Urquhart and *P. hirsutus* was later made a synonym of *P. suterii* by Chamberlain (1946). Simon (1893) was first to recognise that the genus *Periegops* was distinct from other genera and placed it in its own subfamily, Periegopinae Simon, 1893. Forster (1995) elevated the subfamily to family status when he described *Periegops australia* Forster, 1995 and redescribed *P. suterii*. Forster (1995: 96) also noted that he had examined a single

female specimen collected at East Cape, but there were "no clear characters by which the species could be satisfactorily defined"; a male would need to be collected and the palpal bulb examined to determine if it was a separate species. Forster & Forster (1999) mentioned an additional specimen from the Aldermen Islands, which they believed to be a female, and Vink (2006) reported that he had sequence data from a fragment of the mitochondrial gene cytochrome *c* oxidase subunit 1 (COI) [specimen Pk1] that suggested that the North Island specimens were a distinct species.

Periegopidae is part of a group of spiders called the Haplogynae Simon, 1893, which are araneomorph spiders that lack separate fertilisation ducts, do not have a sclerotised epigyne and the male pedipalp is relatively simple. Haplogynae are a monophyletic group (Platnick *et al.* 1991; Ramírez 2000) that includes 17 families. Perigopids have a number of characteristics that are shared with the haplogyne families Diguetidae F. O. Pickard-Cambridge, 1899, Drymusidae Simon, 1893, Plectreuridae Simon, 1893, Scytodidae Blackwall, 1864, and Sicariidae Keyserling, 1880. These include a lamina on the ventral surface of the chelicerae, slender maxillary lobes directed across the labium, and a limited posterior respiratory system with fused apodemes (Forster 1995). Forster (1995) grouped this set of families, along with Periegopidae, into the superfamily Sicarioidea, but did not provide a formal definition of the superfamily. The name Sicarioidea was first used by Berland (1932) and Forster (1995) appears to be the only other arachnologist that has used it.

A more commonly used superfamily name that includes this set of taxa is Scytodoidea (Bristowe 1938; Caporiacco 1938; Brignoli 1978; Lehtinen 1986); however, Scytodoidea has been used to refer to a larger set of haplogyne families that has also included Caponiidae Simon, 1890, Leptonetidae Simon, 1890, Ochyroceratidae Fage, 1912, Pholcidae C. L. Koch, 1850, and Tetrablemmidae O. Pickard-Cambridge, 1873. A morphological phylogenetic analysis by Platnick *et al.* (1991) supports a clade informally named "scytodoids" (Coddington & Levi 1991) that includes Diguetidae, Drymusidae, Leptonetidae, Ochyroceratidae, Pholcidae, Plectreuridae, Scytodidae, Sicariidae, Telemidae Fage, 1913, and Tetrablemmidae. The monophyly of this clade is supported by the reduction of the posterior spiracles to one and the tetrahedral posterior median spinnerets (Platnick *et al.* 1991), although these characters have been reversed in some species in the clade (Platnick *et al.* 1991).

Ramírez (2000) examined the morphology of haplogyne respiratory systems and added characters to the data matrix of Platnick *et al*. (1991) to produce a phylogeny of the Haplogynae. Periegopidae was not included in the analyses but Ramírez (2000) stated that Periegopidae was sister to the Scytodidae. Periegopidae was also included in the scytodoid clade by Coddington (2005); its inclusion was presumably based on Forster (1995) and Ramírez (2000). Labarque & Ramírez (2007a, b) considered that among the scytodoids, Periegopidae was closest to Drymusidae and Scytodidae as they share two characters; asymmetrical superior claws on the anterior two pairs of legs and a field of spicules on the median surface of the posterior median spinnerets. More recently, Labarque & Ramírez (2012) expanded the morphological dataset of Platnick *et al.* (1991) and Ramírez (2000) to include Periegopidae along with a restricted Scytodoidea, which included Drymusidae, Scytodidae, and Sicariidae. *Periegops*, *Drymusa*, and Scytodidae formed a clade, which all shared the synapomorphies of asymmetrical superior claws and a field of spicules on the median surface of the posterior median spinnerets. Labarque & Ramírez (2012) concluded that Periegopidae was sister to Drymusidae, but they did not find any autapomorphies for *Periegops* and suggested that the two families might be synonymised.

Very little is known of the biology of periegopids. They are only found in forest with a deep leaf litter layer and well-drained soil. Specimens have been collected from under logs and rocks, in leaf litter, in pitfall traps, in rotted logs and root cavities, and in a mygalomorph burrow (Forster 1995; Vink 2006). Forster (1995) suggested that periegopids were rare as their habitat has been severely reduced due to human deforestation and only 21 *Periegops* specimens had been collected in New Zealand and Australia between 1891 and 1995. In surveys between October 2002 and May 2003, Vink (2006) found a further 24 specimens of *P. suterii* at ten different locations on the Banks Peninsula. Sirvid *et al.* (2012) classified *P. suterii* as having a relict distribution.

Periegops do not appear to build a web for prey capture, but do build silken retreats. It seems probable that periegopids are cursorial, night-time hunters as they have only been found on the forest floor, have been collected in pitfall traps and lack webs. On two occasions a single female has been found together with two or three males under logs and rocks (Forster 1995; Vink 2006), which implies that the female might possess some method of attracting males.

MORPHOLOGY AND TERMINOLOGY

The morphological structures required for the identification of New Zealand and Australian Periegopidae are

referred to in Fig. 1–16 and explained in the glossary of technical terms (Appendix A), and Paquin *et al*. (2010). As with almost all spiders, the male pedipalp is important when identifying periegopids to species. The female epigyne, which is usually useful for identifying spider species (Paquin *et al.* 2010), is just a lightly sclerotised area that covers the internal genitalia in periegopids, and many other haplogyne spiders, and therefore is not likely to be diagnostic. The internal genitalia, however, are diagnostic, as is the case with most spider species. The morphological nomenclature of the pedipalp and the internal genitalia follows Forster (1995).

A phylogenetic species concept (Wheeler & Platnick 2000) has been implemented in this study. It defines a species as the smallest aggregation of populations diagnosable by a unique combination of character states.

METHODS AND CONVENTIONS

Collecting. Periegopids can be collected by a variety of methods. The best method for collecting periegopids is by searching under rocks and logs that are sitting on or partially embedded in soil on open ground within forest in areas with a good litter layer over well drained soil (Vink 2006). Periegopids have also been found under wooden discs (M. H. Bowie, pers. comm.) that are facsimiles for natural fallen logs (Bowie & Frampton 2004). Periegopids have also been collected by sieving and searching leaf litter. Specimens of *P. suterii* and *P. australia* have been caught in pitfall traps, but unless specimens are collected and preserved within a couple of days of being caught they can start to decay, which can make identification difficult. Decay of specimens caught in pitfall traps can be mitigated by the use of a good preservative such as propylene glycol, which also preserves DNA but can shrivel soft tissue (Vink *et al.* 2005). Malumbres-Olarte *et al*. (in press) used propylene glycol in their pitfall traps and found that useful DNA was preserved after two weeks in the field.

Preservation. Periegopids are best preserved long-term in 70–75% ethanol. To ensure adequate DNA preservation, specimens should also be stored at ≤ -20°C (Vink *et al.* 2005). Spiders can be stored in 95–100% ethanol to preserve DNA but as with lower ethanol concentrations, it is still best to combine this with storage temperatures ≤ -20°C (Vink *et al.* 2005). Preservation in 95–100% ethanol makes specimens brittle, potentially rendering them unsuitable for morphological examination.

Preparation. Specimens should be labelled with the locality, including area code (Crosby *et al.* 1976, 1998), latitude and longitude, collection date, collector's name, habitat data, and collection method.

Most morphological features used in identification can be seen under an ordinary dissecting microscope. When examining a spider in ethanol it should be rested in washed quartz sand or glass beads to provide support for the specimen. This also allows the specimen to be positioned at any desired viewing angle. The features of the male pedipalp are best viewed by removing the left pedipalp at the junction between the trochanter and the femur, and viewed ventrally. In periegopids, as with other haplogyne spiders, there is no sclerotised external genitalia, only a slightly sclerotised plate, which makes distinguishing females from immature specimens difficult. Female internal genitalia were excised using a sharp entomological needle and were prepared for examination by placing the dissected genitalia in either lactic acid or 10% KOH solution for 1–3 hours at 37°C to dissolve soft tissue. Internal genitalia were only illustrated for *P. suterii* and *P. australia*.

Measurements. All measurements are in millimetres (mm). Where the measurements are expressed as a fraction, the numerator refers to the length of the structure and the denominator refers to its width. Measurements outside parentheses are for males and inside parentheses for females. The size ranges given for the body and carapace length of each species represent the smallest and largest individuals of each sex that we examined. The mean body length and carapace length were calculated and the number of specimens measured given.

Descriptions. For the new species, illustrations, measurements and colour pattern descriptions were made from the type specimen. For the existing species, illustrations, measurements, and colour pattern descriptions were prepared from a non-type representative male and female specimen (with collection information shown).

Descriptions of colours are for ethanol-preserved specimens. It should be noted that colours and colour patterns can fade in older specimens, particularly those that have not been stored away from light.

Measurements were made with a micrometer ruler fitted to the eyepiece of a Leica M125 stereo microscope.

Characters diagnostic in other spider families (e.g., eye size and position, leg spination) are not diagnostic for Periegopidae species and have not been included in the descriptions.

Illustrations. Specimens to be illustrated were first photographed with a Nikon Coolpix 950 digital camera attached to a SMZ-U Nikon dissection microscope. The digital photos were then used to establish proportions and the illustrations were detailed and shaded by referring back to the structure under the microscope.

Map images were created using the geographic information system software ArcMap 10 (ESRI).

Text conventions. The area codes of Crosby *et al*. (1976, 1998) are used in collection records.

The following acronyms for repositories are used:

AMNH	American Museum of Natural History, New York, U.S.A.
LUNZ	Entomology Research Museum, Lincoln University, New Zealand
MONZ	Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand
NZAC	New Zealand Arthropod Collection, Auckland, New Zealand
OMNZ	Otago Museum, Dunedin, New Zealand
QMB	Queensland Museum, Brisbane, Australia

Molecular biology. To construct a molecular phylogeny of New Zealand Periegopidae and to facilitate the identification of immature specimens, we used the mitochondrial gene cytochrome *c* oxidase subunit 1 (COI) and the nuclear ribosomal RNA gene 28S. COI is one of the fastest evolving mtDNA genes and has been used to examine genetic differences between and among haplogyne spiders (e.g., Arnedo *et al.* 2001, 2009; Astrin *et al.* 2006; Starrett & Waters 2007; Binford *et al.* 2008; Dimitrov *et al.* 2008; Huber & Astrin 2009; Duncan *et al.* 2010) and New Zealand spider species (Vink & Paterson 2003; Vink *et al.* 2008, 2011a, b; Framenau *et al.* 2010; Vink & Dupérré 2010; Lattimore *et al.* 2011; Malumbres-Olarte & Vink 2012). 28S was selected because it is a slow evolving gene (Hedin & Maddison 2001) and has been used in phylogenetic analyses of haplogynes (Bruvo-Mađaric *et al.* 2005; Binford *et al.* 2008) as well as other spiders (e.g., Hedin & Bond 2006; Rix *et al.* 2008; Wang *et al.* 2008; Spagna *et al.* 2010). Eight specimens of *P. suterii* and three specimens of *P. keani* were sequenced for COI. Each specimen was arbitrarily assigned a specimen code (Table 1). A subset of four specimens, two from each species, was sequenced for 28S.

DNA was extracted non-destructively (see Paquin & Vink 2009) from either two to three legs using a ZR Genomic DNA™ Tissue Minipreps (Zymo Research). The primers used to PCR amplify and sequence COI fragments were either LCO1490 (5'-GGTCAACAAATCATAAAGATATTGG-3') (Folmer *et al.* 1994) plus C1-N-2776-spider (5'-GGATAATCAGAATANCGNCGAGG-3') (Vink *et al.* 2005) or C1-J-1718-spider (5'-GGNGGATTTGGAAATTGRTTRGTTCC-3') (Vink *et al.* 2005) plus C1-N-2776-spider. The two COI fragments were 1260 base pairs (bp) and 1055 bp long, respectively. Two different primer pairs were used to amplify and sequence two overlapping 28S fragments; 28S-B1 (5'-GACCGATAGCAAACAAGTACCG-3') (Bruvo-Mađaric *et al.* 2005) plus 28S-B2 (5'-GATTAGTCTTTCGCCCCTATA-3') (Bruvo-Mađaric *et al.* 2005) and 28Sa (5'-GACCCGTCTTGAAACACGGA-3') (Nunn *et al.* 1996) plus LSUR (5'-GCTACTACCACCAAGATCTGCA-3') (Rix *et al.* 2008). The two 28S fragments were 819–821 bp and 830–833 bp long, respectively. PCR amplification was performed using *i*-StarTaq™ DNA Polymerase (iNtRON Biotechnology) in a Mastercycler® (Eppendorf) thermocycler with a cycling profile of 35 cycles of 94ºC denaturation (30 s), 48°C (COI) or 60°C (28S) annealing (30 s), 72ºC extension (1 min) with an initial denaturation of 3 min and a final extension of 5 min. Excess primers and salts were removed from the resulting double-stranded DNA using a DNA Clean & Concentrator™ Kit (Zymo Research). Double bands were observed when 28S PCR products of Pk1 were visualised via gel electrophoresis; both bands were excised from the gel and prepared for sequencing using a Zymoclean™ Gel DNA Recovery kit. For Pk1, the primer pair 28S-B1 plus 28S-B2 amplified a fragment of 28S DNA that BLAST database searching indicated may have come from a ciliate protozoan. For Pk2, the primer pair 28Sa plus LSUR amplified a fragment of 28S DNA from a soil nematode in the family Cephalobidae. Amplification of 28S was attempted for specimens Ps5 and Ps6, but was not possible owing to contamination by a fungus that the primers preferentially annealed to. Contaminants were identified by BLAST searching their sequences (Altschul *et al.* 1997). Purified PCR fragments were sequenced in both directions at the Core Instrumentation Facility (University of California, Riverside, USA), the Massey Genome Service (Massey University, New Zealand), or Macrogen (Korea). Sequence data were deposited in GenBank (www.ncbi.nlm.nih.gov/GenBank/ – see Table 1 for accession numbers). Sequences were edited using Sequencher 4.6 (Gene Codes Corporation).

Table 1. Specimens used for molecular analysis.

Species	Specimen code	Sex	Collection information	GenBank accession numbers
Periegops suterii	Ps1	♂	MC, Hinewai Reserve, 43°48.59'S, 173°01.28'E, 11 October 2002, CJV, AMNH (ARAMR-000615)	JX174281
Periegops suterii	Ps2	♀	MC, Hinewai Reserve, 43°48.59'S, 173°01.28'E, 11 October 2002, CJV, AMNH (ARAMR-000616)	JX174282
Periegops suterii	Ps3	♀	MC, Hay Reserve, 43°42.18'S, 172°53.87'E, 13 March 2003, CJV, LUNZ (00012720)	JX174283
Periegops suterii	Ps4	♂	MC, Kennedys Bush Reserve, 43°37.9'S, 172°37.3'E, 22 April 2011, CJV, H.P. & L.J. Hudson Vink, LUNZ (00012715)	JX017357, JX017353
Periegops suterii	Ps5	♂	MC, Montgomery Park Reserve, 43°44.7'S, 172°52.2'E, 5 November 2010, CJV & JM-O, LUNZ (00012722)	JX174284
Periegops suterii	Ps6	♂	MC, Hinewai Reserve, 43°48.69'S, 173°00.95'E, 11 January 2011, M.H. Bowie, LUNZ (00012735)	JX174285
Periegops suterii	Ps7	subadult ♀	MC, Montgomery Park Reserve, 43°44.7'S, 172°52.2'E, 5 November 2010, JM-O & CJV, LUNZ (00012725)	JX174286, JX174291
Periegops suterii	Ps8	♀	MC, Kennedys Bush Reserve, 43°37.9'S, 172°37.3'E, 13 August 2011, CJV & H.P. Hudson Vink, LUNZ (00012718)	JX174287
Periegops keani	Pk1	immature	CL, Ruamahuanui Island, 36°57.25'S, 176°05.52'E, 19 November 2003, B.M. Fitzgerald, MONZ (AS.002310)	JX174288, JX174292
Periegops keani	Pk2	♂	CL, Ruamahuanui Island, 36°57.25'S, 176°05.52'E, 23 March 2012, CJV & J.M. Kean, LUNZ (00012716)	JX174289, JX174293
Periegops keani	Pk3	immature	CL, Ruamahuanui Island, 36°57.25'S, 176°05.52'E, 23 March 2012, CJV & J.M. Kean, LUNZ (00012717)	JX174290

Table 2. Uncorrected distance matrix for cytochrome c oxidase subunit 1 (COI).

	Pk1	Pk2	Pk3	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Ps7
Pk2	0.006									
Pk3	0.007	0.007								
Ps1	0.135	0.131	0.135							
Ps2	0.135	0.131	0.135	0.000						
Ps3	0.139	0.135	0.139	0.007	0.007					
Ps4	0.141	0.138	0.138	0.084	0.084	0.086				
Ps5	0.132	0.130	0.132	0.012	0.012	0.013	0.082			
Ps6	0.135	0.131	0.135	0.000	0.000	0.007	0.084	0.012		
Ps7	0.132	0.130	0.132	0.012	0.012	0.013	0.082	0.000	0.012	
Ps8	0.141	0.138	0.138	0.084	0.084	0.086	0.000	0.082	0.084	0.082

PHYLOGENETIC ANALYSIS

Methods. Sequences were aligned using Sequencher 4.6. There was no evidence of insertions/deletions or stop codons in the COI sequences and alignment was straightforward.

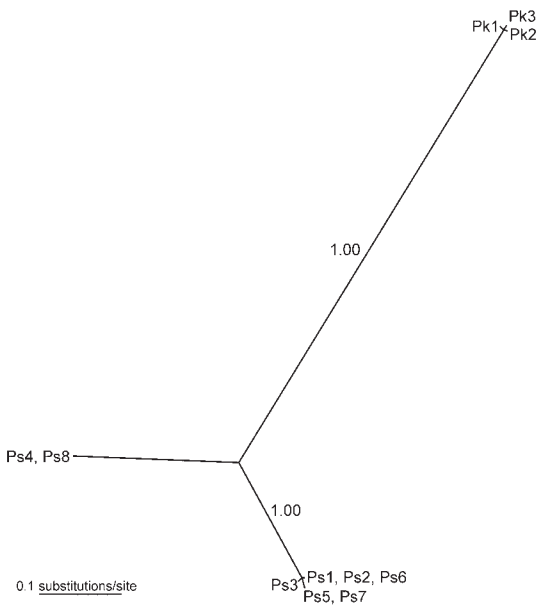
Uncorrected COI pairwise distances were calculated using PAUP* version 4.0b10 (Swofford 2002). Distances using the Kimura-2-Parameter (K2P) model (Kimura 1980) were also calculated for comparison with previously reported intraspecific distances in spiders (Robinson *et al.* 2009). Although K2P has been commonly used in most DNA barcoding studies (e.g., Robinson *et al.* 2009), there is no evidence that this model is better for species identification than simpler metrics such as uncorrected pairwise distances (Astrin *et al.* 2006; Collins *et al.* 2012).

Partitioned Bayesian analysis implemented in MrBayes version 3.1.2 (Ronquist & Huelsenbeck 2003) was used to estimate the COI phylogenetic tree topology. MrModeltest version 2.3 (Nylander 2008) implemented in PAUP* version 4.0b10 (Swofford 2002) was used to select the optimal model and model parameters. Within MrModeltest the Akaike Information Criterion was used for model selection (Posada & Buckley 2004). Based on the results of Brandley *et al*. (2005), the COI data were partitioned by codon with models selected for each codon; GTR+I (Lanave *et al.* 1984; Tavaré 1986) for the 1st and 3rd codon positions and HKY+I (Hasegawa *et al.* 1985) for the 2nd codon positions. Bayesian analysis was conducted by running two simultaneous, completely independent analyses each with four heated chains, sampling every 1000th tree. The analysis was run for 20 million generations, by which time the average standard deviation of split frequencies had dropped below 0.002, which indicated that the two tree samples had converged. Tracer version 1.5 (Rambaut & Drummond 2009) was also used to determine if the analyses had sufficient effective sample sizes. MrBayes was used to construct majority rule consensus trees, discarding the first 25% of trees generated as burn-in. TreeView 1.6.6 (Page 1996) was used to view and save trees in graphic format.

Results. A 1031 base pair (bp) COI fragment was sequenced from eight specimens of *P. suterii* and three specimens of *P. keani*. Four COI haplotypes occurred among the eight specimens of *P. suterii*. Each of the three specimens of *P. keani* had a different COI haplotype. Inter- and intraspecific uncorrected pairwise distances between COI sequences of *P. suterii* and *P. keani* are shown in Table 2. The minimum divergence between the two species was 13.0% (uncorrected) and the mean divergence was 13.5% (uncorrected). The mean intraspecific divergences in *P. suterii* and *P. keani*, were 4.0% (uncorrected) and 0.6% (uncorrected), respectively. The maximum intraspecific divergence in *P. suterii* was 8.6% (uncorrected, 9.2% K2P-distance) and was 0.7% (uncorrected and K2P-distance) in *P. keani*.

The 1360 bp fragments of 28S from two specimens of *P. suterii* were identical. The amplification of 28S from two specimens of *P. keani* (Pk1 and Pk2) was only partially successful with an 821 bp fragment from Pk1 and an 833 bp fragment from Pk2; however, the 281 bp overlap was identical. There were 12 nucleotides that varied between the two species.

The phylogenetic analysis of the COI data (Text-fig. 1) showed that *P. suterii* and *P. keani* are monophyletic with *P. suterii* divided into two clades.



Text-fig. 1 Unrooted Bayesian consensus tree based on cytochrome c oxidase subunit I (COI) sequence data. Values on branches are posterior probabilities. Specimen codes are listed in Table 1. Branch lengths are proportional to the expected number of substitutions per site (see scale bar).

Discussion. *Periegops* COI sequences were very similar or identical (Table 2) for specimens collected at the same sites; however, specimens of *P. suterii* collected at Kennedys Bush Reserve, in the west of the Banks Peninsula (Map 1), were 8.2–8.6% (8.7–9.2% K2P-distance) divergent from *P. suterii* specimens collected from three localities in the eastern Bank Peninsula (Map 1). This high divergence was not found in the slower evolving nuclear marker; 28S sequences were identical from specimens from Kennedys Bush Reserve and Montgomery Park Reserve (Map 1). We also did not observe any morphological differences between Kennedys Bush Reserve specimens and specimens collected from other locations on the Banks Peninsula; therefore we are confident that all specimens are one species, *P. suterii*. A difference of 8.7–9.2% (K2P-distance) in COI sequence divergence is very high in spiders; much more than the average maximum intraspecific divergence of 3.16% (K2P-distance) observed in other spiders (Robinson *et al.* 2009). However, higher intraspecific divergences (>10%) have been observed in other haplogynes (Astrin *et al.* 2006; Binford *et al.* 2008), Hypochilidae (Hedin 2001), and Mygalomorphae (Bond *et al*. 2001), so perhaps COI divergence is higher in ancestral spiders than it is in the Entelegynae. Nevertheless, it is curious that high (8.2–8.6%) COI divergence was observed between specimens from localities only just over 23 km apart and at similar altitudes, while there was much less divergence (0.7–1.3%) between specimens from eastern Bank Peninsula localities, which were 5–15 km apart. Specimens from localities between Kennedys Bush Reserve and Montgomery Park Reserve, such as Kaituna Valley, could reveal if COI divergence is correlated with distance or whether there has been some sort of genetic isolation between the east and west of Banks Peninsula, similar to the geographic distribution of two closely related weta species in the genus *Hemideina* (Townsend *et al*. 1997).

KEY TO NEW ZEALAND PERIEGOPIDAE

1 Tibia of leg I less than 0.7× length of carapace. When viewed retrolaterally, dorsal surface of cymbium of male pedipalp projects dorsally (Fig. 9). Flared flattened flanges near embolus tip (Fig. 6, 7). Found only on Banks Peninsula and Riccarton Bush (Map 1). ... .(p. 15)... ***Periegops suterii* (Urquhart)**

—Tibia of leg I more than 0.75× length of carapace. When viewed retrolaterally, dorsal surface of cymbium of male only slightly projects dorsally (Fig. 9). Flattened flanges near embolus tip not flared (Fig. 9a). Found only on Aldermen Islands and East Cape (Map 2). ..... (p. 17)…***Periegops keani* sp. nov.**

BIOSYSTEMATICS

Family PERIEGOPIDAE

Medium-sized, 3-clawed haplogyne spiders. 6 eyes in 3 widely separated diads (Fig. 1, 14, 15). Proclaw of legs I and II with double row of teeth, retroclaw with single row. Chelicerae with lamina on the ventral surface (Fig. 2) and slender maxillary lobes directed across the labium (Fig. 3). Male pedipalp simple, consisting of a bulb with a short embolus (Fig. 6–9). Slightly sclerotised area anterior to the epigastric furrow (Fig. 10, 11) and simple internal genitalia (Fig. 12, 13).

Genus *Periegops* Simon

Periegops Simon, 1893: 267. —Forster 1995: 93–94. Type species *Periegops hirsutus* Simon, 1893.

Description. Body length 5.9–10.0 mm. Carapace longer than wide, flat, without fovea, orange or orange-brown, darker anteriorly. 6 eyes in 3 widely separated diads; anterior median eyes absent. Chelicerae with lamina on ventral surface and membranous promarginal lobe with 5–7 setae (Fig. 2); 3 promarginal teeth and 1 reduced retromarginal tooth; fang length less than width of paturon; venom outlet anterior on fang (Labarque & Ramírez 2012; fig. 18A). Lateral surface of female chelicerae with stridulatory ridges (Labarque & Ramírez 2012; fig. 16A), with associated palpal femoral thorns (Labarque & Ramírez 2012; fig. 11A). Maxillae slender and more than 2× as long as wide, directed across the labium (Fig. 3). Legs in descending order of length usually I, IV, II, III, but legs I and IV sometimes subequal in females. Male tibiae of leg I with a row of strong setae on retrolateral surface (Fig. 4, 5). Proclaw of legs I and II with double row of teeth, retroclaw with single row. Both superior claws of legs II and IV a single row. Inferior claw of all tarsi with a single tooth. Male pedipalp simple with a bulb and a short embolus (Fig. 6–9); coiled sperm duct often visible within the bulb. Abdomen ovoid, dun or dirty cream usually with a distinct chevron pattern (Fig. 1, 14–16) and black setae. Slightly sclerotised area anterior to the epigastric furrow (Fig. 10, 11). Female internal genitalia simple, haplogyne, consisting of a rounded poreplate with many small invaginated cups (Fig. 12, 13). 6 spinnerets and small colulus; median surface of posterior median spinnerets with field of spicules (Labarque & Ramírez 2012; fig. 21F, 22E). Forster (1995) provided details of the respiratory system of *Periegops*.

Periegops suterii (Urquhart)

Fig. 1, 4, 6, 7, 10, 12, 14, 16; Map 1

Segestria suterii Urquhart, 1892: 230.

Periegops hirsutus Simon, 1893: 268, figs 223–224.—Synonymy by Chamberlain 1946: 88.

Periegops suteri (Urquhart) —Bryant 1935a: 53. —Bryant 1935b: 81, figs 4, 13, 25. —Chamberlain 1946: 88. —Forster 1967: 72, figs 81, 134. —Forster & Forster 1973: 151, figs 87b, 90. —Jocqué & Dippenaar-Schoeman 2006: 202, figs 78a–e. —Labarque & Ramírez 2012: 1, figs 1, 2A, 3A–B, 6A–B, 9A, 10A, 11A, 12A, 13A, 14A, 15A, 16A, 17A, 20A, 21, 22, 29A–B, 31A.

Periegops suterii (Urquhart) —Forster 1995: 94, figs 1–3, 6–14, 23, 24, 27, 31. —Forster & Forster 1999: 143, figs 1.14i, 10.9. —Paquin, Vink & Dupérré 2010: 37, figs 14.1–4.

Diagnosis. Distinguished from all other *Periegops* species by the shape of the embolus and cymbium of the male pedipalp. Flattened flanges near embolus tip more pronounced than those of *P. keani,* and embolus is shorter than that of *P. australia*. Dorsal surface of cymbium projects slightly more than that of *P. keani*, but much less than that of *P. australia*. Poreplate of internal genitalia not as rounded as that of *P. australia*. Leg I of males, females, and immatures shorter than in *P. keani*; tibia I less than 0.7× length of carapace. Found only on Banks Peninsula and Riccarton Bush in the South Island.

Description. Carapace: red-orange anteriorly, orange posteriorly; with sparse black setae; fovea absent. Sternum: orange. Leg I orange-brown, patella, distal ends of femur and tibia light orange; legs II, III, and IV yellow-brown, darker at proximal end of each leg segment. Abdomen: dun with black setae; black-brown chevron pattern (Fig. 1, 14, 16). Chelicerae red-brown. Male pedipalp simple with a bulb and a short embolus, which is flattened and

twisted, flaring out to 2 flanges just before the tip (Fig. 6, 7); coiled sperm duct often visible within the bulb. Slightly sclerotised area anterior to epigastric furrow (Fig. 10). Female internal genitalia simple, haplogyne, consisting of a rounded poreplate with many small invaginated cups (Fig. 12).

Dimensions (mm). Male MC, Kennedys Bush Reserve LUNZ 00012715 (female MC, Kennedys Bush Reserve LUNZ 00012718): total length 6.13 (7.92); carapace 3.06/2.05 (3.82/2.60), height 1.15 (1.71); abdomen 2.87/1.80 (4.12/2.60); sternum 1.64/1.05 (1.93/1.25).

	I	II	III	IV	Palp
Femur	2.43 (2.72)	2.13 (2.41)	1.84 (2.1)	2.35 (2.56)	0.65 (0.95)
Patella	0.85 (0.98)	0.8 (0.98)	0.73 (0.9)	0.8 (0.97)	0.27 (0.38)
Tibia	2.08 (2.15)	1.75 (1.93)	1.45 (1.65)	2.03 (2.3)	0.6 (0.63)
Metatarsus	2.16 (2.17)	1.82 (1.97)	1.62 (1.78)	2.07 (2.28)	
Tarsus	0.88 (0.85)	0.76 (0.83)	0.68 (0.73)	0.68 (0.73)	0.22 (0.78)
Total	8.4 (8.87)	7.26 (8.12)	6.32 (7.16)	7.93 (8.84)	1.74 (2.74)

Variation. Size range, mean. Male body length 5.9–7.4, 6.6, *n* = 12. Female body length 6.8–9.3, 8.1, *n* = 11. Male carapace length 3.0–3.7, 3.4, *n* = 12. Female carapace length 3.4–4.8, 3.9, *n* = 11.

The ratios of the length of tibia I to the length of the carapace (measured for all specimens, including immatures) were between 0.54 and 0.70. The ratio of leg I segment length to carapace length has also been shown to be a reliable character for the separation of other closely related spider species (Vink *et al*. 2008).

The chevron pattern on the abdomen (Fig. 1, 14, 16) was visible in all but one of the specimens examined, a male (LUNZ 00012715). Forster (1995) noted that a female collected at Riccarton Bush did not have abdominal markings.

Type data. Type of *Segestria suterii*: Not examined. Original description based on a female specimen from "Dyer's Pass, Canterbury", which was collected with 2 immature males by H. Suter (Urquhart 1892). Forster (1995) stated the type was in poor condition in the Canterbury Museum, Christchurch, New Zealand, where all of Urquhart's existing type specimens are housed (Court & Forster 1988; Nicholls *et al.* 2000; Paquin *et al.* 2008). However, the type of *Segestria suterii* was not included in the list of arachnid primary types held in Canterbury Museum (Nicholls *et al.* 2000). It was not possible to check whether the type specimen was present at Canterbury Museum, as the collections have not been accessible since the Christchurch earthquake in February 2011 (S. D. Pollard, pers. comm.). The type is not in OMNZ (C. Fraser, pers. comm.), which houses New Zealand's largest collection of spiders. It is possible that the type was amongst specimens at Ray Forster's house at the time of his death and has as yet not been located. We consider the type of *Segestria suterii* missing, but not lost.

Type of *Periegops hirsutus*: Not examined. Original description based on a female specimen from an undisclosed location in New Zealand (Simon 1893). Although many of Simon's type specimens are housed in the Muséum national d'Histoire naturelle, Paris, France, the type of *Periegops hirsutus* could not be found there (C. Rollard, pers. comm.).

Material examined. 32 non-type specimens (15 males, 15 females, 2 subadult females) — see Appendix B for collection details of specimens examined.

Distribution (Map 1)**.** Found only on Banks Peninsula and Riccarton Bush (MC). Forster (1995) and Vink (2006) listed localities where *P. suterii* specimens have been found. Riccarton Bush is the only site outside of the Banks Peninsula where *P. suterii* has been found (in 1994), but subsequent searches there (Chinn 2006; Vink 2006) have failed to find it.

Biology. *Periegops suterii* has been found in forest with a deep leaf litter layer and well-drained soil. It has been found under logs and rocks, and in leaf litter, in both beech and podocarp forest. Within suitable locations, *P. suterii* has a patchy distribution, but specimens are often found years apart in the same specific locations. *Periegops suterii* does not appear to build a web for prey capture, but it does produce dragline silk and builds silken retreats. The lack of webs and their presence in pitfall traps suggest that it is a cursorial, night-time hunter. On two occasions a single female has been found together with two or three males under logs and rocks (Forster 1995; Vink 2006), which implies that the female might possess some method of attracting males. Forster (1995) suggested pheromones, but it could also be stridulation; Forster (1995) did not notice the stridulatory ridges on the chelicerae. Adults have been found from August to May.

DNA. Nine cytochrome *c* oxidase subunit 1 and two 28S rRNA sequences for this species are listed in GenBank (www.ncbi.nlm.nih.gov/GenBank/) under accession numbers EF537066, JX017353, JX017357, JX174281–JX174287, and JX174291.

Remarks. Although the types of *Segestria suterii* and *Periegops hirsutus* were not examined, we have no reason to doubt that these species are synonymous, as Chamberlain (1946) examined the type specimens of both species. Forster (1995: 92) stated that it can "be reliably assumed" that the type of *P. hirsutus* "came from the same locality as Urquhart's *Segestria suterii*." Also, Simon (1893) noted that the type specimen of *P. hirsutus* was 8 mm long, which is within the range of female body lengths we observed for *P. suterii*.

Despite the common usage of the name *Periegops suteri*, the correct original spelling of the specific epithet is *suterii* (as *Segestria suterii* Urquhart, 1892). Article 33.4 in the fourth edition of the *International Code of Zoological Nomenclature* (International Commission on Zoological Nomenclature 1999) states the change from *-i* to *-ii* is an incorrect subsequent spelling. There is provision in the *International Code of Zoological Nomenclature* for prevailing usage of an unjustified emendation (article 33.2.3.1) or incorrect subsequent spelling (article 33.3.1); however, *suteri* is not an emendation but an incorrect subsequent spelling and article 33.4 is an exception to articles 33.2.3.1 and 33.3.1. Both spellings have been used; *P. suterii* by Forster(1995), Forster & Forster (1999), Paquin *et al.* (2010), and Sirvid *et al*. (2011, 2012), and *P. suteri* by Bryant (1935a, b), Chamberlain (1946), Forster (1967), Forster & Forster (1973), Vink (2006), Jocqué & Dippenaar-Schoeman (2006), Brockerhoff *et al.* (2008), Platnick (2012), and Labarque & Ramírez (2012). As this is not a case of prevailing usage of an incorrect subsequent spelling (article 33.3.1) and article 33.4 is quite clear on the matter, we advocate for and use the correct original spelling.

Periegops keani new species

Fig. 2, 3, 5, 9, 15; Map 2

Diagnosis. Distinguished from all other *Periegops* species by shape of embolus and cymbium of the male pedipalp. Flattened flanges near embolus tip not as pronounced as those of *P. suterii* and embolus shorter than that of *P. australia*. Dorsal surface of cymbium projects only slightly, less than that of *P. suterii* and much less than that of *P. australia*. Leg I of male and immatures longer than in *P. suterii*; tibia I more than 0.75× length of carapace. Found only on the Aldermen Islands and East Cape in the North Island.

Description. Carapace: dark orange-brown anteriorly, orange-brown posteriorly; with sparse black setae; fovea absent. Sternum: light orange brown. Leg I dark orange-brown, patella, distal ends of femur, and tibia orange-brown; legs II, III, and IV orange-brown, darker at proximal end of each leg segment. Abdomen: dirty cream with black setae; chevron pattern barely visible (Fig. 15). Chelicerae red-brown. Male pedipalp simple with a bulb and a short embolus, which is flattened and twisted, flaring out slightly to 2 flanges just before the tip (Fig. 9); coiled sperm duct visible within the bulb. Female unknown.

Dimensions (mm). Male holotype: total length 10.03; carapace 4.99/3.48, height 1.66; abdomen 5.25/3.75; sternum 2.40/1.90.

	I	II	III	IV	Palp
Femur	4.99	4.26	3.73	4.41	1.01
Patella	1.41	1.08	1.21	1.26	0.45
Tibia	4.39	3.83	2.97	4.13	0.96
Metatarsus	4.44	3.88	3.23	3.98	
Tarsus	1.31	1.26	1.01	1.26*	0.45
Total	16.54	14.31	12.15	15.04	2.87

*Both tarsi IV were damaged so the length was estimated based on the proportions observed in immature species of *P. keani*.

Variation. The holotype male was the only specimen that did not have abdominal markings; all of the other subadult and immature specimens had a chevron pattern on the abdomen, like that of *P. suterii* (Fig. 1, 14, 16).

The ratios of the length of tibia I to the length of the carapace (measured for all specimens, including immatures) were between 0.77 and 0.88. Based on what we observed for *P. suterii*, it seems likely that female *P. keani* will have a tibia/carapace ratio within that range.

Type data. Holotype: male (LUNZ 00012716) labelled "NEW ZEALAND, CL, Ruamahuanui Island; 36°57.25'S, 176°05.52'E; NW campsite, under rock; 23 Mar 2012, C.J. Vink & J.M. Kean" (LUNZ).

Material examined. Type specimen plus 7 non-type specimens (1 subadult male, 1 subadult female, 5 immatures) — see Appendix B for collection details of specimens examined.

Distribution (Map 2). Found only on the Aldermen Islands and East Cape (CL, GB).

Biology. *Periegops keani* has been found in forest with a deep leaf litter layer and well-drained soil. On the forest floor it has been found under rocks and in a *Stanwellia* sp. (Araneae: Nemesiidae) burrow (Forster 1995). *Periegops keani* does not appear to build a web for prey capture and

probably builds silken retreats, like *P. suterii*. The lack of webs suggests that it is a cursorial, night-time hunter. Adults have been found in March and September, but given that the climates it is found in are milder than those of *P. suterii*, it seems likely that adults occur throughout the year.

DNA. Three cytochrome *c* oxidase subunit 1 and two 28S rRNA sequences for this species are listed in GenBank (www.ncbi.nlm.nih.gov/GenBank/) under accession numbers JX174288–JX174290, JX174292, and JX174293.

Etymology. The specific name is in honour of the senior author's friend and colleague, John Kean, who helped collect the type specimen.

Remarks. The bulb of the holotype was not oriented to the same angle with respect to the cymbium (Fig. 9) as the specimens illustrated of *P. suterii* (Fig. 6, 7) and *P. australia* (Fig. 8); however, when oriented in a slight dorsal direction (Fig. 9a), it looks the same as those of *P. suterii*, other than the flattened flanges near the embolus tip, which are not as pronounced in *P. keani*.

We consider that a female specimen found in forest below the East Cape Lighthouse is *P. keani*. Forster (1995) remarked that the genitalia of this specimen was indistinguishable from that of *P. suterii*. The female specimen from East Cape was collected by Grace Hall (NZAC) on 30 September 1993 and was loaned to the late Ray Forster, but has not been returned to NZAC (G. Hall pers. comm.) and it has not been located at OMNZ (C. Fraser, pers. comm.). Unsuccessful searches for further specimens have been conducted in the small (~10 hectare) patch of forest below the East Cape Lighthouse in October 1994 (G. Hall), February 1995 (G. Hall), September 1995 (G. Hall & P. J. Sirvid), November 1995 (G. Hall & L. J. Boutin), December 2009 (G. Hall), November 2010 (J. Malumbres-Olarte) and February 2012 (C. J. Vink). Searches of the forest floor (including rock and log turning) were conducted in all trips, *Stanwellia* sp. burrows were searched in most trips, and pitfall trapping and litter searches were also conducted in the former and later trips. *Periegops keani* may conceivably now be extinct from that site.

It is possible that the population at East Cape could be a separate species to *P. keani*, as *Periegops* probably has limited dispersal ability. Although the Aldermen Islands and East Cape are 233 km apart, the Aldermen Islands would have been connected to the mainland from the Last Glacial Maximum (McKinnon 1997; Trewick & Bland 2012) up until 12000 years ago (Schofield & Thompson 1964; McKinnon 1997) and there would have been continuous forest between the two sites (McKinnon 1997; Trewick & Bland 2012). If a fresh specimen could be located at East Cape, 28S sequence data could confirm whether they were the same species.

Forster & Forster (1999) stated that they had examined a female specimen from the Aldermen Islands. This specimen was collected from Ruamahuaiti Island in November 1972 and loaned to Ray Forster from NZAC (G. Hall, pers. comm.). We have examined this specimen and determined it to be a subadult male, as it has swollen palpal tibiae, which are characteristic of males in their final moult before adulthood. The specimen did not have an epigyne or internal genitalia and we believe Forster & Forster (1999) made a typographical error in stating the specimen was female. We consider that this specimen is *P. keani*. Ruamahuaiti Island is only 2 km from Ruamahuanui Island and the land below the two islands is no more than 20 m under the sea (Hayward & Moore 1973), therefore, the two populations would have been connected up until 9000 years ago (Schofield & Thompson 1964; McKinnon 1997).

Size may help differentiate *P. keani* from *P. suterii* even though we have only examined a single adult specimen of the former species. The subadult male from Ruamahuaiti Island is larger (body length = 8.8 mm, carapace length = 4.3 mm) than any of the 11 adult male *P. suterii* that we have examined. Also, a *P. keani* specimen (MONZ AS.002301) that appeared to be one or two moults from adulthood was larger (body length = 9.3, carapace length = 3.9) than five of the 11 adult specimens of *P. suterii* examined; based on this and the size of the male, it would be reasonable to expect an adult female *P. keani* to be larger than any *P. suterii* female.

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APPENDIX A: Glossary of technical terms

abdomen — posterior division of the spider body; sometimes referred to as the opisthosoma

bulb — refers to the male pedipalpal organ as a whole

carapace — the hard dorsal covering of the cephalothorax

cephalothorax — anterior division of the spider body; sometimes referred to as the prosoma

chelicerae — first pair of appendages of the cephalothorax, consisting of two segments (the distal segment is called the fang, basal segment is called the paturon)

coxa — first or basal segment of the legs

cymbium — tarsus of the adult male pedipalp

distal — near the apex

dorsal — upper (surface)

epigastric furrow — a transverse groove across the anterior ventral part of the abdomen

epigyne — the sclerotised region of female spiders covering the internal genitalia and located between the book lungs and anterior of the epigastric furrow

embolus — the intromittent structure of the bulb containing the terminal portion of the ejaculatory duct

femur — third segment of the legs and pedipalps

fovea — depression on the thoracic region of the carapace where muscles of sucking stomach are attached internally

haplogyne — the primitive form of spider genitalia where the female has the copulatory openings internally, within the gonopore, and typically lacks a sclerotised epigyne, and the male has relatively simple pedipalps. This form is found in the basal spiders, including Mygalomorphae, Gradungulidae and Haplogynae.

maxilla — (= endite) the expanded lobe of the palpal coxa situated laterally of the labium (plural **maxillae**)

metatarsus — sixth segment of the legs; absent in the pedipalps

paturon — the basal segment of a chelicerae

pedipalp — six-segmented second appendage of the cephalothorax, anterior to legs I

patella — fourth segment of the legs and pedipalp

promarginal — anterior margin

proximal — near the base

retrolateral — on the outer side i.e., the surface nearer to the posterior end of the body

retromarginal — posterior margin

sclerotised — hardened by sclerotin or other substances in the cuticle

seta — a sclerotised hair-like projection arising from the cuticle (plural **setae**)

sternum — plate on the ventral surface of the cephalothorax between the coxae of the legs

tarsus — last segment of the legs and pedipalp

tibia — fifth segment of legs and pedipalp

trochanter — second segment of the leg and pedipalp

ventral — lower (surface)

APPENDIX B: Collection details of specimens examined. Localities (including coordinates) and dates collected, collectors, and institutions of specimens examined.

Periegops suterii

MC. 3 ♂, 1 ♀, Riccarton Bush, 43°31.7'S, 172°35.7'E, 9 Apr 1994, A. D. Blest, OMNZ IV35925; 1 ♂, Kennedys Bush Reserve, 43°37.9'S, 172°37.3'E, 22 Apr 2011, C. J. Vink, H. P. & L. J. Hudson Vink, LUNZ 00012715; 1 ♀, Kennedys Bush Reserve, 43°37.9'S, 172°37.3'E, 13 Aug 2011, C. J. Vink & H. P. Hudson Vink, LUNZ 00012718; 1 ♀, Kennedys Bush Reserve, 43°37.9'S, 172°37.3'E, 13 Aug 2011, C. J. Vink & H. P. Hudson Vink, LUNZ 00012719; 1 ♂, Rhodes Bush, 43°40'S, 172°37'E, 13 Nov 1915, G. Archey, OMNZ IV35927; 1 ♀, Hay Reserve, 43°42.18'S, 172°53.87'E, 13 Mar 2003, C. J. Vink, LUNZ 00012720; 2 ♀, Kaituna Valley, 43°43'S, 172°45'E, 11 Sep 1949, R. R. Forster, OMNZ IV35923; 1 ♂, Montgomery Park Reserve, 43°44.7'S, 172°52.2'E, 5 Nov 2010, C. J. Vink & J. Malumbres-Olarte, LUNZ 00012721; 1 ♂, Montgomery Park Reserve, 43°44.7'S, 172°52.2'E, 5 Nov 2010, C. J. Vink & J. Malumbres-Olarte, LUNZ 00012722; 1 ♂, Montgomery Park Reserve, 43°44.7'S, 172°52.2'E, 5 Nov 2010, C. J. Vink & J. Malumbres-Olarte, LUNZ 00012723; 1 ♂, Montgomery Park Reserve, 43°44.7'S, 172°52.2'E, 5 Nov 2010, J. Malumbres-Olarte & C. J. Vink, LUNZ 00012724; 1 ♀, 1 subadult ♀, Montgomery Park Reserve, 43°44.7'S, 172°52.2'E, 5 Nov 2010, J. Malumbres-Olarte & C. J. Vink, LUNZ 00012725; 1 ♀, Panama Rock , 43°44.77'S, 173°02.49'E, 12 Jan 2011, M. H. Bowie, LUNZ 00012726; 1 ♀, Panama Rock , 43°44.77'S, 173°02.49'E, 12 Jan 2011, M. H. Bowie, LUNZ 00012727; 1 ♂, Otepatotu Reserve, 43°44.90'S, 173°00.95'E, 4 Jan 2011, M. H. Bowie, LUNZ 00012728; 1 ♂, Otepatotu Reserve, 43°44.90'S, 173°00.95'E, 12 Jan 2011, M. H. Bowie, LUNZ 00012729; 1 ♀, Otepatotu Reserve, 43°44.90'S, 173°00.95'E, 4 Jan 2011, M. H. Bowie, LUNZ 00012730; 1 ♀, Otepatotu Reserve, 43°44.93'S, 173°00.95'E, 12 Jan 2011, M. H. Bowie, LUNZ 00012731; 1 ♂, Tititipounamu , 43°45.47'S, 173°01.44'E, 4 Jan 2011, M. H. Bowie, LUNZ 00012732; 1 ♀, Little River, 43°46'S, 172°47'E, 10 Jan 1985, A. C. Harris, OMNZ IV35924; 1 ♂, Ellangowan Reserve, 43°47.89'S, 173°02.08'E, 12 Jan 2011, M. H. Bowie, LUNZ 00012733; 1 ♂, Hinewai Reserve, 43°48.59'S, 173°01.28'E, 11 Oct 2002, C. J. Vink, AMNH ARAMR-000615; 1 ♀, Hinewai Reserve, 43°48.59'S, 173°01.28'E, 11 Oct 2002, C. J. Vink, AMNH ARAMR-000616; 1 ♀, Hinewai Reserve, 43°48.6'S, 173°01.3'E, 27 Aug 1996, C. J. Vink, LUNZ 00012734; 1 ♂, Hinewai Reserve, 43°48.69'S, 173°00.95'E, 11 Jan 2011, M. H. Bowie, LUNZ 00012735; 1 ♀, Akaroa, 43°48.8'S, 172°57.5'E, 16 Oct 1920, G. Archey, OMNZ IV35928; 1 subadult ♀, Fishermans Bay , 43°49.54'S, 173°03.85'E, 21 Dec 2010, M. H. Bowie, LUNZ 00012736.

Periegops keani

CL. 1 immature, Ruamahuanui Island, 36°57.3'S,176°05.5'E, 7 Nov 2002, M. D. Wakelin, MONZ AS.002302; 1 immature, Ruamahuanui Island, 36°57.25'S, 176°05.52'E, 19 Nov 2003, B. M. Fitzgerald, MONZ AS.002310; 1 immature, Ruamahuanui Island, 36°57.25'S, 176°05.52'E, 19 Nov 2003, B. M. Fitzgerald, MONZ AS.002300; holotype ♂, Ruamahuanui Island, 36°57.25'S, 176°05.52'E, 23 Mar 2012, C. J. Vink & J. M. Kean, LUNZ 00012716; 1 immature, Ruamahuanui Island, 36°57.25'S, 176°05.52'E, 23 Mar 2012, C. J. Vink & J. M. Kean, LUNZ 00012717; 1 subadult ♀, 1 immature, Ruamahuanui Island, 36°57.25'S, 176°05.52'E, 18 Apr 2005, B. M. Fitzgerald & P. MacDonald, MONZ AS.002301; 1 subadult ♂, Ruamahuaiti Island, 36°58.5'S, 176°05'E, 8-12 November 1972, G. W. Ramsay, NZAC.

ILLUSTRATIONS

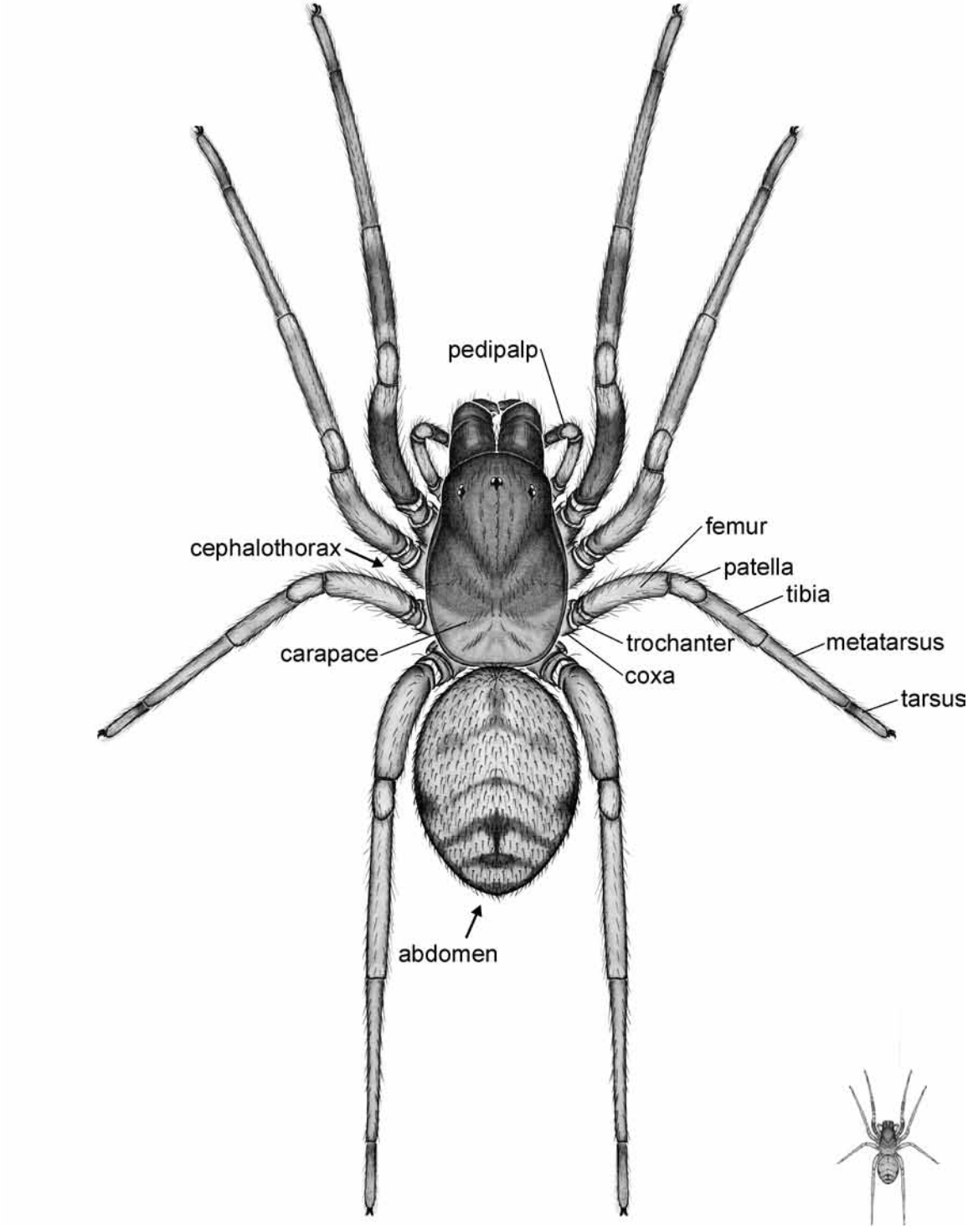
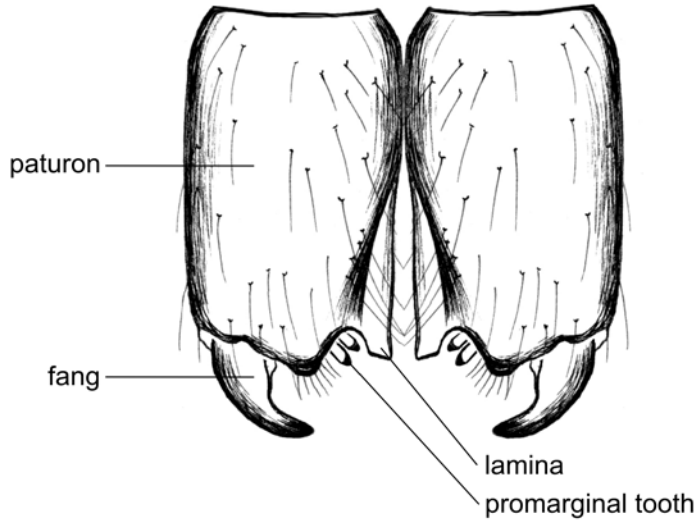
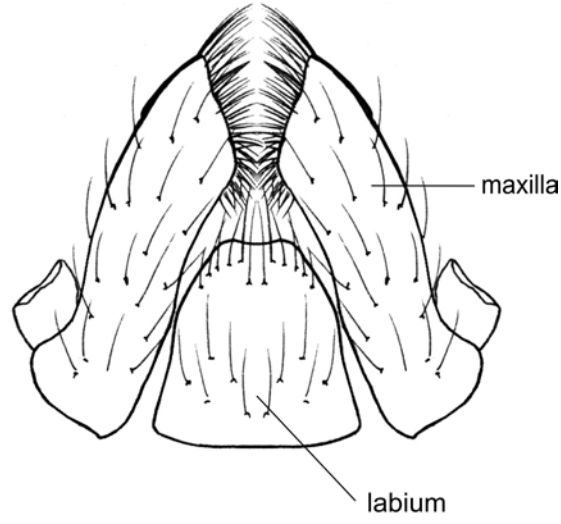


Fig. 1 Schematic dorsal view, *Periegops suterii*, female (LUNZ 00012720). Actual size on the right.

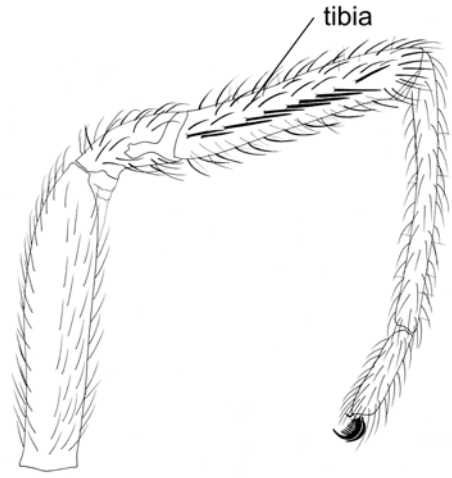


(2) Anterior view of chelicerae

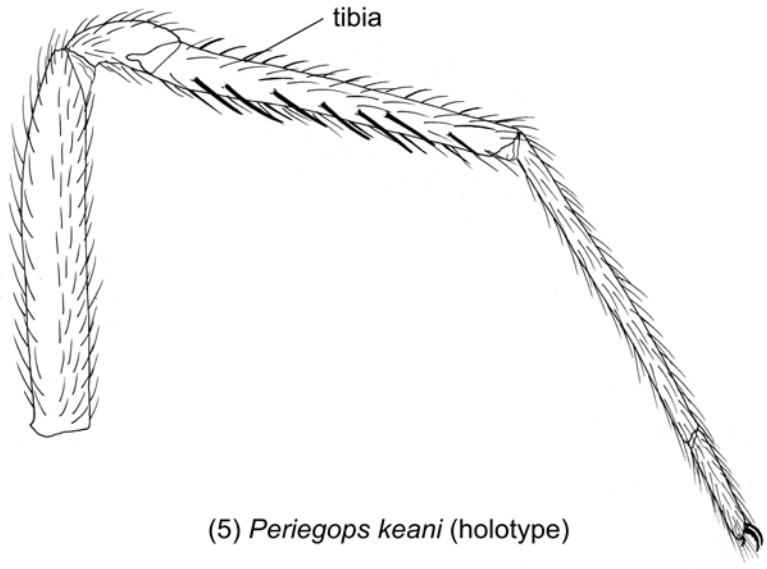


(3) Ventral view of mouthparts

Fig. 2, 3 *Periegops keani* (holotype): (2) anterior view of chelicerae; (3) ventral view of mouthparts.



(4) *Periegops suterii*



(5) *Periegops keani* (holotype)

Fig. 4, 5 Retrolateral view of leg I: (4) *Periegops suterii* (LUNZ 00012722); (5) *Periegops keani* (holotype).

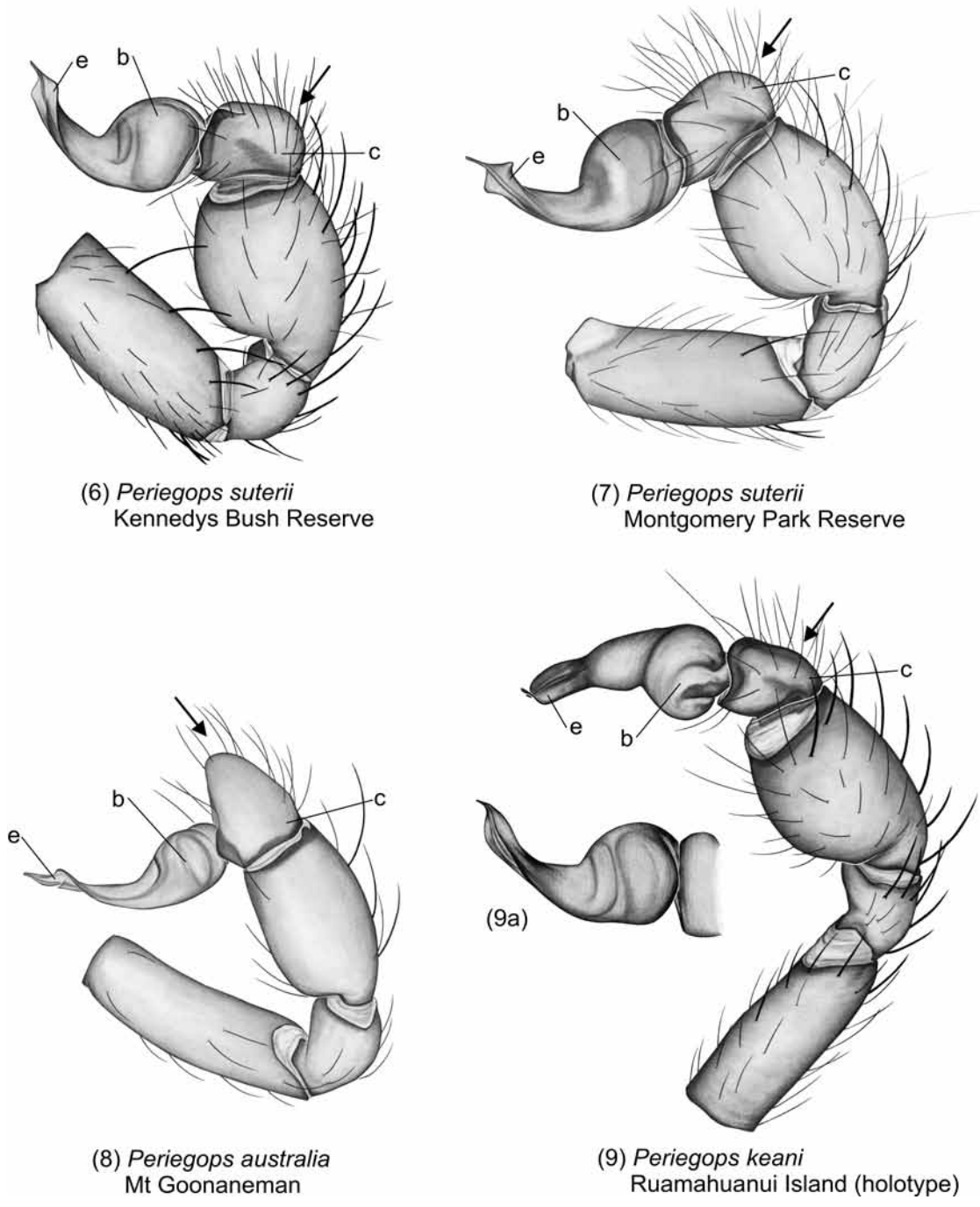
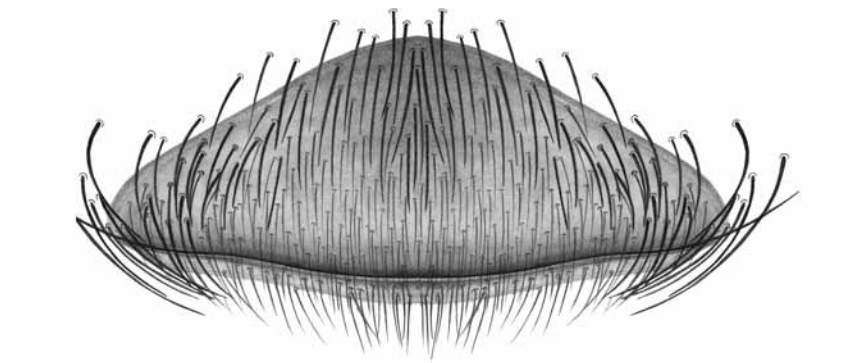
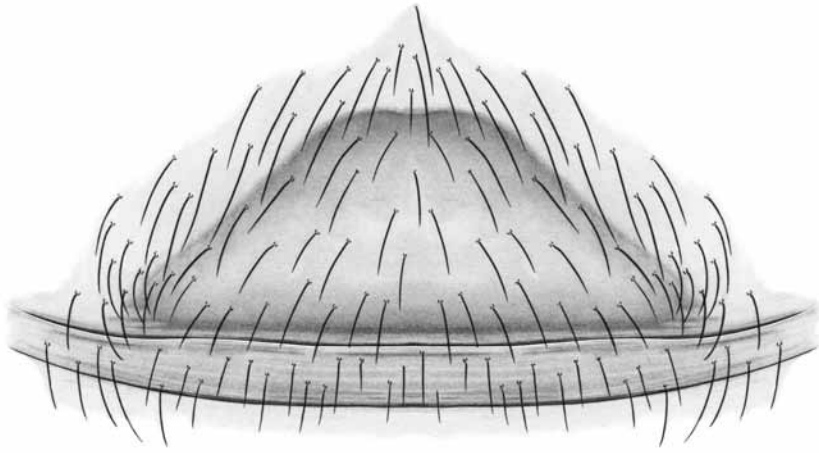


Fig. 6–9 Retrolateral view of left male pedipalps (b – bulb; c – cymbium; e – embolus), arrow indicates dorsal projection on the cymbium: (6) *Periegops suterii*, Kennedys Bush Reserve (LUNZ 00012715); (7) *Periegops suterii*, Montgomery Park Reserve (LUNZ 00012721); (8) *Periegops australia*, Mt Goonaneman (QMB S20421); (9) *Periegops keani*, Ruamahuanui Island (holotype) (9a = laterodorsal view of bulb and cymbium).

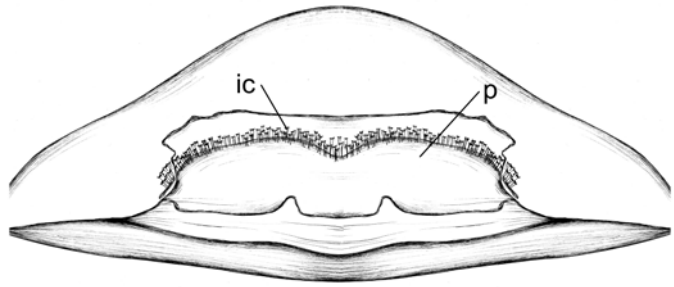


(10) *Periegops suterii*
Hay Reserve

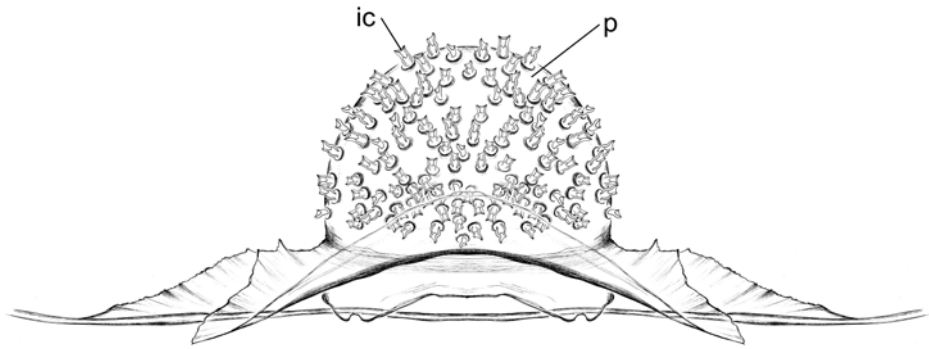


(11) *Periegops australia*
Mt Goonaneman

Fig. 10, 11 Ventral view of female epigastric area: (10) *Periegops suterii*, Hay Reserve (LUNZ 00012720); (11) *Periegops australia*, Mt Goonaneman (QMB S20419).



(12) *Periegops suterii*
Hay Reserve



(13) *Periegops australia*
Mt Goonaneman

Fig. 12, 13 Dorsal view of female internal genitalia (p – poreplate; ic – invaginated cup): (12) *Periegops suterii*, Hay Reserve (LUNZ 00012720); (13) *Periegops australia*, Mt Goonaneman (QMB S20419).

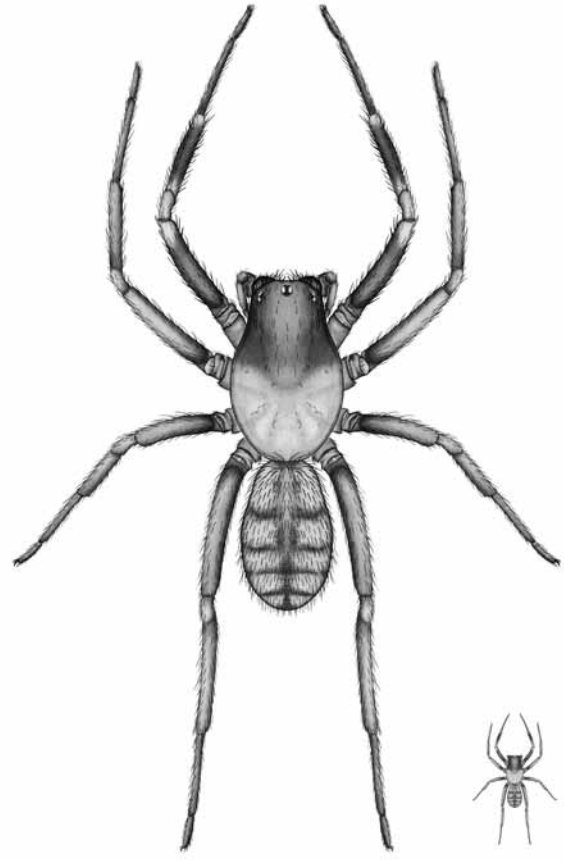


Fig. 14 Dorsal view of *Periegops suterii*, male (LUNZ 00012721). Actual size on the right.

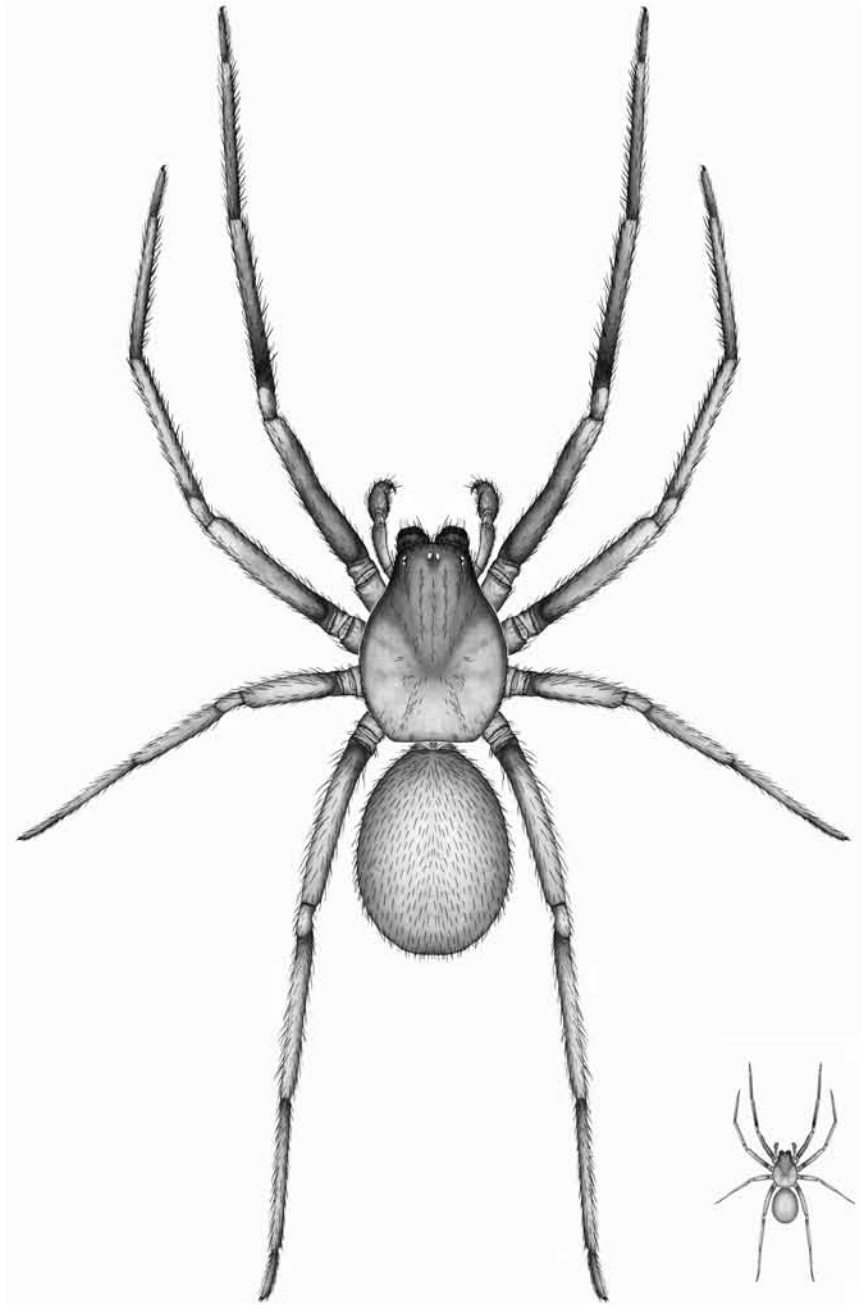


Fig. 15 Dorsal view of *Periegops keani*, male (holotype). Actual size on the right.

Fig. 16 Photograph of *Periegops suterii*, female (LUNZ 00012718). Photographer: Bryce McQuillan.

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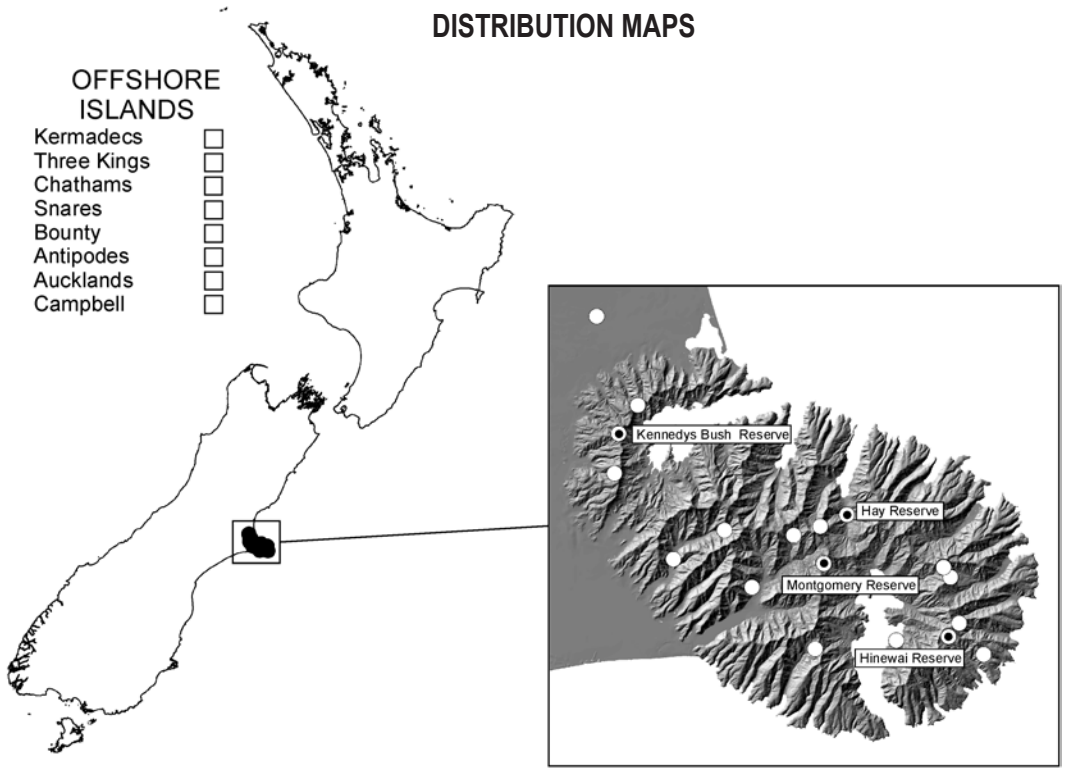
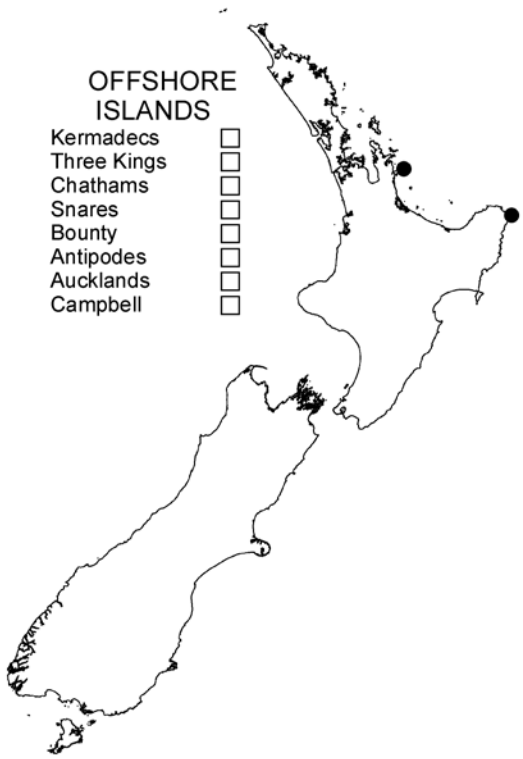


Map 1 Collection localities, *Periegops suterii*. Inset shows localities on and near Banks Peninsula, and labelled locations indicate collection sites for DNA specimens.



Map 2 Collection localities, *Periegops keani*.

TAXONOMIC INDEX

Page numbers in **bold** type denote a description, and in italic type illustrations. A suffixed letter 'k' indicates a key, and 'm' a map.

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Drymusa 9
Drymusidae 9
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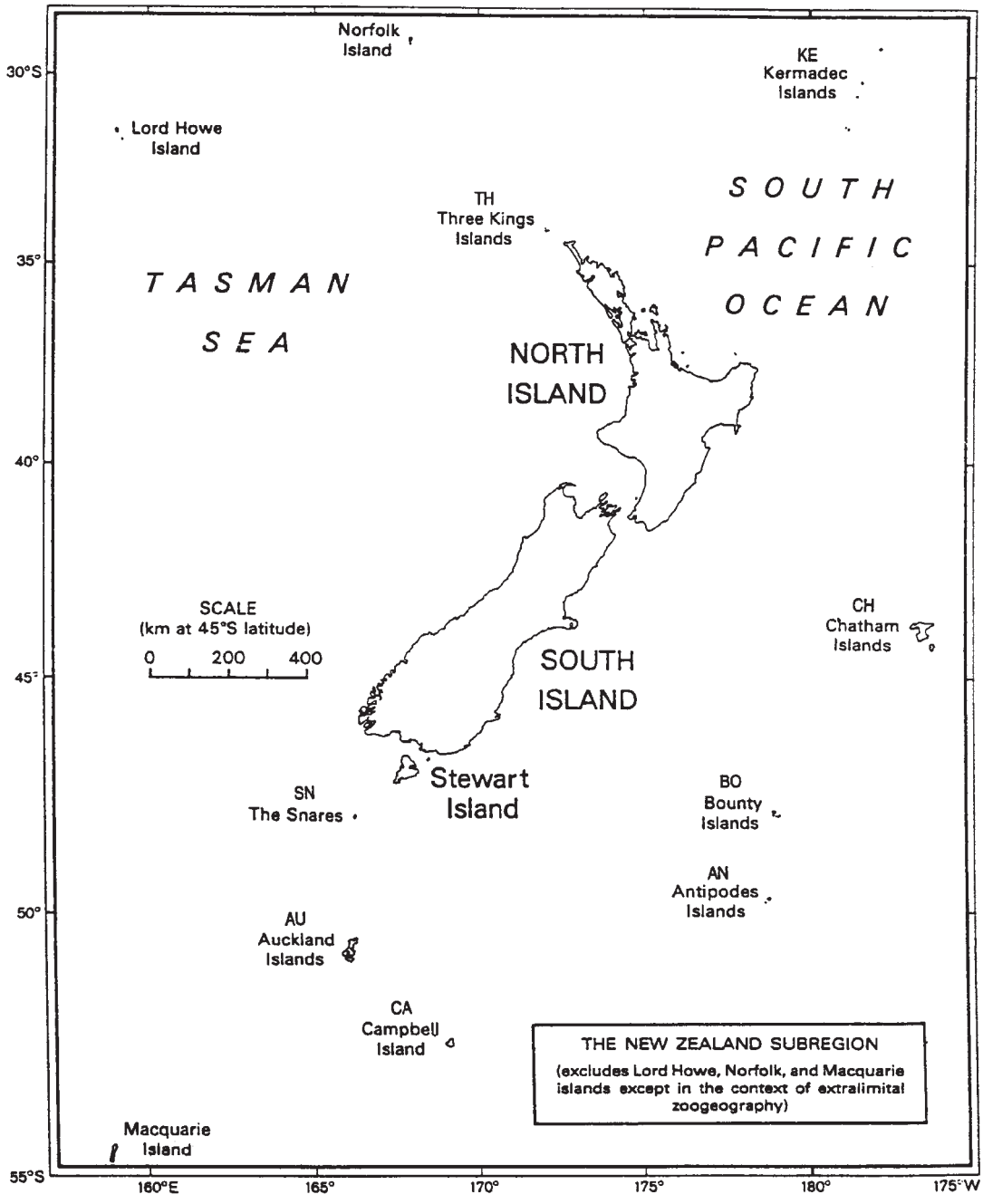
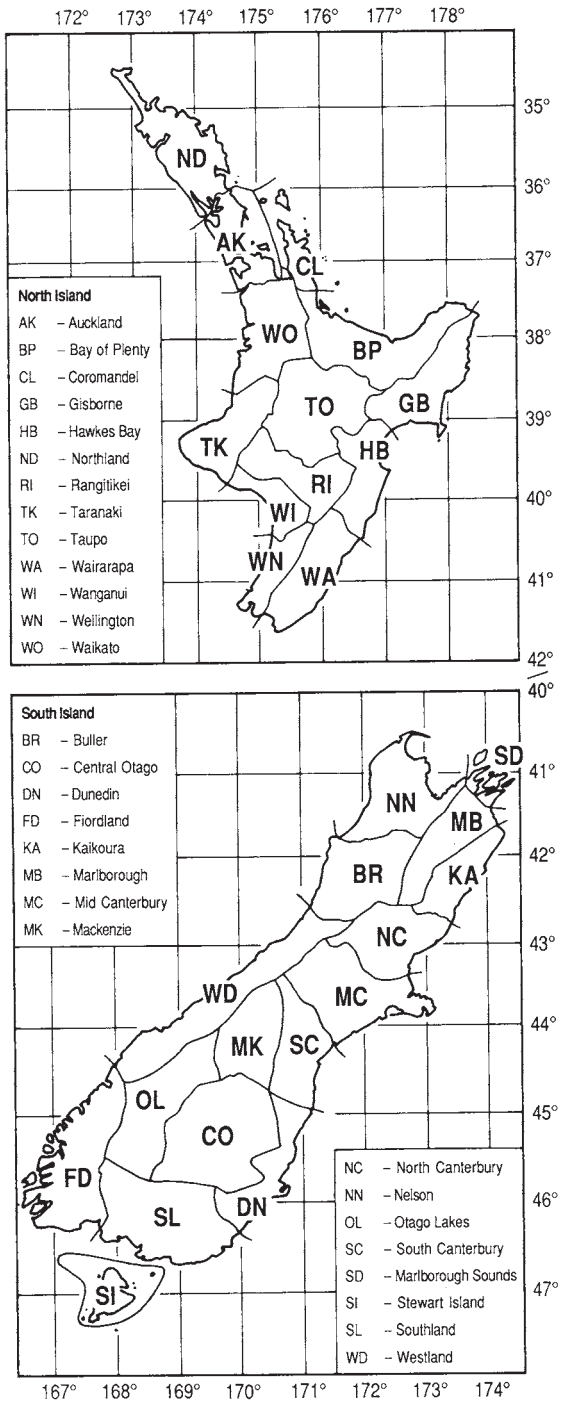
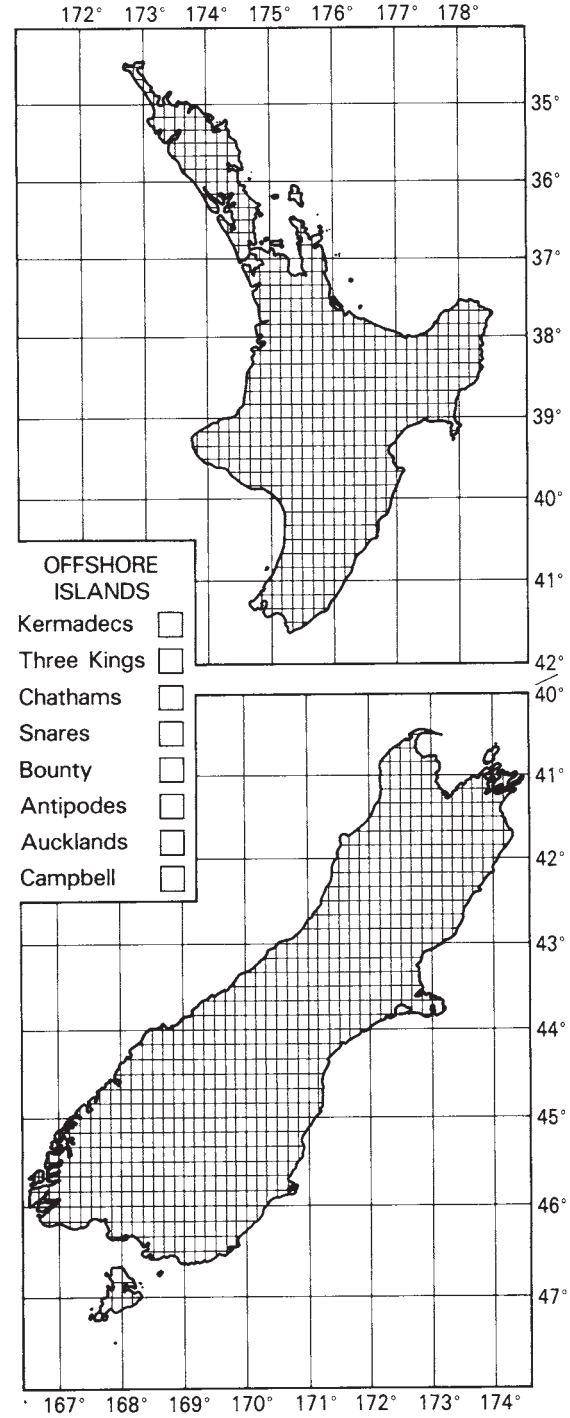

Norfolk Island
KE Kermadec Islands
Lord Howe Island
TH Three Kings Islands
SOUTH PACIFIC OCEAN
TASMAN SEA
NORTH ISLAND
SOUTH ISLAND
Stewart Island
SCALE (km at 45°S latitude)
0 200 400
CH Chatham Islands
SN The Snares
BO Bounty Islands
AN Antipodes Islands
AU Auckland Islands
CA Campbell Island
Macquarie Island
THE NEW ZEALAND SUBREGION
(excludes Lord Howe, Norfolk, and Macquarie islands except in the context of extralimital zoogeography)
30°S
35°
40°
45°
50°
55°S
160°E
165°
170°
175°
180°
175°W



Area codes and boundaries used to categorise specimen locality data (after Crosby *et al.* 1976)



Base-map for plotting collection localities; this may be photocopied without copyright release

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