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(continued on page 3)

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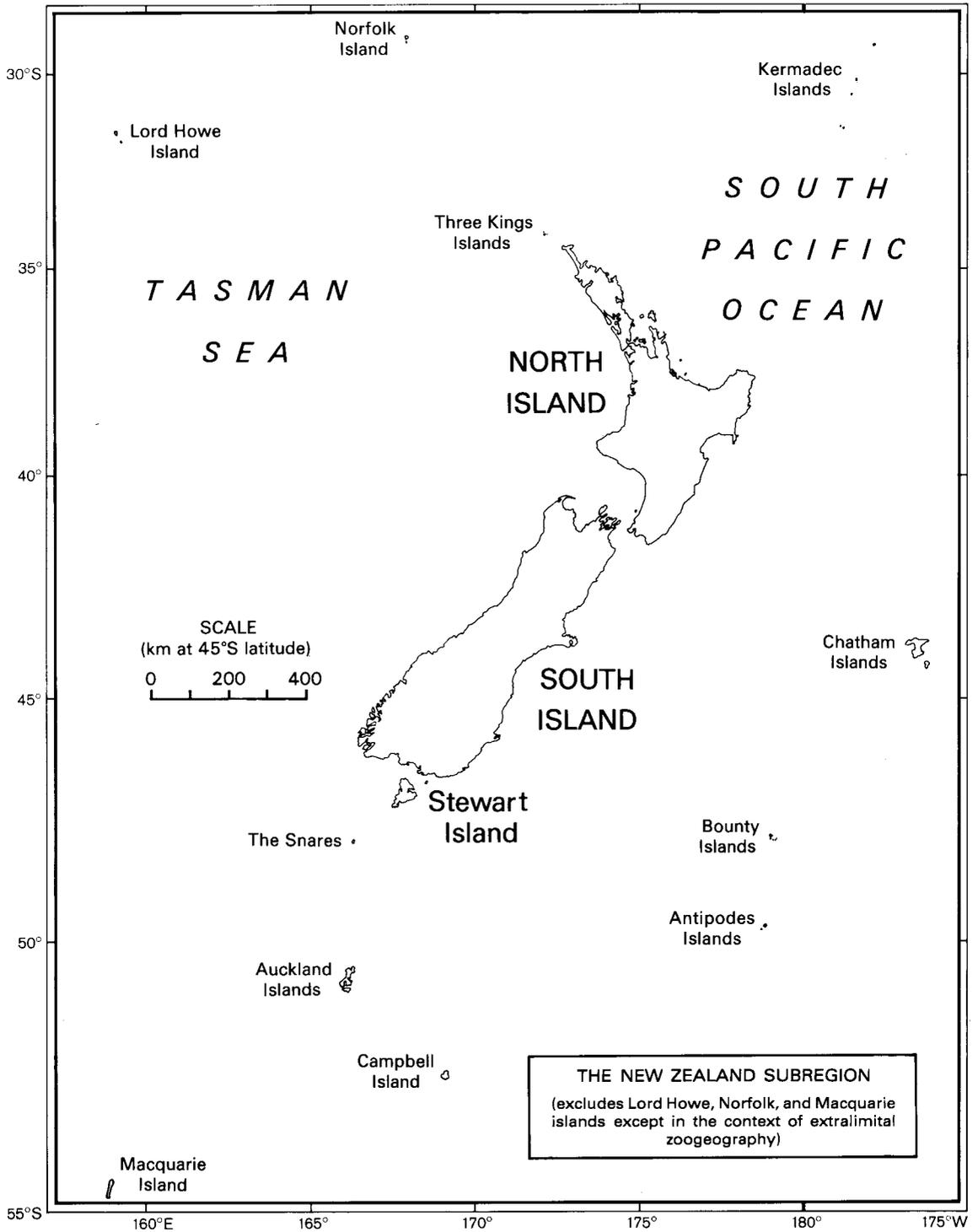
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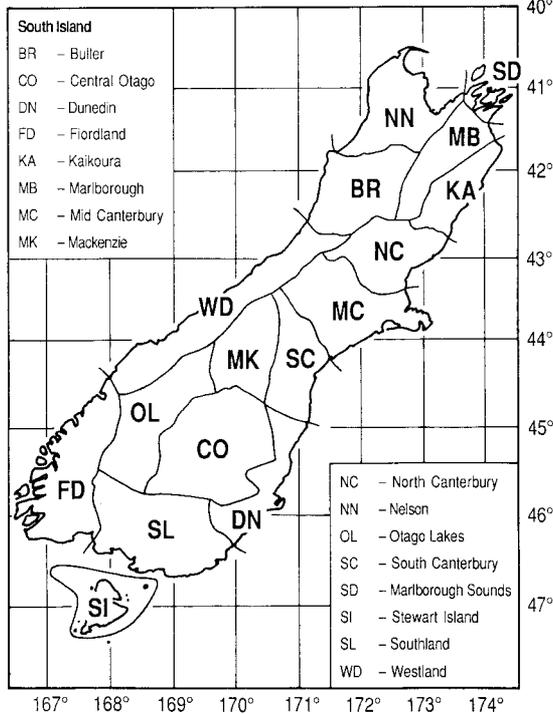
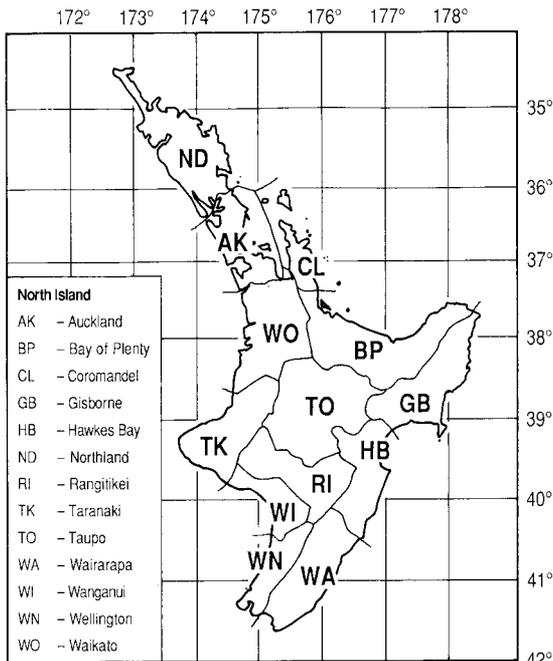
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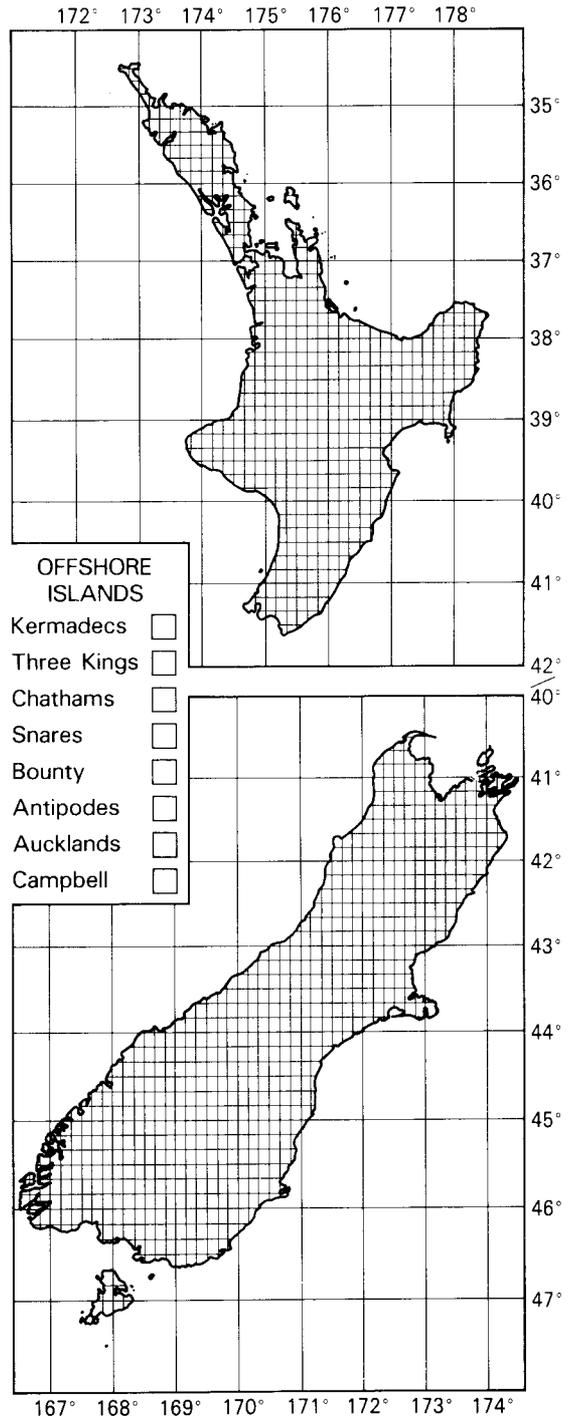
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E toe ana nga pukapuka o mua. Mehemea e hiahia ana koe ki te katoa o nga pukapuka, toona mai kia heke iho te utu. E rua pai heneti te heke iho o te utu ki nga toa hoko pukapuka.

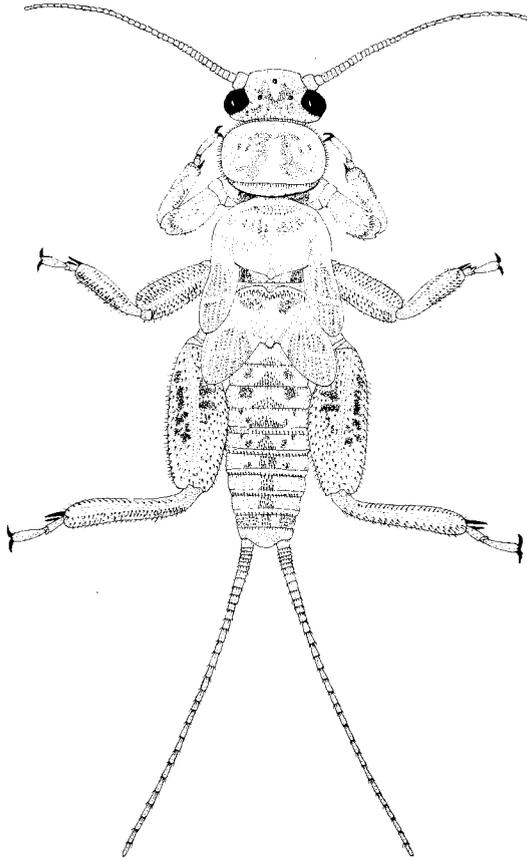




Area codes and boundaries used to categorise specimen locality data (after Crosby *et al.* 1976)



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



Frontispiece Nymph of *Halticoperla gibbsi* (artist: I.D. McLellan)

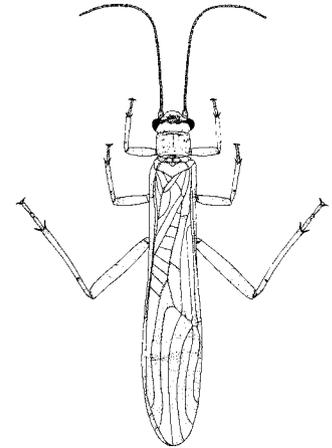
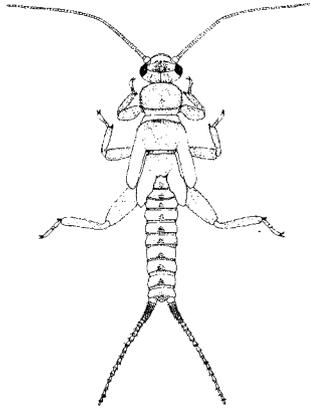
Notonemouridae

(Insecta: Plecoptera)

I. D. McLellan

P.O. Box 95
Westport
New Zealand

ILLUSTRATION
Spaniocerca zelandica,
nymph and adult female



Popular summary

The Notonemouridae are one of four families of stoneflies in New Zealand. Their juvenile stages (nymphs) live in freshwater habitats such as water films, streams, and underground gravels with a flowing water table.

Nymphs moult several times before emerging as soft-bodied, four-winged adults which live for a few weeks, feeding on plant material and mating before depositing eggs. Many of the females have a long ovipositor, which is a feature uncommon in other stonefly families.

New Zealand's twenty-six species of Notonemouridae are small and not as conspicuous as some members of the other families. This has meant that they are not well known, and like all stoneflies they have no Maori names, either individually or collectively.

The browsing nymph of one widespread species is the most commonly encountered member of its family because its habitat is in waterways of a type more usually visited during investigations of fisheries and for environmental impact studies. In contrast, the adults of another species are collected near such streams but its nymphs are infrequently encountered because they live deep in underwater gravels. Other notonemourids, although not common, are largely unnoticed because their habitats have so far not been closely studied. For example, nymphs of one species are found in water films fed by springs, usually in rain forest.

Our knowledge of Notonemouridae has increased markedly in the past thirty years, and this greater awareness has already had some impact on applied entomology. Increasingly, various publications acknowledge the presence of stoneflies and their place in nature. The literature overseas contains many reports on their usefulness as indicators of

(continued overleaf)

He whakapotonga ma te marea

Ko te *Notonemouridae* teetahi o nga whaamere e whaa o nga ngaro-koowhatu e kitea ana i Niu Tiireni nei. Ko nga punua (he aahua ngaarara) e noho ana i roto i te wai maaori, araa i roto i nga awa ririki, i nga wai e rere ana i raro kirikiri raanei.

E rua, e toru pea nga whakamaaunutanga kiri a te punua; ko te pakeke he koowari wari te tinana, e whaa oona parirau. E torotoru wiki noa iho te orange; ka kai i te raakau i mua i te ainga, i te whakaputanga heeki. Kei eetahi o nga uwaha he mea roa, peenei me te ngira, to raatou mea whakatakoto heeki. Ko teenei mea kaaore e kitea ana i eetahi atu whaamere ngaro koowhatu.

Kaaore e peenei nga tuumomo ngaro koowhatu e rua tekau maa ono o Niu Tiireni me nga ngaro koowhatu o eetahi whaamere; he iti, aa, kaaore e aata kitea ana. No reira, kaaore raatou e tino moohiotia ana, aa, kaaore oo ratou ingoa Maaori.

Ko te punua kaikai o teetahi whaamere-iti te mea e tino kitea ana, no te mea e noho ana i roto i nga awa me nga wai e torohia ana e te tangata e maatakitaki ana i nga waahi hii ika, e nga taangata hoki e aata titiro ana i te hauora o te whenua. Konga pakeke o teetahi whaamere-iti e kohikohia ana, e paatata ana ki nga awa peenei, engari, kaaore e tino kitea ana, i te mea kei raro tonu i nga kirikiri i roto i te wai te nohoanga. Ko eetahi *Notonemouridae* kaaore e tino kitea ana, na te mea kaaore anoo kia aata maatakitakina te waahi e noho nei raatou. Hei taurira, ko te punua o teetahi whaamere-iti e kitea ana i nga wai e puta mai ana i nga punawai i roto i te ngaaherehere.

Kua piki haere te maatauranga e paa ana ki te Notonemouridae i nga tau toru tekau kua pahure nei, aa, kua paa tenei maatauranga ki te waahanga maatauranga e kiia ana

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Front cover. The insect depicted is *Notonemoura latipennis*, nymph

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water quality, and now, with easier identification, New Zealanders are beginning to use them for the same purpose.

Along with other stoneflies, the nymphs and adults of Notonemouridae are food for both native and introduced fishes, and consequently anglers manufacture artificial flies to represent them.

Although some of the larger species of stonefly can be identified with the naked eye, most identification must be done using a stereoscopic microscope to check wings, body, legs, and genitalia. It is possible that new species may be found in regions not yet well covered by collectors.

applied entomology. Kua paanuitia nga ngaro koowhatu me to raatou mahi i runga i te whenua. E maha nga paanuitinga i roto i nga pukapuka o taawaahi e whakaatu ana raatou maahi tohutohu i te pai, i te kino raanei o te wai o nga awa me nga punawai. Inaiaianei, i te mea kua ngaa-wari te moohio ko teewhea, ko teewhea o raatou, ka meinga peenei raatou i Aotearoa nei.

He kai na nga ika maaori, na nga ika kuhu mai hoki, nga *Notonemouridae*. No reira ka mahia peeneitia ai nga ngaro paataritari o nga kai-hii taraute.

Mo eetahi ngaro koowhatu, ma te mata tangata e kite ko teewhea whaamere-iti toona; heoi, mo te nuinga, ma te maikara koroapu e titiro ki te parirau, ki te tinana, ki te waewae, ki te teke, ure raanei, aa, kaatahi anoo ka kitea ai ko teewhea whaamere-iti. Teeraa pea ka kitea he whaamere-iti hoou kei nga waahi kaaore anoo kia haerea nuitia e nga tohunga kai-kohikohi ngaarara.

ABSTRACT

The genera of Notonemouridae are assigned to three phylogenetic groups. The New Zealand fauna now consists of twenty-six species in six genera, of which eight species are here described as new. Keys to genera and species are given. Information is given on habitats, distribution, endemism, phylogeny, and systematics in the family. Methods of collecting and preparation of specimens are outlined. Drawings are included of genitalia, wings, and other parts of diagnostic value, as well as a number of habitus studies. The distribution of collection localities is mapped for each species. Copulation in *Notonemoura* is described and illustrated.

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INTRODUCTION

Plecoptera or stoneflies are an ancient order known from fossil records dating back to the Lower Permian. They are soft-bodied insects with clearly separated thoracic segments, cursorial legs, and untegmised forewings which are characteristically folded straight back and closely applied to the abdomen; cerci may be long (e.g., Gripopterygidae) or reduced to one segment (e.g., Notonemouridae). Nymphs are normally aquatic, and have filamentous gills (e.g., Gripopterygidae) or no gills (e.g., Notonemouridae). Nymphs normally live in cool, running fresh water, but in New Zealand (and southern South America) a number of apterous species have terrestrial nymphs living in cool, humid microclimates beneath stones or vegetation in alpine and subantarctic situations. At low altitudes there are winged species with semi-terrestrial nymphs which spend their early instars in water, then in winter move out under stones of stream flood-plains.

The Plecoptera of New Zealand consist of four families containing fifty-five named species: Eustheniidae has two species in one genus, Gripopterygidae has twenty-six species in nine genera, Austroperlidae has one species, and Notonemouridae now has twenty-six species in six genera. Zwick (1973) divided Plecoptera into two suborders, Arctoperlaria for stoneflies of Northern Hemisphere origin and Antartoperlaria for those of Southern Hemisphere origin. He assigned Notonemouridae to Arctoperlaria and considers it a sister-group of Nemouridae. Notonemouridae are found only in areas derived from Gondwana fragments (Australia, New Zealand, South America, South Africa, Madagascar). The only other arctoperlarian family in the Southern Hemisphere are the Perlidae, which are widespread on the northern continents and extend through South America and South Africa. Gripopterygidae, Austroperlidae, and Eustheniidae – the only families in Antartoperlaria – are widespread in New Zealand, Australia, and South America.

SYSTEMATICS

The first notonemourid described was *Udamocercia antarctica* (Enderlein, 1905), from South America. Tillyard (1923) described two New Zealand species, *Notonemoura latipennis* and *Spaniocerca zelandica*. Until 1950 these and further species were assigned to Nemouridae. Ricker (1950) created Notonemourinae as a subfamily of Nemouridae to contain the growing number of southern genera and species, and finally Zwick (1973) raised it to family status, removing it from the Capniidae where it had been placed by Illies (1961). Zwick divided the family into two

groups, the *Notonemoura* group and the *Spaniocerca* group (changed to *Aphanicerca* and finally *Austrocercella* group). The change in group names came about as Zwick (1981 & pers. comm.) felt that the monophyly of the family was in doubt. He considered that it might be an artificial group of several primitive, similar, but not closely related lines of pre-nemourid stock.

In the course of this study I examined representatives of most genera from overseas, and the literature. Madagascar material was not available, but Paulian (1949, 1951, 1959) has given descriptions in sufficient detail to show the close affinity of Madagascan and South African genera. I have not been able to undertake a thorough phylogenetic investigation because of constraints in the quality of the material and in the literature available to me in crucial areas. However, there is sufficient indication to show that the Notonemouridae comprise at least three groups. To show the results of this I first set down Zwick's (1981) groups, as follows.

AUSTROCERCELLA GROUP (in the sense of Zwick)
Austrocercella, *Austrocercia*, *Austrocercoides*, and *Tasmanocerca* from Australia; *Spaniocerca* and *Omanuperla* from New Zealand; and, with reservations, *Aphanicerca*, *Aphaniceropsis*, *Afronemoura*, *Aphanicerella*, and *Desmonemoura* from South Africa and *Madenemura* from Madagascar.

NOTONEMOURA GROUP (in the sense of Zwick)
Notonemoura from New Zealand and Australia; *Kimminsooperla* from Australia; *Halticooperla*, *Cristaperla*, and *Spaniocercoides* from New Zealand; *Neofulla*, *Udamocercia*, and *Neonemoura* from South America.

NOTE: *Austronemoura* from S. America at first tentatively here, but removed because its affinities are unknown.

The table on p. 11 shows characters used in my grouping that are considered plesiomorphic or apomorphic relative to Nemouridae, the sister-group of Notonemouridae.

In these groups there are a few genera which have characters different from other group members. In the *Notonemoura* group all have six anal veins in the hind wing except *Neonemoura*, which has five (as in Nemouridae); and *Halticooperla* has a complex membranous epiproct with a sclerotised skeleton, much like that in Nemouridae. In the *Spaniocercoides* group the majority of genera have simple, hook-shaped epiprocts, but *Cristaperla* has a complex, cockscomb-like epiproct housed in a pocket; and *Omanuperla* has a two-bladed epiproct with a sac at the base of each blade. *Udamocercia* (which I have left ungrouped) has wings and male genitalia of the *Austrocercella*-group form, but the ovipositors are much like those in the *Austrocercella* group.

These anomalies could have arisen as follows. The anal vein difference in *Neonemoura* is possibly an instance of

Table 1 Characters used in deriving a three-group phylogenetic structure for the Notonemouridae (abbreviations: ap, apomorphic; ep, epiproct; go, genital opening; hwav, hind wing anal veins; ov, ovipositor; pa, paraproct; pl, plesiomorphic; sg, segment; sgp, subgenital plate; st, sternite).

Nemouridae	<i>Austrocercella</i>	<i>Notonemoura</i>	<i>Spaniocercoides</i>
• 5 hwav	6 hwav (ap)	6 hwav (ap)	5 hwav (pl)
Males			
• pa bilobed	pa bilobed (pl)	pa entire (ap)	pa entire (ap)
• pa free from sgp	pa fused to sgp (ap)	pa free from sgp (pl)	pa free from sgp (pl)
• go at rear of sg 9	go subterminal on sgp (ap)	go terminal on sgp (ap)	go at rear of sg 9 (pl)
• ep membranous with sclerotised skeleton	ep usually a hook (ap)	ep usually a hook (ap)	ep usually a hook (ap)
Females			
• go at rear of sg 8	go at rear of sg 8 (pl)	go terminal on ov (ap)	go at rear of sg 8 (pl)
• st 8(-9) at most with short extension	st 8-9 produced, forming ov (ap)	ov formed from invagination of st 8 (ap)	st 8-9 produced, forming ov (ap)

convergent evolution. The *Halticoperla* epiproct may have its origin in the *Notonemoura* group, but may also be the result of a pre- or post-familial division and not be closely related to the rest of the group. The same could apply to *Cristaperla* and *Omanuperla* with their unusual epiprocts and to *Udamocercia* with its mixture of characters.

I have the same doubts as Zwick regarding the monophyly of the family, but go one step further in questioning the affinity of *Halticoperla* with the *Notonemoura* group, which Zwick (1981) considered to be the only monophyletic aggregate in Notonemouridae. However, for as long as the family and its notional genus-groups serve as tools for further work, they can usefully be left in place, with some modification.

Revised generic groups

AUSTROCERCELLA GROUP (modified from Zwick 1981)
Hindwing with 6 anal veins and 2A free from 3A.

Genitalia. Male. Detached inner lobes (upper forks) of paraprocts fused to dorsal membrane of subgenital plate, with free ends arising some distance down subgenital plate and extending beyond its tip. Genital opening subterminal on subgenital plate. Lateral lobes (lower forks) of paraprocts either apparent and horn-shaped or reduced or absent. Lateral processes on tergite 9 either large claspers or tipped with spines.

Female. Genital opening at rear of sternite 8. Sternites 8 and 9 usually produced to form an ovipositor, but if either is not produced there is some modification, i.e., sclerotisation or lack of it, or a longitudinal ridge or groove.

Genera included: *Austrocercella*, *Austrocercia*, *Austrocercoides*, and *Spaniocerca*. *Udamocercia* could be in-

cluded here on its wing venation and male genitalia, but its female genitalia appear more like those of the *Notonemoura* group.

NOTONEMOURA GROUP

(modified from Zwick 1981)
Hindwing with 6 or, more rarely, 5 anal veins; 2A and 3A fused basally.

Genitalia. Male. Subgenital plate long, tapered. Paraprocts free from subgenital plate. Genital opening terminal on subgenital plate. Epiproct usually a simple hook, but sometimes a complex membranous structure strengthened with chitinous rods.

Female. Ovipositor long, derived from an invagination at centre of sternite 8, strengthened by a longitudinal and a ventral sclerotised strip, apically equipped with 2 lateral lobes. Genital opening terminal on ovipositor.

Genera included: *Notonemoura*, *Halticoperla*, *Neofulla*, and (with only 5 hindwing anal veins) *Neonemoura*.

SPANIOCERCOIDES GROUP (a new group)

Hindwing with 5 anal veins and 2A free from 3A.

Genitalia. Male. Subgenital plate long. Paraprocts free from subgenital plate. Genital opening posterior on segment 9. Epiprocts diverse in shape, but usually a simple hook. Tergite 9 without lateral processes.

Female. Gonopore usually at rear of sternite 8, and subgenital plate formed from extensions of posterior sternites. If gonopore central on sternite 8 or in front of it, there may be either a lobe or a plate anterior to it, or an anterior and a posterior lobe.

Genera included: *Spaniocercoides*, *Cristaperla*, *Omanuperla*, *Kimminsoperla*, *Tasmanocerca*, *Austronemoura*,

Afronemoura, *Aphanicerca*, *Aphaniceropsis*, *Aphanicerella*, *Desmonemoura*, and (with reservations) *Madenemoura* and its subgenus *Tsaranemoura*.

HABITATS IN NEW ZEALAND

The nymphs of the *Notonemoura* group show a preference for shallow, fast-flowing water or water films. Nymphs of *Spaniocerca*, our only genus in the *Austrocercella* group, inhabit a variety of habitats ranging from seepages through small streams to rivers, either in forest or grassland, and in both alpine and lowland zones. Members of the *Spaniocercoides* group inhabit forested or weedy streams, but some species go underground, living in stream sediments and deep in the underwater gravels, a lifestyle most probably derived from an ancestral existence in temporary streams.

DISTRIBUTION

McLellan (1990) covers the distribution of New Zealand stonefly genera and species. In this publication collection localities are mapped for each species (pp. 49–61); here I deal principally with trends in distribution apparent within genera.

Overall a pattern is evident, with differences from genus to genus – more complex in some and simple, with missing components, in others. It is as follows (see maps on pp. 4 and 5). A Northland species is replaced south of AK by one or more species through the rest of the North Island. In three genera, species extend into the South Island. There is a northern South Island set of species, most of them occurring to about the middle of the island but some with restricted range. These are replaced by others extending through FD, OL–CO, and western SL. Another species change may occur elsewhere in SL and in eastern CO–DN.

Notonemouridae have recently been recorded from Stewart Island (Chadderton 1988), but none are known from the Chatham Islands, the Kermadecs, or the subantarctic islands.

CRISTAPERLA. One species is recorded from the south of the North Island through the South Island as far as Haast, WD. It is replaced south of there in the Olivine Range, WD, by a species which extends through FD and CO. Further south there is another species in the east of FD (near Lake Monowai) and in SL. A species has recently been recorded from Stewart Island (Chadderton 1988).

HALTICOPERLA. A lower North Island species, a northern South Island species, and a southern South Island species. Towns's (1978) record from the Waitakere Range (AK) is

incorrect. I have examined his material, and they are *Spaniocerca* species.

NOTONEMOURA. A mid to lower North Island species and two northern South Island species.

OMANUPERLA. An alpine/subalpine species is found in WA and WN. Its South Island counterpart extends through SD, NN, and BR.

SPANIOCERCA. There is an indication in material that there may be a ND–AK species. One species is recorded from BP south through the North Island into the South Island as far as NC and BR. In the northern South Island there is another species restricted to NN, BR, and WD. An alpine species is found in NC and WD. There are three southern South Island species, one from Franz Josef through WD, FD, OL, and CO, another through the same range but also in SL, and one restricted so far to MK.

SPANIOCERCOIDES. Exhibits a more complex pattern. There is a Northland species, then three species in the lower North Island, two of which are present in the northern South Island. Of these last two, one exists as far as NN–BR and the other into WD. There are also two other species in the north of the South Island, one restricted to alpine north-west NN, the other to NN and BR. An alpine species extends from MB through to FD.

Collector effort is an important factor in recording distribution. Some areas like FD, WD, BR, NN, and WN have been well covered, but others have not. The areas with the least representation in the material I have seen are in the east of the South Island and the upper half of the North Island.

ENDEMISM

Apart from *Notonemoura*, which is shared with Australia, all New Zealand genera are endemic, with no genus restricted to one of the two main islands. Species in each genus do show such endemism, with fourteen species restricted to the South Island and five to the North Island. Of the South Island endemics, eight are restricted to the northern half of the island; one of these is found only in north-west NN, and an alpine species in the Southern Alps. Eight others are in the southern half of the island, four of them through southern WD, FD, and north-western Otago. One species appears to be restricted to MK. SL has two species, one shared with eastern FD and the other ranging through CO into southern WD. One more widely ranging species is found through southern WD, western and central Otago, and FD. Apart from those inhabiting the northern and southern 'halves' of the island there is a wide-ranging alpine species found from NN and SD to southern FD.

METHODS AND CONVENTIONS

Collecting

For adults, spring through summer is the most productive collecting time, although some species emerge in all seasons. Sweeping streamside vegetation or beating into a net is a most productive method. Malaise nets work well, and a lamp at night will attract some species. Careful examination of dry undersides of stones in rapids can be used to collect both adults and nymphs, particularly in the damp zone just out of the water. In seepages netting and visual methods are good. The traditional method of catching nymphs by disturbing the substrate into a net will catch some species, but I find the method tends to catch the same fairly common ones, because many stonefly nymphs prefer to live where they can retreat into damp, hidden verges. Leaf packets and driftwood are good sources, and in seepages careful lifting of leaves, probing likely cracks and depressions, and blowing on the surface to make nymphs move will produce much material.

Preparation of specimens

Both adults and nymphs are best collected straight into 70–80% ethanol. They can then remain in it indefinitely, but I find it better to change to fresh ethanol after sorting. Isopropyl alcohol (*n*-butyl alcohol) is just as good, and Pampel's and FAA fixatives can be used successfully. Dried, pinned specimens cannot be studied adequately. Wings may be removed from adults, spread in a little ethanol on a slide, covered with a coverslip, and drawn using a drawing tube. If a tube is not available, and also if a permanent slide is required, the wings can be mounted between two 50x22 mm coverslips and then mounted in photographic slide mounts with a 22x15 mm aperture. This allows the image of the wings to be thrown on to a sheet of paper and drawn. Genitalia need no special treatment, and can be studied through a stereomicroscope while still attached to the specimen and immersed in ethanol. Nymphs can be studied the same way. Genitalia and wings in late-instar nymphs may need examination to associate with adults. Happily, in most instances, the genitalia can be seen through the nymphal integument, but sometimes may need clearing or dissection. Wings within wingpads need to be dissected out and put in lactic acid for a short time. This will relax them so that they can be spread out on a slide.

An excellent method of relaxing dried specimens for transfer to ethanol without using special equipment is as follows. Remove labels and put the pinned specimen into 1% trisodium phosphate (Na_3PO_4), sinking it with a drop of detergent. Leave for 24 hours, and the animal should plump up to life size. Leave in solution for another day if required, but no longer. Wash in water and transfer to ethanol.

Abbreviations

Repositories:

AMNZ	Auckland Institute and Museum, Auckland, N.Z.
BMNH	British Museum (Natural History), London, U.K.
CMNZ	Canterbury Museum, Christchurch, N.Z.
IDMC	I.D. McLellan private collection, Westport, N.Z.
NMNZ	National Museum of New Zealand, Wellington

Collection localities: the area codes of Crosby et al. (1976; see p. 5) are used to categorise records.

DESCRIPTIONS

Family NOTONEMOURIDAE

Diagnosis. Small to medium-sized stoneflies. Wings divided into 2 almost equal parts by a transverse cord (a transverse line of crossveins). Distal part of each wing containing only a set of main veins sub-parallel to each other, devoid of crossveins, and sometimes with at most a single forking of *Rs*. Hindwing with 5 or 6 unforked anal veins; 2*A* and 3*A* sometimes fused basally. Forewing with Cu_2 long, extending well into distal half. Legs each with a pair of distoventral spurs. Both sexes with 1-segmented cerci.

Males with tergite 10 divided into 2 anterolateral sclerites and a posterior sclerite. Sternite 10 not sclerotised, and paraprocts inserted directly behind sternite 9, which forms a subgenital plate, the plate and/or paraprocts forming an intromittent organ during copulation. Epiproct usually present, as either a simple hook or a complex membranous and sclerotised structure. A posteriorly directed ventral lobe arising anteromedially on sternite 9.

Females usually with an ovipositor, derived either from an invagination of the centre of sternite 8 or a prolongation of sternite 8 and modification of sternite 9.

Nymphs with no visible gills, and with a pair of distoventral spurs on tibiae. Cerci multi-segmented, the segments cylindrical and flexible or ampullate and fragile.

KEY TO GENERA OF NOTONEMOURIDAE KNOWN FROM NEW ZEALAND

Adults

- 1 Hindwing with 6 anal veins ... 2
—Hindwing with 5 anal veins ... 4
- 2 Hindwing with 2*A* and 3*A* free... (p.22)... *Spaniocerca*
—Hindwing with 2*A* and 3*A* fused in proximal half ... 3

- 3 Forewing with *1A* and *2A* fused at midpoint
 ... (p. 16) .. *Halticoperla*
 —Forewing with *1A* and *2A* free at midpoint
 ... (p. 18) .. *Notonemoura*
- 4 Male epiproct 2-bladed; ovipositor 2-lobed (upper and lower)
 ... (p. 21) .. *Omanuperla*
 —Male epiproct not divided into blades; ovipositor without upper and lower lobes ... 5
- 5 Male epiproct a hook; ovipositor with apical lobes large, well defined ... (p. 27) .. *Spaniocercoidea*
 —Male epiproct cockscomb-shaped; ovipositor sharply pointed, without evident apical lobes
 ... (p. 14) .. *Cristaperla*

Nymphs

- 1 Pronotum without a marginal fringe of hairs
 ... (p. 27) .. *Spaniocercoidea*
 —Pronotum with a marginal fringe of hairs ... 2
- 2 Pronotum rectangular, with hair fringes on anterior and posterior margins only ... (p. 18) .. *Notonemoura*
 —Pronotum with hair fringe on lateral margins and at least on part of anterior and posterior margins ... 3
- 3 Pronotum with lateral margins concave anteriorly, fringed with pale hairs which extend partly on to anterior and posterior margins ... (p. 14) .. *Cristaperla*
 —Pronotum with lateral margins convex; a short, hairy fringe extending around entire perimeter ... 4
- 4 Hind femora enlarged (twice as long and wide as fore femora) and with prominent socketed setae
 ... (p. 16) .. *Halticoperla*
 —Hind femora not greatly enlarged (less than twice as long and wide as fore femora) and without prominent socketed setae ... (p. 22) .. *Spaniocerca*

Genus *Cristaperla* McLellan

Cristaperla McLellan, 1972: 475–477 (first diagnosed).

Type species *Spaniocercoidea fimbria* Winterbourn, 1965

Adult. Small stoneflies. Head with prominent ocelli. Pronotum with convex lateral margins. Forewing with transverse cord interrupted and a pale bar through it.

Hindwing with *Cu* and *1A* some distance apart; *2A* and *3A* free; *6A* fused with wing margin; a pale bar through transverse cord or a pale spot in pterostigma.

Genitalia. Male. Sternite 9 produced into a long, up-curved ventral process with a row of slender spines on its posterior surface. Epiproct a complex, cockscomb-like structure with its posterior margin slotted to house a peg-like projection of the epiproct's basal plate when the epiproct is extended. Paraprocts apparent as small lobes free from subgenital plate. Cerci bulged dorsally, with a distal nipple. Ventral lobe short.

Female. Sternite 8 produced to form an ovipositor, which is membranous dorsally, sclerotised ventrally, and tapered to a point which is slit vertically. Sternite 9 modified, membranous medially, sclerotised laterally, tapered to a sharp tip.

Nymph. Pronotum of a distinct, almost shield-like shape (Fig. 2), with long hairs forming a fringe on its lateral margins and continuing for a short distance on other margins. Long hairs present on legs, hind surface of eyes, and behind antennae. Maxillary palps extending forwards.

Remarks. The epiproct of *Cristaperla* males has no parallel in other genera of Notonemouridae. This further strengthens Zwick's (1981) view that the family's monophyly is doubtful. It is impossible to ascertain whether the 'cockscomb' is actually the distal part of the epiproct or is derived from the mid-posterior of tergite 10. If the latter, then the peg-like projection of the basal plate would be the distal part of the epiproct. However, in the absence of proof that the 'cockscomb' is part of tergite 10, it is convenient to consider it as part of the epiproct.

KEY TO SPECIES OF *CRISTAPERLA*

Males

- 1 Ventral process with a patch of compacted hairs dorsally on apex; greatest depth of process about half length of cercus ... (p. 15) .. *fimbria*
 —Ventral process with no patch of compacted hairs on apex; greatest depth of process three-quarters length of cercus ... (p. 15) .. *eylesi*

NOTE. Male of *waharoa* unknown.

Females

- 1 Ovipositor 4x as long as sternite 7, with ventral surface fully sclerotised apart from a thin strip bordering apical slit ... (p. 16) .. *waharoa*
 —Ovipositor not as long and not fully sclerotised ... 2

- 2 Ovipositor with sclerotisation restricted to a band on each lateral margin ... (p. 15) .. *fimbria*
—Ovipositor sclerotised apart from basal medial triangle and medial strip ... (p. 15) .. *eylesi*

Cristaperla eylesi new species

Figures 29, 51, 67, 96, 118; Map 1

Dimensions (mm). Male: length of body 6.0; antenna 4.5; forewing 7.0. Female: length of body 6.5–7.0; antenna 5.0; forewing 7.0.

Adult. Genitalia. Male (Fig. 29, 51, 67). Ventral process arising from posterior of subgenital plate, much deeper for over half its length than in type species; a row of about 16 long, slender spines extending without gaps along distal 0.4 of ventral surface; tip tapered, membranous, without a dorsal compacted hair patch. Paraprocts shorter and deeper than in type species. Epiproct with longer teeth and a triangular basal pocket. Membranous areas present on tergites 6–8.

Female (Fig. 96, 118). Ventral surface of ovipositor sclerotised apart from a narrow medial strip and a small medial triangle at base. Ovipositor 3x as long as sternite 7.

Type data. Holotype male, FD, Fiordland National Park, Takaha Valley, 11 December 1972, A.C. Eyles (NZAC).

Material examined. Holotype, plus 10 non-type examples (2 males, 8 females; NZAC).

— / WD, FD.

Collected January, December.

Remarks. *C. eylesi* is dedicated to Dr A.C. Eyles (ex Entomology Division, DSIR), who collected the first males of this species and other new and interesting stoneflies.

Cristaperla fimbria (Winterbourn)

Figures 2, 7, 30, 52, 68, 69, 97, 98, 119; Map 2

Spaniocercoides fimbria Winterbourn, 1965: 259, 280 (initial description and figures of male genitalia).

Cristaperla fimbria McLellan, 1972: 475–478 (new combination; redescription of male; description of female and part description of nymph). Winterbourn & Gregson, 1981: 21, 22, fig. 56 (figure and part description of nymph).

Dimensions (mm). Male: length of body 4.0–6.0; antenna 4.0–5.0; forewing 5.5–6.5. Female: length of body 5.5–7.5;

antenna 4.0–6.0; forewing 6.0–7.5. Nymph (final instar): length of body 6.5–8.0; antenna 1.8–2.5; cercus 2.0.

Adult. Wings, Fig. 7.

Genitalia. Male (Fig. 30, 52, 68, 69). Ventral process arising from anterior of subgenital plate, sclerotised ventrally, with a line of 7 or so slender spines at about half length and 2 or 3 more just below tip; dorsally, process membranous for about 0.4x its depth, with a dense patch of short, distally directed hairs just below tip. Epiproct red, cockscomb-like, at rest retracted into a pocket between sclerites of tergite 10 (Fig. 68), but in copulation extended posteriorly with its teeth directed ventrally (Fig. 69). Epiproct basal pocket an elongate heart shape in dorsal aspect. Paraproct lobes short, partly sclerotised.

Female (Fig. 97, 98, 119). Ventral surface of ovipositor with a narrow, sclerotised strip along each lateral margin. Tergite 9 sclerotised laterally, tapered to a point posteriorly.

Nymph (Fig. 2) slender. Pronotum narrowed posteriorly; anterior margin convex; anterolateral angles produced slightly, rounded; posterior margin convexly curved on either side of midline. Posterior margins of mesonota and metanota convexly curved. Body clothed in long, fine hairs as indicated in generic diagnosis. Hind tibiae usually extended rearwards in death.

Type data. Holotype male, WN, Wellington, Khandallah Domain, 29 December 1963, M.J. Winterbourn (AMNZ).

Material examined. Holotype, plus 90 non-type examples (33 males, 51 females, 6 nymphs; AMNZ, NZAC, IDMC). WN / NN, BR, WD, NC.

Adults collected January, September–December.

Habitat. Nymphs were collected in fine sediment of small forest streams. Their hairiness is similar to that of other stoneflies which inhabit mud, e.g., *Pelurgoperla personata* Illies (Gripopterygidae) (Illies 1963).

Remarks. There is variation in the wing colour of *C. fimbria*. There may be no pale patch in the forewing, or between the main veins distal to the cord there may be pale bars, or there may be such bars on either side of the cord in the hindwing.

The genitalia show variation between populations. Males from WN have much stronger and longer hairs on the cerci, keel, and apical patch of the ventral process than do NC males, i.e., there is a decrease in hairiness from north to south. In females, ovipositors show a decrease in length from north to south.

Cristaperla waharoa new species

Figures 99, 120; Map 3

Dimensions (mm). Female: length of body 6.0; antenna 3+ (broken); forewing 7.5.

Adult. Genitalia. Female (Fig. 99, 120). Ovipositor larger and longer than in other species (4x as long as sternite 7); ventral surface completely sclerotised, apart from a thin strip bordering apical slit.

Type data. Holotype female, SL, Catlins State Forest Park, Haldane, Waikopikopiko Stream, 27 December 1978, I.D. McLellan (NZAC).

Material examined. Holotype, plus 3 non-type females (NZAC).

— / FD, SL.

Collected November, December.

Remarks. The name *waharoa* is of Maori derivation, and alludes to the long ovipositor, the most outstanding character of this species.

Genus *Halticoperla* McLellan & Winterbourn

Halticoperla McLellan & Winterbourn, 1968: 127–131 (original diagnosis). Winterbourn & Gregson, 1981: 23 (keys to Plecoptera nymphs).

Type species *Halticoperla viridans* McLellan & Winterbourn, 1968

Adult. Medium-sized stoneflies with long hind legs having well developed femora. Head with eyes much larger than in other genera; ocelli prominent; usually a dark facial mask extending around ocelli and down frons. Pronotum subrectangular, wider than long, with a distinct dark pattern. A small, posteriorly directed triangular peg (mesonotal peg) beneath hind margin of mesonotum. Forewing with 1A and 2A fused for a short distance near midlength; Rs forking at or slightly beyond transverse cord. Hindwing with proximal half of 2A and 3A fused, and 6A free of the wing margin.

Genitalia. Male. Subgenital plate produced into a narrow ventral process extending through base of epiproct. Paraprocts (when visible) appearing as spatulate spines on either side of ventral process. Epiproct a complex, hooked structure with a large, bulged base and distally a ventral, sclerotised inner rod holding 2 lateral, membranous leaf-

like plates enclosing distally a membranous lobe. Ventral vesicle large, extending almost to rear of epiproct.

Female. Ovipositor long, arising medially from sternite 8, curving downwards and then up behind tip of abdomen, with a ventral longitudinal sclerotised strip, and terminating in a trilobed tip; genital opening a slit on flat surface between lobes.

Nymph. Eyes larger than in other genera; ocelli prominent; usually a dark facial mask extending around ocelli and down frons. Pronotum wider than long, with strongly convex lateral margins; entire perimeter outlined with bristles. Mesonota and metanota anteriorly with a row of bristles; a metanotal peg present. Hind legs large, with femora twice length and width of fore femora. All femora and tibiae clothed in heavy bristles with prominent sockets. Abdomen with a triangle of bristles on each tergite, apart from the last.

Both adults and nymphs with olive nota and green abdomen and legs; adults with grey wings.

Remarks. The nymphs of all species of *Halticoperla* live in seepages, in swift, shallow water under 1 cm in depth, and under damp stones associated with springs and torrents. When disturbed they run rapidly for cover, much like leptophlebiid mayfly nymphs, but do not leap, as erroneously stated in Winterbourn & Gregson (1981, 1989). Adults are more agile and alert than other stoneflies. Their large eyes enable them to detect movement over a wide field, and they use their long hind legs to launch into flight.

KEY TO SPECIES OF HALTICOPERLA

Adults

- 1 Femora with irregular dark markings... (p. 17) .. *gibbsi*
—Femora without such markings ... 2
- 2 No hairs visible on abdominal sternites at 20x
... (p. 17) .. *tara*
—Dark hairs distinct on abdominal sternites at 20x
... (p. 17) .. *viridans*

Nymphs

- 1 Femora with irregular dark markings... (p. 17) .. *gibbsi*
—Femora without such markings ... 2
- 2 Abdominal tergites with irregular dark markings
... (p. 17) .. *tara*
—Abdominal tergites without such markings
... (p. 17) .. *viridans*

Halticoperla gibbsi new species

Figures 3, 8, 15, 16, 31, 53, 70–73; Map 4

Dimensions (mm). Male: length of body 5.0–6.0; antenna 4.0–5.0; forewing 5.0–6.0. Female: length of body 5.5–7.0; antenna 5.5–6.0; forewing 5.5–6.5. Nymph (final instar): length of body 5.5–7.0; antenna 2.5; cercus 3.0.

Adult. Wings, Fig. 8. Irregular dark markings on hind femora and abdominal tergites (Fig. 15, 16). Very short, dark hairs present on tergites and nota, but none ventrally.

Genitalia. Male (Fig. 31, 53, 70–73). Epiproct distal lobe with an almost oval, bulging tip varying in appearance with turgidity of epiproct. Paraprocts membranous, similar in shape to those of the type species but invisible in most specimens. Ventral process narrow, tapered to a sharp tip.

Female. Ovipositor as in generic diagnosis.

Nymph (Fig. 3). As in generic diagnosis, but with irregular dark markings on hind femora and abdominal terga. Dark patches around lateral ocelli uniting in 'Y' of epicranial suture, so forming a facial mask. Metanotum with peg almost as wide as posterior margin.

Type data. Holotype male and paratype female, WN, Tararua Range, 1112 m asl, below Dundas Hut, streamside, 8 February 1985, sweepnet, G.W. Gibbs (NZAC); 1 paratype female, 9 paratype nymphs, same locality, 6 December 1984, B.G. Bennett & T.K. Crosby (NZAC).

Material examined. Type specimens, plus 70 non-type examples (21 males, 14 females, 35 nymphs; NZAC, IDMC).

RI, WI, WN / —.

Adults collected February, December.

Remarks. I dedicate this species to Dr G.W. Gibbs (Victoria University of Wellington) for his skillful collecting, which has taken not only this species but other new species in Plecoptera and Thaumaleidae (Diptera).

Halticoperla tara new species

Figures 17, 18, 32, 54, 74, 75; Map 5

Dimensions (mm). Male: length of body 4.5–5.0; antenna 4.5–5.5; forewing 5.0–7.0. Female: length of body 5.5–7.0; antenna 4.0–4.5; forewing 5.0–7.0. Nymph (final instar): length of body 5.5–7.0; antenna 2.5–3.0; cercus 2.0–5.0.

Adult. Abdominal sternites without hairs; remainder of body with short, dark hairs. Abdominal tergites with the

same pattern of variable dark markings as on nymphs (see Fig. 17, 18). Legs without irregular dark markings.

Genitalia. Male (Fig. 32, 54, 74, 75). Epiproct distal lobe and ventral rod tapered to a sharp point. Ventral process with a spatulate tip. Paraprocts sclerotised, with membranous centres to their spatulate tips.

Female. Ovipositor as in generic diagnosis.

Nymph. A pattern of dark markings on abdominal tergites varying from that in Fig. 17 for most nymphs through that in Fig. 18 to an occasional example without markings. Metanotum with peg almost as wide as posterior margin.

Type data. Holotype male, WD, Jackson Bay, small bouldery creek 100 m south of entrance to Smoothwater Track, 25 January 1976, I.D. McLellan (NZAC); 6 paratype nymphs, same data as holotype (NZAC); 1 paratype female, Jackson Bay, Big Slip Creek, 30 December 1978, I.D. McLellan (NZAC).

Material examined. Type specimens, plus 67 non-type examples (2 males, 4 females, 61 nymphs; NZAC, IDMC). — / WD, OL, FD.

Adults collected January, September, December.

Remarks. The spread of collection records for adults and the degree of development of nymphs suggest emergence of adults through all months.

The name *tara* is a Maori word meaning 'spike' or 'point', in reference to the pointed epiproct.

Halticoperla viridans McLellan & Winterbourn

Figures 33, 55, 76, 121–124; Map 6

Halticoperla viridans McLellan & Winterbourn, 1968: 127–131, fig. 1–8 (male, female, and nymph described and figured). Winterbourn & Gregson, 1981: 18–23, fig. 64 (keys to Plecoptera nymphs).

Dimensions (mm). Male: length of body 4.0–4.5; antenna 3.5–3.8; forewing 5.5–6.8. Female: length of body 6.0–6.5; antenna 5.0–5.5; forewing 6.5–8.2. Nymph (final instar): length of body 5.0–7.0; antenna 2.5–3.0; cercus 2.5–3.0.

Adult. Thorax and abdomen clothed in dark hairs. Legs and abdominal tergites without irregular dark markings.

Genitalia. Male (Fig. 33, 55, 76). Epiproct with distal lobe as long as side plates, twice their depth, and extending anteriorly to form an obtuse angular tip. Ventral process with a sharp tip. Paraprocts sclerotised, and in ventral aspect like a long-bladed paddle with a membranous centre.

Female (Fig. 121–124). Ovipositor as in generic diagnosis. The figures show differences in the mated and unmated positions, and variability.

Nymph. As in generic diagnosis. Without irregular dark markings on femora and abdominal tergites. Metanotum with peg 0.8x as wide as posterior margin.

Type data. Holotype female and allotype male, NN–BR, lower Buller Gorge, Fuchsia Creek, 19 January 1966, I.D. McLellan (NZAC); 2 paratype nymphs, same data but 26 January 1966 (NZAC); paratype male and female, same data as holotype but 19 January 1966 (CMNZ); 2 paratype nymphs, same data but 26 January 1966 (CMNZ).

The nominal paratype material in AMNZ labelled “New Zealand, WN, Makahika Stream, Ohau River” is here designated as *gibbsi* n.sp. (see p. 17).

Material examined. Type specimens, plus 184 non-type examples (10 males, 22 females, 152 nymphs; NZAC, IDMC).

— / NN, BR, WD, NC.

Adults collected January, February, July, September–December.

Remarks. Females from Otira (WD) and Cora Lynn (NC) have shorter ovipositors and shorter, stouter cerci (Fig. 124) than other females.

Genus *Notonemoura* Tillyard

Notonemoura Tillyard, 1923: 197–217 (initial diagnosis).

Kimmins, 1938: 571–572. Weir, 1967: 65 (a junior synonym, *Varioperla*, erected). McLellan, 1968: 133–135 (revised diagnosis, addition of new species and subspecies). Illies, 1975: 223 (suppression of *Varioperla*, addition of two new species).

Type species *Notonemoura latipennis* Tillyard, 1923

Adult. Small to medium-sized stoneflies with long hind legs having well developed femora. Head with large eyes and ocelli and prominent, dark brown dorsal callosities. Pronotum with a characteristic dark pattern in New Zealand species (Australian species without this pattern, but with 2 distinct bulges in each half). Mesoscutum wide, heart-shaped; mesoscutellum large, with a broad, rounded apex. Metanotal peg present. Forewing with no fusion of 1A and 2A. Hindwing with 2A and 3A fused over proximal half and with 6A free from wing margin. Position of *Sc/Rs* fork variable in both wings. New Zealand species with

wings almost unicolorous (Australian species usually with numerous pale spots on forewing).

Genitalia. Male. Ventral lobe long, stout; subgenital plate produced to form a long, upturned ventral process which is supported by 2 parallel sclerotised strips. Epiproct a well developed triangular hook. Paraprocts a pair of slender, sclerotised spines surrounded by a membranous layer. Tergite 10 comprising 2 chitinised lateral sclerites with a medial membranous groove. Tergite 9 similar, but sclerites larger. Tergite 8 with a posteromedial protuberance.

Female. Ovipositor long, tapered, with 2 small apical lobes, arising medially from sternite 8, strengthened longitudinally by a dorsal and a ventral sclerotised strip. Tip of cercus bulged in New Zealand species so flat apex points posteroventrally (cercus of Australian species without apical bulge, and with tip directed posteriorly). Supra-anal lobe rounded in New Zealand species (pointed in Australian species).

Nymph. Pronotum rectangular, with a distinct dark pattern in New Zealand species only, and fringed with bristles on anterior and posterior margins. Posterior of mesonotum with 2 triangular flaps. Wing pads with a break in sclerotisation across the base, very distinct in early instars. Hind legs larger and longer than forelegs and middle legs (twice as long as forelegs), with stout femora. Tibiae and femora of all legs clothed in strong bristles with prominent sockets.

Remarks. *Notonemoura* is the type genus for its family. With *Stenoperla* (Eustheniidae) it shares the distinction of being one of the two genera of stoneflies not endemic to New Zealand, both being found also in Australia.

The long ovipositor of females in some genera of Notonemouridae has raised the question of how copulation is achieved, and what role each genital part plays in the process. Since I described this process in 1968 no other observations have been published. I repeat the information here because of its value as a model for determining the process in other genera.

In 1967 two pairs of copulating *Notonemoura latipennis* were caught and preserved, both pairs remaining in copulo after preservation. From this material the following process is described (see Fig. 27, 28). The male has the female grasped about the base of the wings with his forelegs and middle legs, his abdomen tip level with the base of the ovipositor and in the same plane. The ovipositor is twisted level with its base; its tip, which is grasped by the male cerci and ventral lobe, rests in the medial groove and notch of the now depressed tergite 10. The epiproct holds open the gonopore and the ventral process extends up the vagina into the mouth of the spermatheca.

From the above a reconstruction can be made of what probably occurs. The tip of the ovipositor is grasped by those parts mentioned and twisted into position so that the epiproct can hold open the gonopore. The apical spine on the ventral process would then assist entry of the process. The sclerotised guide strip would ensure that the ventral process was guided into the mouth of the spermatheca and at the same time close off the oviduct. The ventral process must convey sperm from the gonopore of the male to the spermatheca.

KEY TO SPECIES OF *NOTONEMOURA* KNOWN FROM NEW ZEALAND

Males

- 1 Tip of ventral process membranous, tapered to a point
... (p. 19) .. *alisteri*
—Tip of ventral process with a sclerotised spine ... 2
- 2 Spine on ventral process short; ventral process the same depth for most of its length
... (p. 20) .. *winstanleyi*
—Spine on ventral process curved, tapered to a fine point; ventral process with distal third half as deep as proximal two-thirds ... (p. 20) .. *latipennis*

Females

- 1 Wings with a lime green pterostigma
... (p. 19) .. *alisteri*
—Wings without a lime green pterostigma ... 2
- 2 Distal veins in forewing with pale and dark outline
... (p. 20) .. *spinosa*
—Forewing almost unicolorous ... 3
- 3 Ovipositor 4.5X as long as tergite 10, with straight upper surface
... (p. 20) .. *latipennis*
—Ovipositor 3X as long as tergite 10, with curved upper surface
... (p. 20) .. *winstanleyi*

NOTE. Fading of colour in ethanol of *alisteri* specimens negates couplet 1, and the females will then key out to *latipennis*. The only recourse is associated males, type of habitat, and altitude.

Nymphs

- 1 Paler parts of body green ... (p. 19) .. *alisteri*
—Paler parts of body not green ... 2
- 2 Ventral margin of eye convex ... (p. 20) .. *latipennis*
—Ventral margin of eye concave ... (p. 20) .. *winstanleyi*

NOTE. Nymph of *spinosa* unknown. Colour fading may cause *alisteri* nymphs to key out to *latipennis*.

Notonemoura alisteri McLellan

Figures 19, 77; Map 7

Notonemoura alisteri McLellan, 1968: 133–140.

Dimensions (mm). Male: length of body 4.0–5.0; antenna 4.0; forewing 6.0. Female: length of body 5.0–6.0; antenna 4.5; forewing 6.8. Nymph (final instar): length of body 5.5–7.0; antenna 2.0–2.5; cercus 2.7–3.0.

Adult. Paler parts of body and pterostigma of wings lime green. Eyes red-brown. Legs almost uniformly pale green; hind femora longer than in the type species. Forewing pale grey, hindwing dark grey (apart from pterostigma in both). Legs clothed in dark hairs; apex of tibia, Fig. 19.

Genitalia. Male (Fig. 77). Epiproct without wings. Ventral process in lateral view with ventral surface uniformly curved, parallel to sclerotised strips; tip of process with a membranous tapered extension.

Female. As for type species, but lime green.

Nymph. As in generic diagnosis but a little larger, with slightly longer antennae and cerci. Paler parts of body green tinged with brown. Ventral margins of eyes uniformly rounded. Hind femora pale green for just over half length proximally, then with 1 or 2 dark patches.

Type data. Holotype male, paratype female, and 5 paratype nymphs, BR, Waimea Creek near Westport, seepage on vertical face, 19 February 1967, I.D. McLellan (NZAC).

Material examined. Type specimens, plus 179 non-type examples (5 males, 10 females, 164 nymphs; NZAC, IDMC).

— / NN, BR, NC.

Adults collected February, March, July, October, November.

Habitat. *N. alisteri* is found in seepages, usually from springs, in rain forest up to the subalpine zone, where it is replaced by *N. latipennis*.

Remarks. Both adults and nymphs lose their green colour after a short time in ethanol, and then appear very similar to the type species.

***Notonemoura latipennis* Tillyard**

Figures 4, 21, 27, 28, 34, 56, 78, 79, 100, 125; Map 8

Notonemoura latipennis Tillyard, 1923: 215–216 (holotype female described as male; wings figured). Kimmins, 1938: 571–572 (male and female genitalia of *winstanleyi* described in error). McLellan, 1968: 135–137 (correction to wing venation, description of male and female genitalia and nymph; division into two subspecies).

Notonemoura latipennis paludis McLellan, 1968: 137. New synonymy.

Dimensions (mm). Male: length of body 5.5; antenna 3.5; forewing 5.5. Female: length of body 6.0; antenna 3.5; forewing 5.5. Nymph (final instar): length of body 4.0–6.5; antenna 1.8; cercus 2.0–2.5.

NOTE. In brachypterous populations wing length is about half that given above.

Adult. Epicranium with raised dark brown mottled patches. Frons with a distinct dark mask extending on to dorsal callosities. Legs clothed in short, dark hairs, brown to pale brown with a pale medial bar on tibiae and femora. Meso- and metascuta with a dark brown pattern on raised parts. Abdomen pale brown. Wings pale grey to almost hyaline.

Genitalia. Male (Fig. 34, 56, 78, 79). Epiproct without wings. Ventral process with distal third in lateral view half as deep as proximal two-thirds; ventral surface not parallel to sclerotised strips; tip of process with a dark, slender, curved, sclerotised spine.

Female (Fig. 100, 125). Upper surface of ovipositor almost straight. Ventral sclerotised strip with a band of semisclerotisation on either side for 0.6X length. Ovipositor extending past tip of abdomen by about 1.5X length of tergite 10.

Genitalia in copulo, Fig. 27, 28.

Nymph (Fig. 4) as in generic diagnosis. Background colour brown. Eye (Fig. 21) with ventral margin uniformly rounded.

Type data. Holotype female, NC–WD, Arthurs Pass, 16 January 1920, R. J. Tillyard (NZAC).

Material examined. Holotype, plus 205 non-type examples (56 males, 46 females, 103 nymphs; NZAC, IDMC). — / NN, BR, WD, NC.

Adults collected January, November, December.

Habitat. Nymphs of *N. latipennis* are found in alpine and subalpine zones where seepages from bogs or streams form

thin films of water over the substrate, in shallow bog pools with a water flow, and in steep outflow streams from bogs. With the heavy spines on their legs they are well equipped to maintain station in quite swift currents. The active adults detect movement well with their large eyes, and like *Halticoperla* use their long hind legs to launch into flight.

Remarks. Brachypterous populations have been found on Mt Augustus (NN), Buckland Peaks (BR), and Temple Basin, Arthurs Pass (NC–WD). In 1968 I erected the subspecies *Notonemoura latipennis paludis* to contain the Temple Basin population, but I now consider my action unjustified, and place the subspecies name into synonymy.

***Notonemoura spinosa* new species**

Figures 10, 20, 126; Map 9

Dimensions (mm). Female: length of body 6.0; antenna (broken) 3+; forewing 6.0.

Adult. Similar to type species, but differing in wing coloration, leg vestiture, and genitalia as follows. Forewing (Fig. 10) basally with pale bars between *C* and *R*, *Rs* and *Cu*₁, and *1A* and wing margin; wing pale distal to transverse cord, with each vein surrounded by a narrow, pale band bordered by a dark line. Hindwing hyaline, with brown edging on either side of *Sc* and *R* as far as termination of *Sc* in the wing margin. Legs clothed in brown hairs; posterior face of tibiae (Fig. 20) clothed in distinct short spines.

Genitalia. Female (Fig. 126). Ovipositor long, extending to twice length of tergite 10 past tip of abdomen.

Type data. Holotype female, FD, Wilmot Pass, 10 January 1970, G. Kuschel (NZAC).

Material examined. Holotype only.

Remarks. The holotype is a newly mated female, preserved before the ovipositor could return to normal.

The name *spinosa* (Latin, 'thorny') refers to the tibial spines in this species.

***Notonemoura winstanleyi* new species**

Figures 22, 35, 57, 80, 81, 101, 127; Map 10

Notonemoura latipennis Kimmins, 1938: 571–572 (male and female genitalia) (in error).

Dimensions (mm). Male: length of body 5.5; antenna 4.0; forewing 6.0. Female: length of body 5.5; antenna 5.0;

forewing 7.0. Nymph (late instar): length of body 6.0; antenna 2.0; cercus 2.5.

Adult. Similar to the type species, but differing as follows. No distinct dark mask on frons. Ventral margin of eye straight or concave. Mesonotum and metanotum without a dark pattern. Legs clothed in short, dark hairs and with small, dark patches on dorsal surface of femora.

Genitalia. Male (Fig. 35, 57, 80, 81). Epiproct with wings. Ventral process in lateral aspect much deeper than in the type species; sclerotised strips fused basally for about half their length on ventral surface of process, then dividing and curving to middle of process, and fusing again at tip; sclerotised tip wide, with 2 medial spines, one embedded in and extending back along process, the other projecting distally.

Female (Fig. 101, 127). Ovipositor with a convex curve over most of its upper surface; ventral sclerotised strip with a little semisclerotisation on either side. Ovipositor extending less than length of tergite 10 past tip of abdomen.

Nymph as in generic diagnosis, but with ventral margin of eye concave (Fig. 22), and hind femora pale from base to over half length, and then either completely dark or with 2 large dark patches.

Type data. Holotype male and 2 paratype females, WN, northern Tararua Range, Dundas Basin, 1110 m asl, 26 November 1984, G.W. Gibbs (NZAC).

Material examined. Type specimens, plus 13 non-type examples (2 males, 4 females, 7 nymphs; NZAC).

WO, BP, WN / —.

Adults collected October–December.

Habitat. The habitat of *N. winstanleyi* is similar to that of the type species, but this stonefly appears to range from lowlands into the alpine zone.

Remarks. The genitalia of *N. winstanleyi* were figured by Kimmins (1938) as belonging to *N. latipennis*. Although he did not give the locality of the specimens used for his drawings, Kimmins stated rather ambiguously "Dr. Tillyard had examples from Karori, Wellington and Arthur's Pass. I have seen examples from Wilton's Bush." Wilton Bush is adjacent to Karori, the home of G.V. Hudson, who supplied the specimens seen by Kimmins.

I dedicate this species to W.J. Winstanley of Motueka (ex Victoria University of Wellington), who collected the first specimen and spent much time and effort in obtaining further material as well as other useful and interesting stoneflies.

Genus *Omanuperla* McLellan

Omanuperla McLellan, 1972: 469–481 (initial diagnosis).

Type species *Omanuperla bruningi* McLellan, 1972

Adult. Small stoneflies with the following characteristics. Forewing with transverse cord interrupted, not straight. Hindwing with 2A and 3A free, 6A fused to wing margin. Legs with a pale medial bar on femora and tibiae.

Genitalia. Male. Anterior sclerite of tergite 10 chitinous, with a medial membranous strip; posterior of sclerite with a patch of short spines on either side of this strip. A cavity evident between posterior of tergite 10 and epiproct. Lateral margins of epiproct each a chitinous blade with a membranous, ventrally opening sac forking from its base. Subgenital plate long, upcurved, its extremity membranous with sclerotised margins and midline. Genital pore opening on dorsal surface of plate level with mouths of epiproct sacs. Paraprocts bladelike, less than half as long as subgenital plate and concealed by it. Cerci simple.

Female. Genital opening medial on sternite 8, the sternite produced, forming an ovipositor with an upper and lower lobe.

KEY TO SPECIES OF *OMANUPERLA*

Males

- 1 Epiproct blades converging at tips
... (p. 21) .. *bruningi*
—Epiproct blades parallel ... (p. 22) .. *hollowayae*

Females

- 1 Ovipositor with tip of lower lobe rounded
... (p. 21) .. *bruningi*
—Ovipositor with tip of lower lobe pointed
.. (p. 22) .. *hollowayae*

Omanuperla bruningi McLellan

Figures 11, 36, 37, 58, 82, 102, 128; Map 11

Omanuperla bruningi McLellan, 1972: 478–479 (initial description and figures of male and female).

Dimensions (mm). Male: length of body 5.0; antenna 5.5; forewing 6.0. Female: length of body 6.0; antenna 6.0; forewing 6.5.

Adult. Forewing with 3 hyaline patches, one basal, one before transverse cord, and one distal to cord (Fig. 11).

Genitalia. Male (Fig. 36, 37, 58, 82). Epiproct with an anterodorsally projecting blade on each lateral margin;

blades each with a laterally projecting membranous sac at base, converging and sometimes crossing at their tips; a membranous sheet joining the blades together. Posterior of tergite 10 with a patch of hairs on either side of the spiny patch. Extremity of subgenital plate with a sclerotised midline, tapered to a point. Paraprocts bladelike in ventral aspect.

Female (Fig. 102, 128). Ovipositor short; lower lobe with a blunt tip. Sternite 9 with posterior margin rounded.

Type data. Holotype male, NN-BR, lower Buller Gorge, Norris Creek No. 2, O'Connors Farm, 12 September 1966, I.D. McLellan (NZAC); 2 paratype females, lower Buller Gorge, creek 1 km E of Ohikanui River, 19 November 1966 and 17 May 1967, I.D. McLellan (NZAC).

Material examined. Type specimens, plus 19 non-type examples (7 males, 12 females; NZAC, IDMC).

— / SD, NN, BR.

Adults collected January, May, September–December.

Habitat. The specimens I collected came from small streams with little fall and with a substrate of sand, mud, tree roots, and fallen vegetation. Material from the Heaphy Track was collected on the Goulard Downs (NN), where the stream beds contain limestone slabs and quartz grit. The remaining specimens are from small alpine streams. The nymphal habitat is unknown, but is probably hyporheic, either in stream-side sediments or in the stream bed.

Remarks. Five males from Mt Domett (NN) were mated. In this state the blades of the epiproct, the posterior of tergite 10, and the cerci are forced down. In two males the epiproct sacs are swollen with semen, and have converged basally so that their inner margins are almost touching (Fig. 37). The sacs in the remaining males are in the lateral position, and are empty (Fig. 36). The genital pore on the subgenital plate faces and is about level with the mouths of the swollen sacs. This suggests that the sacs act as a temporary reservoir for semen, and may also serve as a seal on either side of the two-lobed ovipositor by fitting in the lateral grooves between the ovipositor lobes. The blades of the epiproct probably hold open the female gonopore, and the membrane would help to direct the flow of semen.

Omanuperla hollowayae new species

Figures 12, 38, 59, 83, 103, 129; Map 12

Dimensions (mm). Male: length of body 4.0–6.0; antenna 4.0–5.0; forewing 4.0–5.5. Female: length of body 4.5–7.5; antenna 4.5–5.5; forewing 4.5–6.5.

Adult. Forewing (Fig. 12) with 3 hyaline patches, one basal, one before transverse cord, and one distal to cord; patch distal to cord may completely surround a brown oval or be incomplete in pterostigma and radial cells.

Genitalia. Male (Fig. 38, 59, 83). Epiproct sacs opening ventrally; epiproct blades with edges facing laterally, almost parallel to each other and fused over half their proximal length, forming part of posterior of post-tergal cavity, the walls of which are heavily sclerotised. Posterolateral margins of tergite 10 sclerotised, raised, rounded, armed with spines. Subgenital plate with hind margin sclerotised and rounded except for a small medial triangle. Cerci short.

Female (Fig. 103, 129). Ovipositor with lower lobe pointed and with long hairs mid-laterally on upper lobe.

Type data. Holotype male and paratype female, WN, Tararua Range, Pukemoremore Basin, 1250 m asl, 28 November 1984, G.W. Gibbs & K.J. Fox (NZAC).

Material examined. Type specimens, plus 15 non-type examples (6 males, 9 females; NZAC).

WA, WN / —.

Adults collected November.

Habitat. All specimens were found between 940 m and 1300 m asl, i.e., in the subalpine and alpine zones.

Remarks. I dedicate this species to Dr B.A. Holloway, who collected the first examples and who has been most helpful with various projects over the years.

Genus *Spaniocerca* Tillyard

Spaniocerca Tillyard, 1923: 216–217 (initial diagnosis and description of type species). Kimmins, 1938: 572–576 (additions to *zelandica* and inclusion of *minor*). Winterbourn, 1965: 277–278 (description of *zelandica* nymph under *minor*); — 1968: 29–36 (new diagnosis, redescription of *zelandica*; *minor* a junior synonym of *zelandica*). McLellan, 1977: 145–147 (addition of *longicauda*); — 1987: 257–268 (new diagnosis; redescription of *zelandica*; *minor* reinstated and female and nymph described; *longicauda* redescribed; *bicornuta* and *zwicki* n.spp. described).

Type species *Spaniocerca zelandica* Tillyard, 1923

Adult. Small stoneflies 5.5–10.0 mm long. Forewing with transverse cord almost straight, unbroken; a pale transverse bar below pterostigma, and pale areas between crossveins

in the area bounded by *M*, hind margin of wing, and *Cu*. Hindwing with 6A free of margin.

Genitalia. Male. A pair of spines on posterior margin of tergite 9. Epiproct either a tapered hook or cup-shaped. Paraproct forked, fused to subgenital plate; lower fork sclerotised, spinose; upper fork membranous, stouter, with a thin, sclerotised strip extending over most of its length. Subgenital plate consisting of sternite 9 with a posteriorly produced tongue.

Female. Sternite 8 produced posteriorly, forming a subgenital plate through which sclerotised margins of a broad genital cavity can be seen. Tip of plate turned upwards, with a medial notch accommodating a ridge on sternite 9. Sternites 8 and 9 not fused, but nevertheless acting as a short ovipositor.

Nymph. A fringe of bristles around perimeter of pronotum and on anterior and posterior margins of mesonotum and metanotum. Cerci very brittle; distal segments ampullate, with a ring of bristles around thickest part. A distinct facial mask formed by pale and dark patterns on frons and clypeus.

KEY TO SPECIES OF *SPANIOCERCA*

Males

- 1 Epiproct cup-like ... 2
—Epiproct a hook ... 4
- 2 Lower fork of paraproct on ventral surface of subgenital plate tongue ... (p. 26) .. *zwicki*
—Lower fork of paraproct above tongue ... 3
- 3 Width of lower fork of paraproct about one-quarter its length; spines on tergite 9 convergent ... (p. 24) .. *bicornuta*
—Lower fork variable in length, but width never more than one-eighth of length; spines on tergite 9 divergent ... (p. 25) .. *zelandica*
- 4 Tongue of subgenital plate one-third length of sternite 9 ... (p. 25) .. *minor*
—Tongue of subgenital plate 1.5–1.6X length of sternite 9 ... 5
- 5 Tip of epiproct bulged, in shape like a bird's head ... (p. 24) .. *longicauda*
—Tip of epiproct tapered to a sharp point ... (p. 23) .. *acuta*

Females

- 1 Tip of subgenital plate with a pair of small, pointed projections ... (p. 23) .. *acuta*

- Tip of plate not so ... 2
- 2 Tongue of subgenital plate well tapered ... 3
—Tongue of subgenital plate broadly rounded ... 4
- 3 Tip of tongue sharply pointed ... (p. 25) .. *zelandica*
—Tip of tongue rounded ... (p. 24) .. *bicornuta*
- 4 Lateral margins of genital cavity divergent ... (p. 25) .. *minor*
—Lateral margins of genital cavity almost parallel ... 5
- 5 Uprturned tip of subgenital plate deep (about 0.6X width) ... (p. 24) .. *longicauda*
—Uprturned tip of subgenital plate shallow (about 0.3X width) ... (p. 26) .. *zwicki*

Nymphs

- 1 Abdomen with a mid-dorsal row of dark spots ... 2
—Abdomen without such spots ... 3
- 2 Pronotum with 11–13 pale spots ... (p. 24) .. *longicauda*
—Pronotum with a large, dark area along midline flanked on either side by a pale area ... (p. 25) .. *minor*
- 3 Hind femora without a pale medial bar ... (p. 26) .. *zwicki*
—Hind femora with a pale medial bar ... 4
- 4 Median ocellus equal to lateral ocelli ... (p. 25) .. *zelandica*
—Median ocellus distinctly smaller than lateral ocelli ... (p. 24) .. *bicornuta*

NOTE. Nymph of *acuta* unknown.

Spaniocerca acuta new species

Fig. 39, 60, 84, 104; Map 13

Dimensions (mm). Male: length of body 6.0; antenna 6.0; forewing 6.5. Female: length of body 7.0–7.5; antenna 6.5; forewing 7.5.

Adult. Head with a dark brown facial mask and prominent ocelli. Thorax and abdomen brown. Legs with a pale medial bar on femora and tibiae.

Genitalia. Male (Fig. 39, 60, 84). Tergite with a pair of strong spines enclosing a large, subcircular excision of the hind margin. Epiproct a large, dark hook with a tapered sharp point. Tongue of subgenital plate long, over 1.5X as

long as sternite 9. Lower fork of paraproct curved around tongue apex, crossing upper fork, which is blade-like and translucent, with a thin internal strip through proximal half.

Female (Fig. 104). Tongue of subgenital plate long, as long as sternite 8, or shorter, straight-sided, tapering to a pair of small, pointed projections with a sclerotised bar between; a pimple-like extrusion medially, below bar. Sclerotised margins of genital cavity parallel basally, curved slightly inwards distally. Notch on subcircular upturned tip of plate and ridge on sternite 9 as wide as sclerotised bar.

Type data. Holotype male and paratype female, MK, Lake Ohau, Parsons Stream, 3 December 1986, G.W. Gibbs (NZAC).

Material examined. Type specimens, plus 1 male and 1 female collected with them (IDMC).

Remarks. *S. acuta* is closely related to *S. longicauda*. The name *acuta* (Latin, 'sharp') alludes to the sharp tip of the male epiproct.

***Spaniocerca bicornuta* McLellan**

Fig. 40, 61, 85, 105; Map 14

Spaniocerca bicornuta McLellan, 1987: 257–268 (initial description of male, female, and nymph).

Dimensions (mm). Male: length of body 5.5–6.0; antenna 6.0–8.0; forewing 6.0–8.0. Female: length of body 6.5–7.0; antenna 8.0–8.5; forewing 8.0–10.5. Nymph (final instar): length of body 8.0–9.0; antenna 5.0; cercus 5.0–7.0.

Adult. Head brown, with a paler facial mask. Thorax brown apart from a pale stripe along midline of pronotum. Abdomen paler brown than thorax. Forewing tinged with brown, but slightly darker along transverse cord and darker outlining of veins distal to cord. Hindwing tinged with brown, a little darker in pterostigma.

Genitalia. Male (Fig. 40, 61, 85). Tergite 9 with small, inward-directed spines enclosing an almost semicircular excision. Posteromedial strip of tergite 10 produced, apically either rounded or with 2 teeth. Tergite 10 with, on either side, a broad, sclerotised tooth at junction of posterior sclerite. Epiproct cup-shaped with a round tip. Tongue of subgenital plate 0.6–0.8x as long as sternite 9. Lower fork of paraproct short (about 0.3x total length), stout, terminating in a strong spine; upper fork long, slightly tapered to a bulged tip, with a thin, sclerotised strip on inner surface bearing a small spine at its tip and another below bulge.

Female (Fig. 105). Tongue of subgenital plate half as long as sternite 8, tapered to a rounded tip. Sternite 9 with a semicircular membranous area anteromedially, its base on anterior margin, its circumference darkly pigmented. Laterally, margins of genital cavity almost straight.

Nymph. General colour grey-brown. Head with median ocellus smaller than lateral ocelli and with a dark grey area anterior to it. Pronotum with a pale, C-shaped patch laterally in either half. Mesonotum and metanotum with a pale, heart-shaped area medially. Legs with a pale medial bar on tibiae. Abdomen unicolorous.

Type data. Holotype male and paratype female, NN–BR, lower Buller Gorge, stream 1 km south of Fuchsia Creek, 14 June 1964, I.D. McLellan (NZAC).

Material examined. Type specimens, plus 66 non-type examples (12 males, 19 females, 35 nymphs; NZAC, IDMC).

— / NN, BR, WD.

Adults collected in all months.

Remarks. *S. bicornuta* inhabits steep, stony streams in forest.

***Spaniocerca longicauda* McLellan**

Fig. 41, 62, 86, 106; Map 15

Spaniocerca longicauda McLellan, 1977: 145–147, fig. 25 (description of male, female, and nymph); — 1987: 257–268, fig. 4, 9, 16, 21, 24 (redescription of male, female, and nymph).

Dimensions (mm). Male: length of body 6.0; antenna 5.0; forewing 6.0. Female: length of body 7.0; antenna 6.0; forewing 7.0. Nymph (final instar): length of body 6.0; antenna 3.0; cercus 4.0.

Adult. Head and nota brown; head usually with a facial mask. Abdomen paler brown than thorax, with a medial dark spot on tergites 2–9. Forewing tinged brown, with a darker bar along transverse cord and darker outlining of veins distal to cord. Hindwing lightly tinged with darker brown in pterostigma.

Genitalia. Male (Fig. 41, 62, 86). Tergite 9 with long, robust spines enclosing a large, subcircular excision. Epiproct a large, dark hook, its tip shaped like a bird's head. Tongue of subgenital plate long, 1.6x as long as sternite 9. Lower fork of paraproct curving around tongue apex,

crossing upper fork, which is blade-like and translucent with a thin internal sclerotised strip in proximal half.

Female (Fig. 106). Tongue of subgenital plate short, rounded, bulged, with a pimple-like extrusion medially. Tip upturned, subtriangular, with a small medial notch accommodating a ridge on sternite 9. Sclerotised margins of genital cavity almost parallel.

Nymph largely brown. Head with ocelli equal in size. Pronotum with 5 pale spots in either half and 1 on midline. Legs with a pale medial to apical bar and a pale longitudinal stripe medially on anterior surface of middle and hind femora. Anterior margins of abdominal tergites 2–9 with a dark spot medially flanked by 3 pale spots on either side.

Type data. Holotype male and 4 paratype females, FD, Wilmot Pass, 630–1000 m asl, 10–23 January 1970, J.I. Townsend (NZAC).

Material examined. Type specimens, plus 211 non-type examples (49 males, 54 females, 108 nymphs; NZAC, IDMC).

— / WD (as far north as Franz Josef), CO, OL, FD.

Adults collected January–March, July, August, October, December.

Habitat. The nymphs of *S. longicauda* inhabit steep, stony streams, usually in forest.

***Spaniocerca minor* Kimmins**

Fig. 42, 63, 87, 107; Map 16

Spaniocerca minor Kimmins, 1938: 575–577, fig. 11, 12 (description of male genitalia, wings, and body). Winterbourn, 1968: 29–36 (junior synonym of *zelandica*). McLellan, 1987: 257–268, fig. 3, 11, 15, 22, 28 (reinstated; male redescribed; female and nymph described).

Dimensions (mm). Male: length of body 7.0; antenna 7.0; forewing 6.5. Female: length of body 6.0–8.0; antenna 6.0–7.0; forewing 7.0–8.3. Nymph (final instar): length of body 6.0–7.0; antenna 2.0–3.0; cercus 3.0.

Adult. Head and thoracic nota brown; pronotum with a paler, almost hourglass pattern around midline; abdomen very pale brown, with a dark spot anteromedially on tergites 3–8 or 4–8. Wings tinged with brown, darker in pterostigma and along transverse cord; hindwing paler than forewing.

Genitalia. Male (Fig. 42, 63, 87). Tergite 9 with strong, convergent spines enclosing a straight-based incision. Tergite 10 without strong sclerotisation. Epiproct a dark, narrow hook. Tongue of subgenital plate short, 0.4x as long as sternite 9. Upper fork of paraproct bulged at base, the rest blade-like, translucent, tapering to a sharp tip curved on to tergite 10; lower fork nearly as long as upper fork and crossing it.

Female (Fig. 107). Tongue of subgenital plate short, 0.4x as long as sternite 8; margins rounded, forming a bulged, almost hemispherical tip to plate. Sclerotised margins of genital cavity curving outwards to a wide genital opening.

Nymph. General colour brown. Head with ocelli equal in size. Mesonotum and metanotum with a dark patch anteriorly on either side of midline. Pronotum brown; lateral quarters pale, with irregular boundaries between colours and sometimes with a pale spot on midline and an occasional pale spot within the brown. Abdominal tergites 2–9 with a dark spot anteriorly on midline. Middle and hind femora with a pale medial to apical bar.

Type data. Holotype male and 2 paratype males, NC–WD, Arthurs Pass, 915–1220 m asl, January 1933 and January 1935, G. V. Hudson (BMNH, BM1933-274).

Material examined. Type specimens, plus 20 non-type examples (1 male, 7 females, 12 nymphs; BMNH, NZAC, IDMC).

— / NC, WD.

Collected January, February, October.

Habitat. *S. minor* is found in alpine seepages and water films associated with small waterfalls. It is probably more widespread along the Southern Alps than the material suggests.

***Spaniocerca zelandica* Tillyard**

Fig. 1, 5, 13, 43, 64, 65, 88, 108; Map 17

Spaniocerca zelandica Tillyard, 1923: 216–217, fig. 18 (female only; wings figured). Kimmins, 1938: 573–574, fig. 10 (male and female described, figured). Winterbourn, 1968: 29–36, fig. 1 and 2 (*minor* synonymised; male, female, and nymph described, figured; variation in male genitalia discussed, figured). McLellan, 1977: 145 (key to species); — 1987: 257–268 (male, female, and nymph redescribed; *minor* reinstated).

Dimensions (mm). Male: length of body 7.0–7.5; antenna 6.0–7.0; forewing 7.0–8.0. Female: length of body 8.0–10.0; antenna 7.0–8.0; forewing 8.0–10.0. Nymph (final instar): length of body 7.0–8.5; antenna 3.0–4.0; cercus 3.0–5.0.

Adult. Habitus, Fig. 1. Head, mesonotum, and metanotum dark brown to red-brown; facial mask sometimes present. Pronotum pale grey or pale brown with a slightly darker lyre-like pattern. Abdomen pale to dark brown. Wings (Fig. 13) tinged grey-brown or fuscous, apart from pale areas indicated in generic diagnosis.

Genitalia. Male (Fig. 43, 64, 65, 88). Posterior margin of tergite 9 with outward-directed spines. Tergite 10 with a strongly sclerotised posteromedial strip terminating in 1–4 minute teeth. Epiproct cup-shaped; tip rounded or truncate. Tongue of subgenital plate short, one-third as long as sternite 9, and with margin entire. Upper fork of paraproct long, slightly tapered, bulged at tip; longitudinal sclerotised strip with 2 minute, projecting spurs, one before the bulged tip, the other near its apex; lower fork variable in length (Fig. 65).

Female (Fig. 108). Tongue of subgenital plate long, 0.6–0.8x as long as sternite 8, and tapered to a sharp point. Sternite 9 membranous medially. Sclerotised margins of genital cavity almost parallel.

Nymph (Fig. 5). General colour brown. Head with ocelli equal in size. Pronotum either uniformly brown or brown laterally with a pale patch on either side of midline, or with pale patches coalesced to some degree. Mesonotum and metanotum with a pale, medial heart-shaped area. Legs with a pale medial bar on femora, but this sometimes faint or missing on fore and middle femora.

Type data. Holotype female, NN, Nelson, 6 January 1921, A. Philpott (NZAC).

Material examined. Holotype, plus 299 non-type examples (62 males, 73 females, 164 nymphs; NZAC, IDMC).

TK, TO, BP, GB, HB, WN, WA/SD, NN, BR, MB, NC.

Adults collected in all months except May, June.

Habitat. *S. zelandica* inhabits a variety of running-water habitats: streams, seepages, and small rivers in forest or grassland, in both alpine and lowland areas.

Remarks. There are in the material two females from AK and a small nymph from ND. The females have characteristics which indicate that they could be a different species, but the lack of males makes a decision impossible. I therefore record their presence and hope that future collecting will give an answer.

Spaniocerca zwicki McLellan

Fig. 44, 66, 89, 109; Map 18

Spaniocerca zwicki McLellan, 1987: 257–268, fig. 6, 12, 17, 23 (initial description of male, female, and nymph).

Dimensions (mm). Male: length of body 6.0; antenna 6.0; forewing 8.0. Female: length of body 7.0; antenna 8.5; forewing 10.0. Nymph (late instar): length of body 8.0; antenna 4.0; cercus broken.

Adult. Head with a facial mask. Pronotum brown, with a dark transverse line anteriorly and a faint rugose pattern on either half. Mesonotum and metanotum brown, with a dark brown mark either side of midline. Abdomen paler brown than thorax. Forewing tinged with brown, hindwing paler.

Genitalia. Male (Fig. 44, 66, 89). Tergite 9 with small, outward-directed spines on either side of a shallow excision. Tergite 10 with a broad, sclerotised tooth on posterior margin of lateral sclerites. Epiproct cup-shaped, but with a pointed tip. Tongue of subgenital plate over 1.5x as long as sternite 9. Lower fork of paraproct variable in length, 0.6–0.8x as long as subgenital tongue and fused laterally to its ventral surface; upper fork bulged at base, then tapered to a slightly expanded tip; a thin, sclerotised strip running the length of the fork, with a small spur on outer edge of its final curve and another subapically; fork about twice as long as sternite 9.

Female (Fig. 109). Subgenital plate tongue short, less than half as long as sternite 8, hemispherical, sclerotised around its tip. Lateral margins of genital cavity faint, turned slightly inwards at genital opening. Uprturned tip of plate a shallow V-shape.

Nymph. General colour brown. Head with median ocellus smaller than lateral ocelli, and a pale area immediately anterior to median ocellus. Pronotum with or without pale areas. Mesonotum and metanotum with a central pale area. Abdomen and legs brown.

Type data. Holotype male and paratype female, SL, Gore, Dolamore Park, Whisky Creek, 23 December 1978, I.D. McLellan (NZAC).

Material examined. Type specimens, plus 17 non-type examples (3 males, 2 females, 10 nymphs, 2 exuviae; NZAC, IDMC).

— / WD, CO, SL.

Collected February, November, December.

Remarks. Nymphs of *S. zwicki* have been found in stony streams in forest.

Genus *Spaniocercoides* Kimmins

Kimmins, 1938: 561–580. Aubert, 1960: 47–60 (comparison with Australian, South African, and South American genera). Winterbourn, 1965: 253–284 (addition of *fimbria* and *philpotti*); — 1968: 29–36 (addition of *cowleyi*). McLellan, 1972: 469–481 (revised diagnosis; removal of *fimbria*); — 1984: 167–178 (new diagnosis; addition of *foxi*, *townsendi*, and *watti*).

Type species *Spaniocercoides hudsoni* Kimmins, 1938

Adult. Small stoneflies 4.5–7.0 mm long. Forewing with transverse cord interrupted and not straight as in *Spaniocerca*. Hindwing with Cu_1 and $1A$ some distance apart at wing margin; anal fan with 6 veins, the 6th fused with the wing margin.

Genitalia. Male. Tergite 9 without spines; tergite 10 consisting of 2 anterolateral sclerites and a posterior sclerite with its hind margin indented medially, forming 2 lobes. Cercus 1-segmented, with an apical spur. Epiproct hooked anterodorsally, with a wide base and a barb on either side of tip. Sternite 9 produced into a long, tapered subgenital plate (ventral process); gonopore dorsal, some distance from apex. Paraprocts spatulate, not fused to subgenital plate.

Female. Sternite 8 produced into an ovipositor, consisting of a posterior extension tapered to 2 lobes (sternal lobes), each capped with an apical sclerite which may be fused to it. Sternite 9 heavily sclerotised, sometimes with a central depression.

Nymph. Pronotum almost square, with angles rounded and lateral margins convex, without a fringe of hairs and without markings apart from longitudinal and transverse anterior grooves. Mesonotum without a hair fringe on posterior margin. Legs without pale bars. Cerci long, very fragile.

Remarks. The species of *Spaniocercoides* clearly show different lines of development from basic patterns in the male and female genitalia. In males the position of the cercal spur in relation to the 'pimple' (remnant of cercal segment 2?) divides the genus in two, *hudsoni* having the spur on the outer margin and the pimple on the inner, whereas all other males have those positions reversed. There is great variation in the shape and length of cerci and the length of the cercal spur in males of the latter group. The basic form of female ovipositors is described in the diagnosis. Two patterns have evolved, one with the sternite 8 extension short and with large, unfused apical sclerites, the other with a long extension and long, narrow apical sclerites fused to long, narrow sternal lobes. *S. watti* has evolved

in another direction, having a rectangular subgenital plate bearing long sternal lobes with large lateral apical sclerites all situated on sternite 8.

KEY TO SPECIES OF *SPANIOCERCOIDES*

Males

- 1 Cercus with spur on outer face of tip
... (p. 29) .. *hudsoni*
—Cercus with spur on inner face of tip ... 2
- 2 Cercal spur longer than twice width of cercus ... 3
—Cercal spur as long as width of cercus, or shorter ... 4
- 3 Forewing with 3 pale transverse bars; tip of paraproct expanded
... (p. 30) .. *philpotti*
—Forewing uniformly grey-brown; tip of paraproct not expanded
... (p. 28) .. *cowleyi*
- 4 Cercus in lateral aspect half as wide as long
... (p. 31) .. *townsendi*
—Cercus in lateral aspect less than one-quarter as wide as long
... 5
- 5 Epiproct tip bifurcate ... (p. 28) .. *foxi*
—Epiproct tip not bifurcate ... (p. 29) .. *howesi*

NOTE. Males of *jacksoni* and *watti* unknown.

Females

- 1 Ovipositor with apical sclerites fused to sternal lobes
... 2
—Ovipositor with apical sclerites free from sternal lobes
... 4
- 2 Ovipositor 4X as long as segment 8
... (p. 30) .. *jacksoni*
—Ovipositor less than 3.5X as long as segment 8 ... 3
- 3 Sternite 9 with a depression in each lateral half; forewing with pale bars
... (p. 28) .. *foxi*
—Sternite 9 without depressions; forewing uniformly grey-brown
... (p. 28) .. *cowleyi*
- 4 Ovipositor with apical sclerites lateral to sternal lobes
... (p. 31) .. *watti*
—Ovipositor with apical sclerites posterior to sternal lobes
... 5
- 5 Ovipositor nearly 3X as long as segment 8 ... 6
—Ovipositor about 1.8X as long as segment 8 ... 7

- 6 Ovipositor with sternal extension width (at base of sternal lobes) half length of segment 8
 ... (p. 30) .. *philpotti*
 —Ovipositor with sternal extension width (at base of sternal lobes) about equal to length of segment 8
 ... (p. 29) .. *howesi*
- 7 Ovipositor with lateral margins of apical sclerites convex
 ... (p. 29) .. *hudsoni*
 —Ovipositor with lateral margins of apical sclerites straight
 ... (p. 31) .. *townsendi*

Nymphs

- 1 Frons uniformly brown ... 2
 —Frons with pale patches ... 3
- 2 Ocelli distinct ... (p. 30) .. *philpotti*
 —Ocelli indistinct ... (p. 31) .. *watti*
- 3 Cercal base about half as wide as labrum; lateral ocelli larger than anterior ocellus ... (p. 28) .. *cowleyi*
 —Cercal base 0.3X as wide as labrum; lateral ocelli not larger than anterior ocellus ... 4
- 4 Frons with a pale patch bounded by epicranial sutures and ocelli ... (p. 28) .. *foxi*
 —Mask-like pale patch extending width of head between epicranial sutures and anterior ocellus
 ... (p. 29) .. *howesi*

NOTE. The nymphs of *hudsoni*, *townsendi*, and *jacksoni* are unknown. The key should therefore be used with caution in the range of those species. A further aid to the identification of nymphs is the difference in the position of hind legs in dead specimens. Surface-dwelling species have the tibiae directed forwards, but phreatic species have the tibiae directed to the rear.

Spaniocercoides cowleyi (Winterbourn)

Figures 23, 45, 90, 110; Map 19

Notonemoura cowleyi Winterbourn, 1965: 278–279, fig. 2d–f, 3a (original description of male and female).

Spaniocercoides cowleyi Winterbourn, 1968: 35, fig. 3. McLellan, 1972: 474–475, fig. 9, 10; — 1984: 167–168 (redescription of adults and description of nymph).

Dimensions (mm). Male: length of body 5.5; forewing 6.5; antenna 4.0. Female: length of body 5.5; forewing 7.0; antenna 4.0. Nymph: length of body 5.5; antenna 2.5; cercus broken, estimated to be 2+.

Adult. Wings uniform grey. Legs grey-brown.

Genitalia. Male (Fig. 45, 90). Tergite 10 posterior sclerite with deeply concave lateral margins; posterior lobes each with a patch of spines; a membranous strip extending the length of the tergite. Epiproct strongly curved; lateral margins curved upwards and inwards, forming an ear-shaped flap. Cercus long, curved upwards, with a long spine projecting from inner surface of tip.

Female (Fig. 110). Ovipositor with a much tapered posterior extension of sternite 8, about twice as long as sternite, forming long sternal lobes fused to long apical sclerites.

Nymph (Fig. 23). Epicranial sutures well defined; ocelli distinct, the lateral ocelli larger than anterior ocellus; frons with pale and dark patches. Cercal base almost half as wide as labrum. Hind tibiae usually extended to rear in death.

Type data. Holotype male and paratype female, BR–WD, Kumara, 24 January 1964, D.R. Cowley (AMNZ).

Material examined. Type specimens, plus 231 non-type examples (102 males, 113 females, 2 associated exuviae, 14 nymphs; AMNZ, IDMC, NZAC).

TK, WN / NN, BR, WD.

Collected January, April (alpine NN), September–December.

Habitat. Nymphs of *S. cowleyi* are phreatic, inhabiting the underwater gravels of stony streams. Consequently, specimens are rarely found unless specialised collecting methods are used, or when adults are emerging. Even at the peak of emergence few are found; passage to the surface may therefore occur immediately before ecdysis.

Spaniocercoides foxi McLellan

Figures 24, 46, 91, 111; Map 20

Spaniocercoides foxi McLellan, 1984: 167–178 (female and nymph described).

Dimensions (mm). Male: length of body 4.0; forewing 3.0; antenna 3.5–4.0. Female: length of body 4.5–6.0; forewing 3.2–5.8; antenna 3.8–4.5. Nymph: length of body 6.5; antenna 2.0; cercus 3.0.

Adult. Forewing grey, darker anteriorly and in anal area, with a pale basal patch and 2 pale bars, one along transverse cord and another from pterostigma to R_{2+3} . Legs with a pale bar medially on femur and tibia and an apical pale bar on femur.

Genitalia. Male (Fig. 46, 91). Posterior lobes of tergite 10 clothed in spines and long hairs. Epiproct tapered to an anterodorsally curved lamina terminating in a pair of lateral spines; 2 lateral lobes with sclerotised outer surface arising from epiproct base. Cerci 1.5X as long as tergite 10, curved upwards and inwards, terminating with a spine extending from inner surface and about as long as the tip's greatest width; a ring of setae surrounding spine, and a pimple adorning outer surface of tip. Ventral process long, tapered to a sharp tip. Paraprocts digitiform.

Female (Fig. 111). Ovipositor with sternal extension 1.5X as long as sternite 8, acutely tapered; sternal lobes very small or non-existent; apical sclerites extending from posterior of segment 8 past tip of sternal lobes. Sternite 9 sclerotised, with a depression in each lateral half.

Nymph (Fig. 24). Epicranial sutures well defined; anterior ocellus smaller than lateral ocelli. Frons with a large pale patch bounded by ocelli and a pair of small pale patches on either side. Cercal base 0.3X as wide as labrum. Hind tibiae usually extended to rear in death.

Type data. Holotype female and 7 paratype females, TK, Mt Egmont, Manganui Ski Field, 1370 m asl, 8 November 1970, K.J. Fox (NZAC).

Material examined. Type series, plus 33 non-type examples (4 males, 27 females, 2 nymphs; NZAC).

TK, WN / —.

Collected in November.

Taken at 1000–1370 m asl.

Habitat. Adults and nymphs of *S. foxi* were found in and around streams draining alpine bogs. Only two nymphs were found, despite intensive searching; this may be attributed to the phreatic lifestyle prevalent in this genus.

Remarks. The Tararua Range (WN) specimens have shorter wings than those from Taranaki: the female wings terminate at the abdomen tip, and male wings are a little shorter. About half the Tararua specimens have an additional pale spot between Cu_1 and the forewing margin.

Spaniocercoides howesi McLellan

Figures 25, 47, 92, 112; Map 21

Spaniocercoides howesi McLellan, 1984: 167–178 (male, female, and nymph described).

Dimensions (mm). Male: length of body 5.5; forewing 7.0; antenna 4.5. Female: length of body 7.0; forewing 7.5;

antenna 5.0. Nymph: length of body 6.5; antenna 3.0; cercus 2+.

Adult. Forewing grey-brown with a basal pale area, a pale bar along transverse cord, and 2 pale spots distally (one in pterostigma, another from Cu_2 to wing margin). Hindwing paler, with dark costal and subcostal areas. Legs with a pale bar medially on femur and tibia.

Genitalia. Male (Fig. 47, 92). Posterior sclerite of tergite 10 slightly tapered, covered in hairs; inner surface of lobes heavily sclerotised, clothed with spines; a heart-shaped membranous area extending from front of sclerite into lobes. Epiproct with barb of hook straight, sharp-tipped, extended ventrally. Cerci almost cylindrical, sharply tapered, curved inwards at tips, each tip bearing a short apical spine on its inner surface and a dark sclerotised 'pimple' on its outer surface; tips extending slightly beyond epiproct.

Female (Fig. 112). Ovipositor with posterior extension about 0.7X as long as sternite, tapered with concave margins to broad, well rounded sternal lobes; apical sclerites about 0.6X as long as sternite 8, free, with lateral margins rounded. Cerci short, stout.

Nymph (Fig. 25). Epicranial sutures well defined; ocelli small, sometimes indistinct; frons with a mask-like area across width of head between sutures and anterior ocellus. Cercal base 0.3X as wide as labrum. Hind tibiae of last instar extended forwards in death, but earlier instars die with hind tibiae extended rearwards.

Type data. Holotype male and 2 paratype females, NN, Mt Glasgow, 1200 m asl, 2 December 1967, I. D. McLellan (NZAC).

Material examined. Type specimens, plus 41 non-type examples (10 males, 15 females, 16 nymphs; NZAC).

— / MB, NN, BR, WD, NC, MC, SC, OL, FD.

Adults collected January, February, October, December.

Taken at 1000–1417 m asl.

Habitat. *S. howesi* is an alpine species inhabiting seepages and small streams.

Spaniocercoides hudsoni Kimmins

Figures 48, 93, 113; Map 22

Spaniocercoides hudsoni Kimmins, 1938: 577–579, fig. 13–15 (in part *S. howesi*). McLellan, 1972: 470–474 (in error for *S. philpotti* and *S. howesi*); — 1984: 167–178 (description of male and female).

Dimensions (mm). Male: length of body 4.5–5.0; antenna 3.0–4.0; forewing 5.5–6.0. Female: length of body 5.0–5.5; antenna 5.0; forewing 5.0–5.7.

Adult. Forewing fuscous, with a pale area near base, a pale bar along transverse cord, and 2 pale spots distally (one near base of pterostigma, another between Cu_1 and wing margin). Hindwing pale, with darker costal and subcostal areas. Legs uniformly dark grey-brown.

Genitalia. Male (Fig. 48, 93). Tergite 10 slightly tapered, clothed in long hairs posteriorly; a shallow medial indentation on posterior margin, with a sclerotised strip over most of its length. Epiproct narrow from base to bend in lateral aspect, expanded at barbs, tapered to tip; perhaps a long, fragile seta arising from keel, level with barbs. Cercus stout, upcurved; tip heavily sclerotised; a stout spur extending from outer margin, and a dense tuft of setae on inner surface of tip.

Female (Fig. 113). Ovipositor with posterior extension of sternite 8 very short (about 0.3x as long as sternite); lateral margins convex; sternal lobes fused to posterior extension, forming a continuation of convex lateral margins; a shallow medial indentation between the lobes; apical sclerites large (0.3x as long as sternite 8), not fused to sternal lobes and with lateral margins rounded.

Type data. Holotype male, WN, Korokoro, 12 October 1923, G.V. Hudson (BMNH); paratype female, WN, Upper Hutt, 1 July 1925, G.V. Hudson (BMNH).

Material examined. Type specimens, plus 55 non-type examples (18 males, 37 females; NZAC).

WA, WN / SD, BR.

Collected September–December.

Habitat. Apparently seepages (W.J. Winstanley, pers. comm.); found up to 1000 m asl in forest.

Remarks. The epiproct of one male has a long seta arising vertically from the keel. This is not present in the holotype or other males. It has possibly been broken off in those specimens, so I have added it to the description.

The female of *S. howesi* included in Kimmins's types and description gives the false impression that *S. hudsoni* occurs as far south as Arthurs Pass (NC–WD).

***Spaniocercoides jacksoni* new species**

Figures 14, 114; Map 23

Dimensions (mm). Female: length of body 4.0; forewing 6.0; antenna broken.

Adult. Wings (Fig. 14) pale grey. Forewing with pale areas at base, a pale bar along transverse cord, and a pale spot in pterostigma. Legs with a medial pale bar on femur and tibia.

Genitalia. Female (Fig. 114). Ovipositor with posterior extension long, about twice as long as sternite 8. Apical sclerites fused to sternal lobes, extending well past tip of abdomen.

Type data. Holotype female, WD, Jackson River (tributary of Arawata River), small stream, 2 January 1979, I.D. McLellan (NZAC).

Material examined. Holotype only.

Remarks. *S. jacksoni* is dedicated to John Richard Jackson, who collected wingless terrestrial griptopterygids for me. He loved the mountains and did many solo expeditions through the Southern Alps. In November 1987 he disappeared in the Red Hills, just south of this species' collection site, and was never found.

***Spaniocercoides philpotti* Winterbourn**

Figures 6, 49, 94, 115; Map 24

Spaniocercoides philpotti Winterbourn, 1965: 280–281, fig. 3e (description of female). McLellan, 1972: 470–474, fig. 1–8, 11–14 (as *hudsoni*; male and female genitalia and nymph); — 1984: 167–178 (redescriptions, figures).

Dimensions (mm). Male: length of body 4.5–5.5; forewing 4.5–6.5; antenna 5.0–6.0. Female: length of body 5.0–7.0; forewing 5.5–7.0; antenna 4.5–5.0. Nymph: length of body 6.5–7.5; antenna 2.5–3.0; cercus 3.0.

Adult. Forewing brown, usually darker in distal part of pterostigma, with a pale area near base, a pale bar along transverse cord, and another parallel and distal to it, from pterostigma to hind margin. Hindwing paler, with darker costal and subcostal areas. Legs with a pale bar medially on femur and tibia.

Genitalia. Male (Fig. 49, 94). Posterior sclerite of tergite 10 with slightly concave lateral margins; inner part of each posterior lobe clothed in short spines; a membranous medial strip running the length of the sclerite. Epiproct strongly curved, short, broad in lateral view; lateral margins from bend to tip curved upwards and inwards, forming a flap which merges with tip. Cerci long, curved upwards; tip with a long spine projecting dorsally from its inner surface and a small pimple on its outer surface.

Female (Fig. 115). Ovipositor with posterior extension about 1.5x as long as sternite 8; lateral margins concave; sternal lobes very short, rounded; apical sclerites with rounded lateral margins, almost half as long as sternite 8.

Nymph (Fig. 6). Epicranial sutures well defined; ocelli distinct; frons uniformly brown. Cercal base 0.3x as wide as labrum. Hind tibiae usually directed forwards in death.

Type data. Holotype female and paratype female, BR, Lake Rotoroa, 10 January 1928, A. Philpott.

The types of this species are presumed lost. NZAC has no record of their deposition, and they are not in available Philpott material.

Material examined. 125 non-type examples (45 males, 28 females, 52 nymphs; NZAC).

— / NN, BR.

Adults and nymphs collected January, September–December; nymphs also August.

Remarks. The types were the sum total of material available to the author of the species; their disappearance consequently means that a lectotype cannot be designated. The determination of *S. philpotti* is, however, made easy by the fact that it is the only species with a pale bar distal to the transverse cord in the forewing. This fact enabled McLellan (1984) to identify material from Nelson Lakes National Park and give adequate descriptions.

***Spaniocercoides townsendi* McLellan**

Figures 50, 95, 116; Map 25

Spaniocercoides townsendi McLellan, 1984: 167–178 (initial description of male and female).

Dimensions (mm). Male: length of body 5.0; forewing 6.0; antenna 3.5. Female: length of body 6.0; forewing 6.0; antenna 3.5. Nymph unknown.

Adult. Forewing grey-brown, with a basal pale area, a pale bar along transverse cord, and 2 pale spots distal to cord (one in pterostigma, another from Cu_2 to wing margin). Hindwing paler, with darker costal and subcostal areas. Legs with a pale medial bar on tibia and femur and a pale apical bar on femur.

Genitalia. Male (Fig. 50, 95). Posterior sclerite of tergite 10 not tapered, covered with long hairs; lobes clothed in short spines, heavily sclerotised; membranous medial strip extending length of sclerite, expanding into lobes. Epiproct similar to that in type species but with straight margins to

bend and barb. Cerci short, stout, with a short spur on inner face and a small, dark 'pimple' on outer face; tip ventrally bulged, clothed in long hairs.

Female (Fig. 116). Ovipositor with posterior extension about 0.8x as long as sternite, moderately tapered; margins convex; sternal lobes well rounded; apical sclerites half as long as sternite 8, tapered with straight margins to acute apex. Cerci short, stout.

Type data. Holotype male and paratype female, NN, Abel Tasman National Park, Canaan Plateau, Moa Park, 1000 m asl, 9 December 1964, J.I. Townsend (NZAC).

Material examined. Type specimens, plus 6 non-type examples (5 males, 1 female; NZAC) from Mt Arthur and Mt Domett.

— / NN.

Collected November, December.

***Spaniocercoides watti* McLellan**

Figure 26, 117; Map 26

Spaniocercoides watti McLellan, 1984: 167–178 (description of female, nymph).

Dimensions (mm). Female: length of body 6.0; forewing 7.0. Nymph: length of body 6.0; antenna 2.5.

Adult. Forewing brown, pale basally, with a pale bar along transverse cord. Legs with a pale medial bar on femur and tibia.

Genitalia. Female (Fig. 117). A rectangular subgenital plate extending to about halfway down sternite 8; medially from hind margin of subgenital plate extend 2 digitate sternal lobes, flanked on either side by a large apical sclerite extending from base of lobe to tip. Sternite 9 membranous medially, sclerotised laterally.

Nymph (Fig. 26). Epicranial sutures and ocelli indistinct; frons uniform brown. Cercal base 0.3x as wide as labrum. Hind legs extending rearwards in death.

Type data. Holotype female and paratype female, ND, Waipoua State Forest, banks of Waipoua River near Forest HQ, beaten from shrubs, 17 October 1967, J.C. Watt (NZAC).

Material examined. Type specimens, plus 4 non-type examples (3 females, 1 nymph; NZAC) from Omahutu State Forest and Warra Warra State Forest.

ND / —.

Collected October, November.

Remarks. *S. watti* has the development of the same basic genital parts entirely different from other members of *Spanioceroides*, and could be considered not to qualify as a member of this genus. A decision as to its proper position must await discovery and description of the male.

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ILLUSTRATIONS

Abbreviations used in figures

A. Wing venation

<i>IA-6A</i>	anal veins
<i>Cu_{1,2}</i>	cubital veins
<i>M_{1+2, 3+4}</i>	medial veins
<i>R_{1, 2+3, 4+5}</i>	radial veins
<i>Sc</i>	subcosta
<i>tc</i>	transverse cord

B. Body and genitalia

<i>aps</i>	apical sclerite
<i>brk</i>	break in wing pad chitin
<i>cer</i>	cercus
<i>cph</i>	compacted hairs
<i>csp</i>	cercal spur
<i>ctr</i>	cercus truncated
<i>eb1</i>	epiproct blade
<i>ed1</i>	epiproct distal lobe
<i>epp</i>	epiproct pocket
<i>ept</i>	epiproct
<i>epw</i>	wing of epiproct
<i>esc</i>	epiproct sac
<i>esp</i>	epiproct side plate
<i>evr</i>	epiproct ventral rod
<i>fcm</i>	facial mask
<i>gds</i>	guide strip
<i>ocl</i>	ocellus
<i>ovd</i>	oviduct
<i>ovp</i>	ovipositor
<i>plf</i>	lower fork of paraproct
<i>ppt</i>	paraproct
<i>ptc</i>	post-tergal cavity
<i>puf</i>	upper fork of paraproct
<i>sbl</i>	subanal lobe
<i>scm</i>	sclerotised margin of genital cavity
<i>scs</i>	sclerotised strengthening strip
<i>sgp</i>	subgenital plate
<i>spa</i>	spermatheca
<i>spl</i>	supra-anal lobe
<i>spt</i>	tongue of subgenital plate
<i>stl</i>	sternal lobe
<i>s8,9</i>	sternite 8, 9
<i>s9r</i>	ridge on sternite 9
<i>tbs</i>	tibial spur
<i>t8,9</i>	tergite 8, 9
<i>vtl</i>	ventral lobe
<i>vtp</i>	ventral process
<i>wgp</i>	wing pad

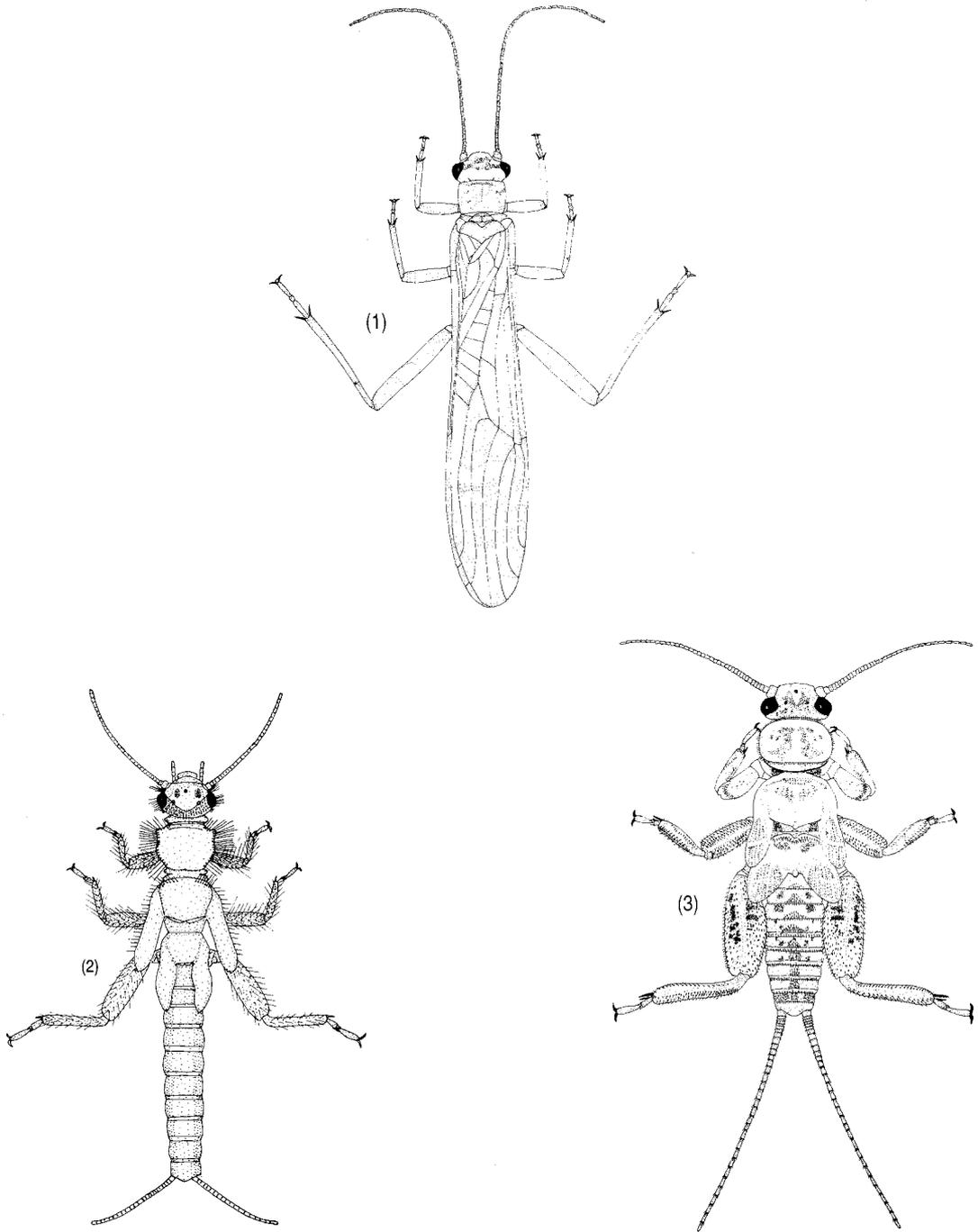
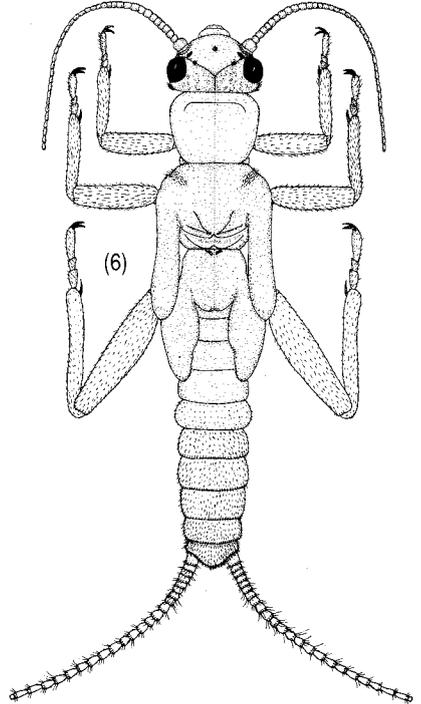
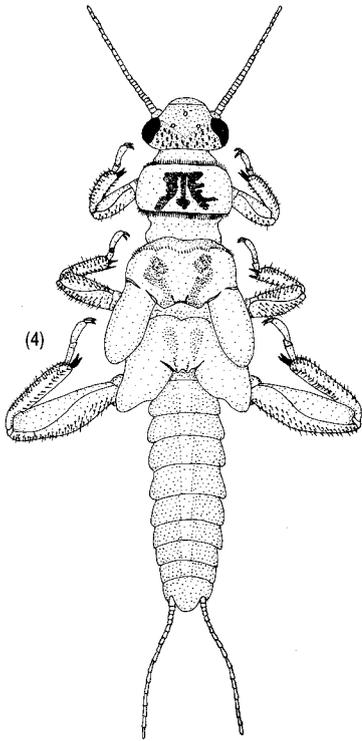
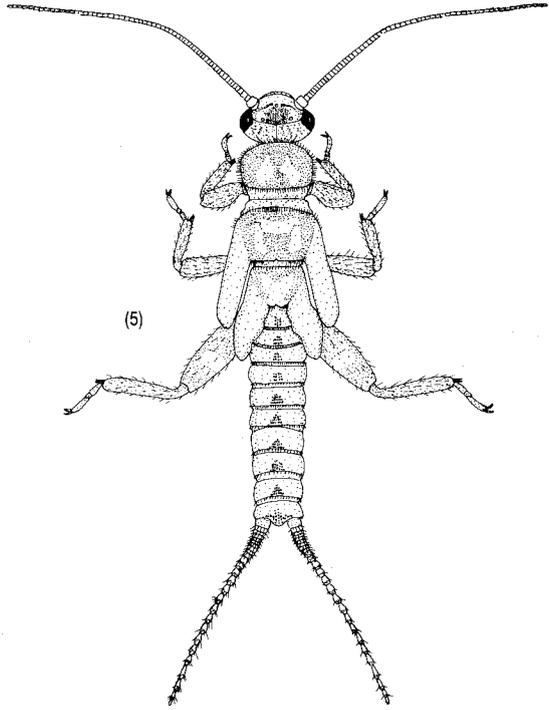


Fig. 1–6 Habitus, dorsal, of representative New Zealand notonemourid stoneflies. *Artist: I.D. McLellan.*
1 *Spaniocerca zelandica*, adult female; **2** *Cristaperla fimbria*, nymph; **3** *Halticoperla gibbsi*, nymph;
4 *Notonemoura latipennis*, nymph; **5** *Spaniocerca zelandica*, nymph; **6** *Spaniocercoides philpotti*, nymph.



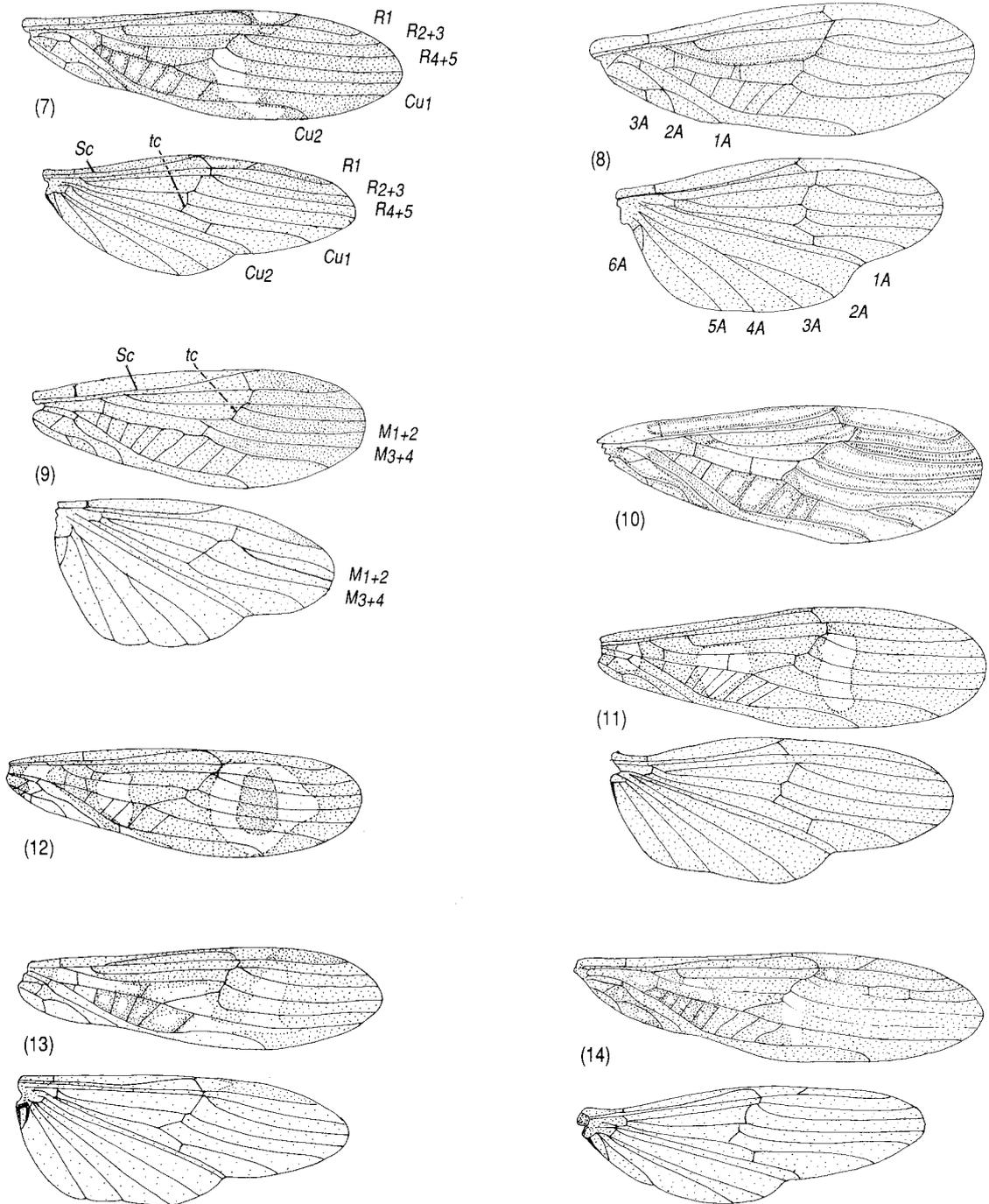


Fig. 7-14 Wings: 7 *Cristaperla fimbria*; 8 *Halticoperla gibbsi*; 9 *Notonemoura latipennis*; 10 *N. spinosa*, forewing; 11 *Omanuperla bruningi*; 12 *O. hollowayae*, forewing; 13 *Spaniocerca zelandica*; 14 *Spaniocercoides jacksoni*.

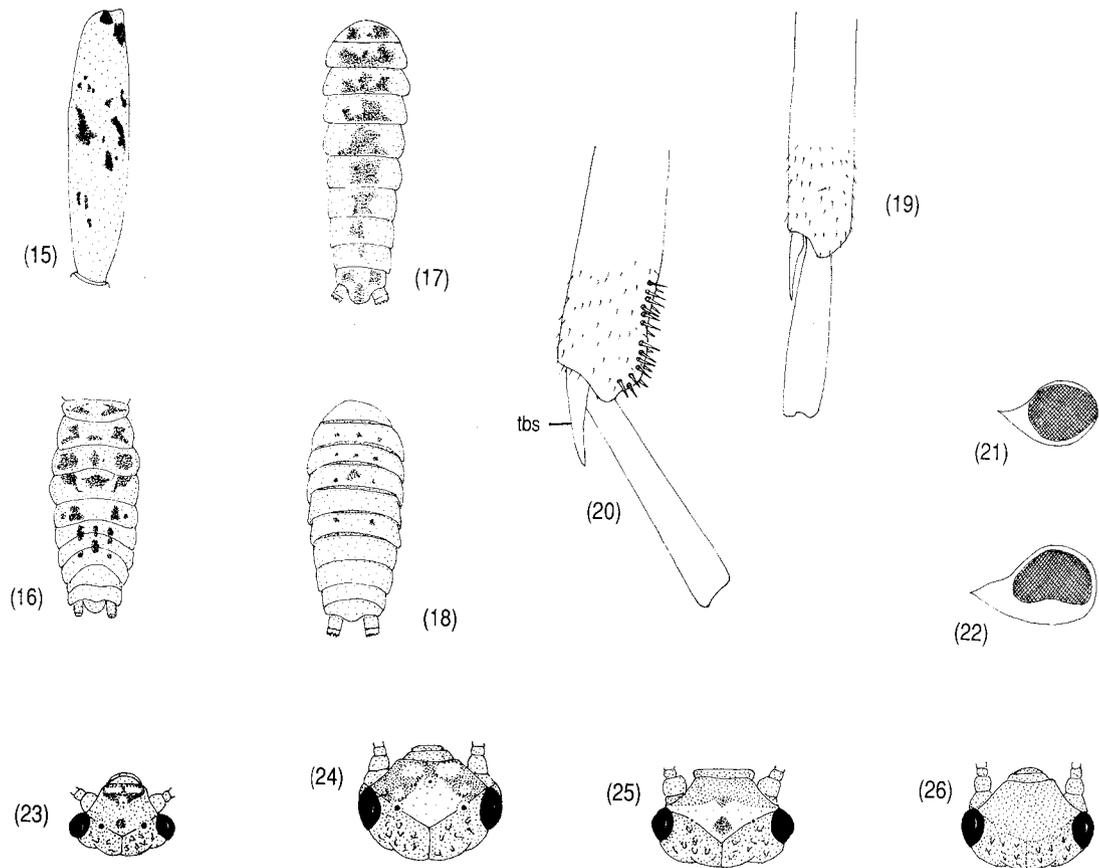


Fig. 15–26 Diagnostic features in external morphology: **15, 16** *Halticoperla gibbsi*, femur and dorsal abdomen, showing distinctive markings; **17, 18** *H. tara*, dorsal abdomen of nymphs, showing variation in markings; **19, 20** *Notonemoura alisteri* and *N. spinosa*, tibiotarsal junction; **21, 22** *N. latipennis* and *N. winstanleyi*, left eye of nymph; **23–26** *Spaniocercoides cowleyi*, *S. foxi*, *S. howesi*, and *S. watti*, head of nymph, dorsal.

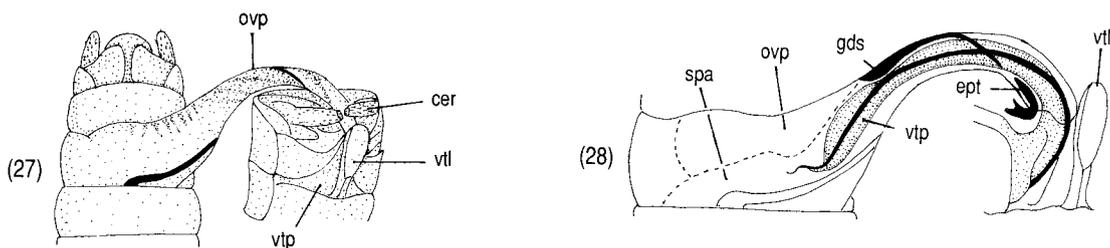


Fig. 27, 28 *Notonemoura latipennis*, genitalia of female and male *in copulo*, external (27) and internal (28; schematic).

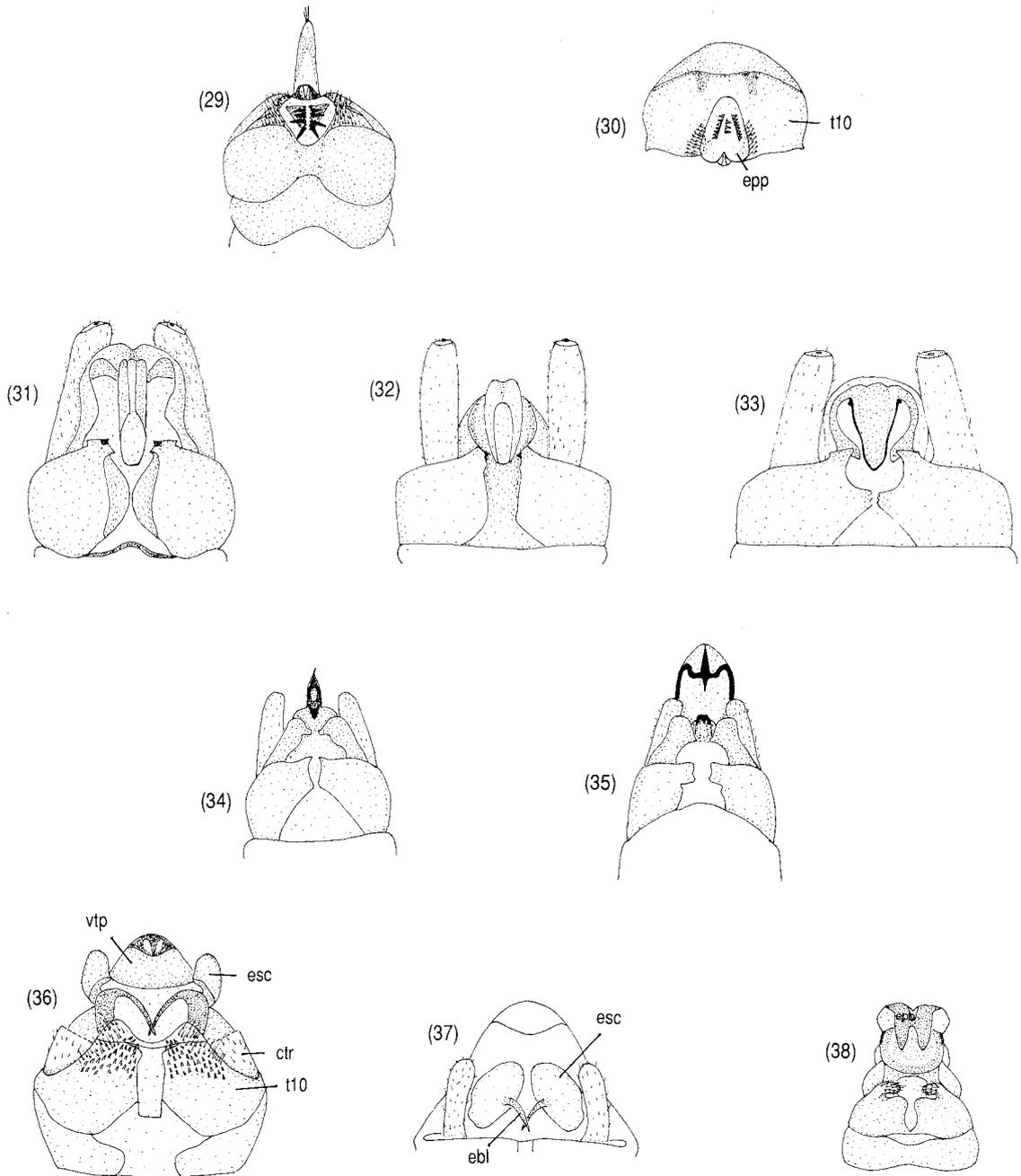
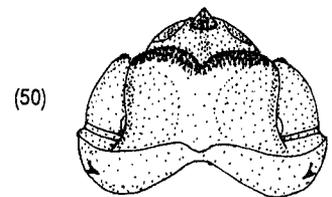
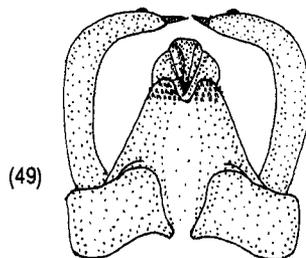
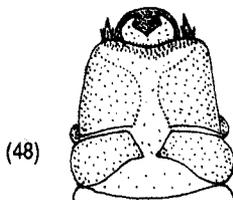
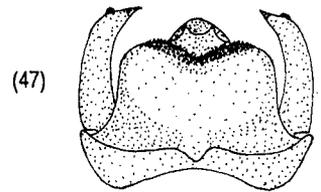
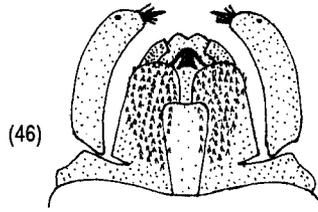
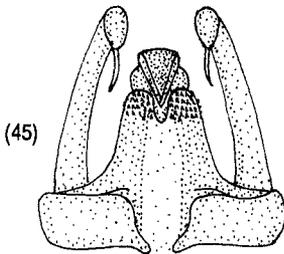
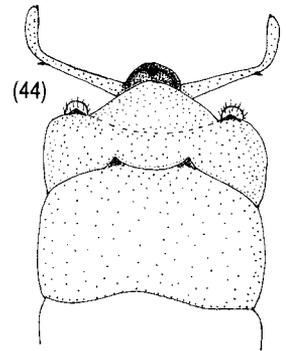
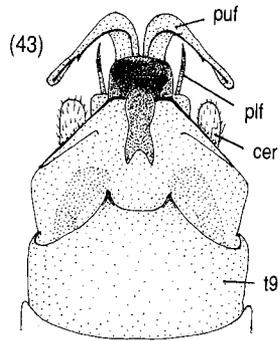
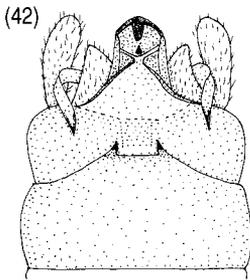
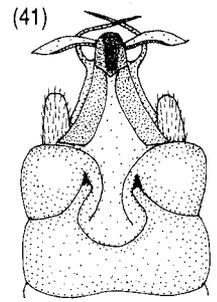
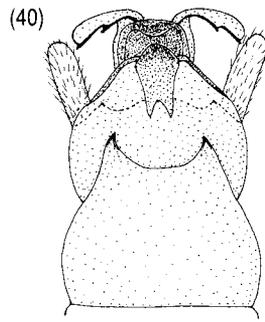
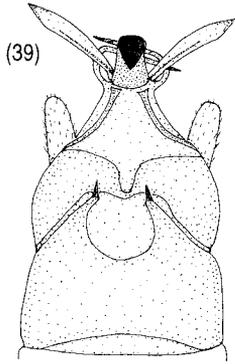
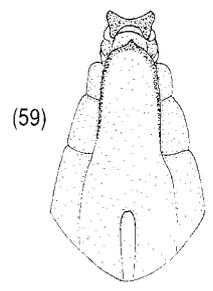
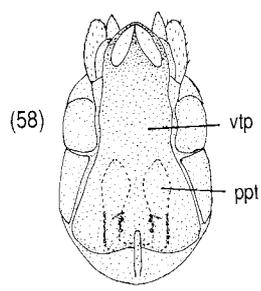
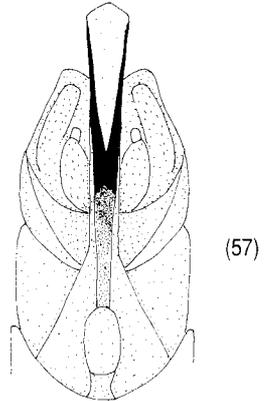
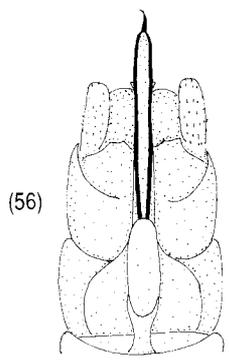
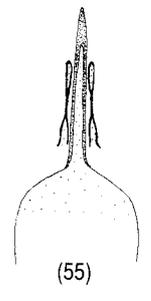
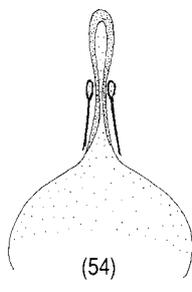
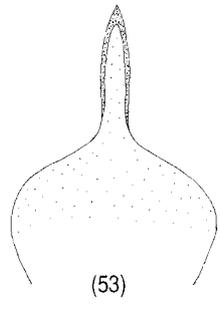
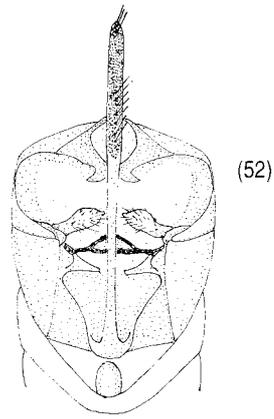
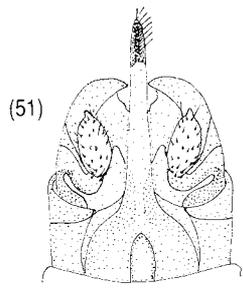


Fig. 29–50 Male genitalia, dorsal: 29 *Cristaperla eylesi*; 30 *C. fimbria*; 31 *Halticoperla gibbsi*; 32 *H. tara*; 33 *H. viridans*; 34 *Notonemoura latipennis*; 35 *N. winstanleyi*; 36, 37 *Omanuperla bruningi*, unmated and mated; 38 *O. hollowayae*; 39 *Spaniocerca acuta*; 40 *S. bicornuta*; 41 *S. longicauda*; 42 *S. minor*; 43 *S. zelandica*; 44 *S. zwicky*; 45 *Spaniocercoides cowleyi*; 46 *S. foxi*; 47 *S. howesi*; 48 *S. hudsoni*; 49 *S. philpotti*; 50 *S. townsendi*.





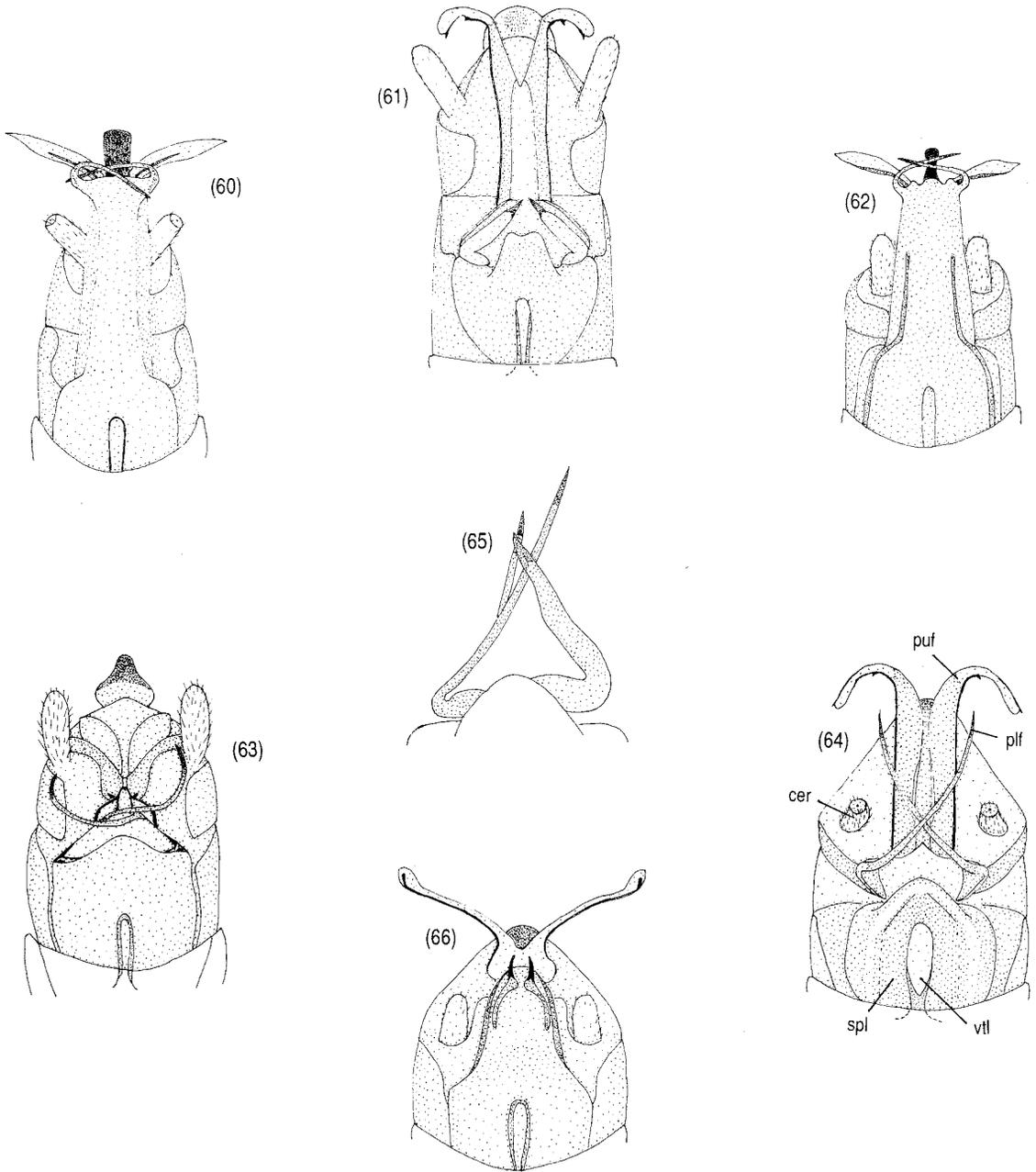
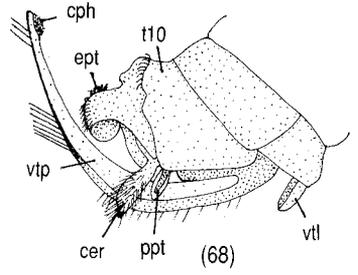
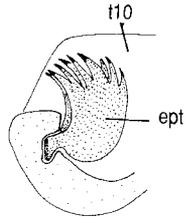
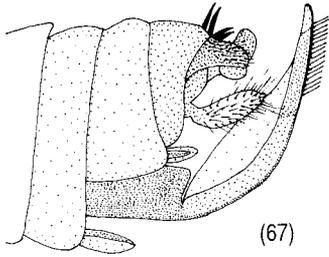
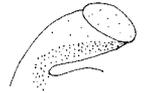
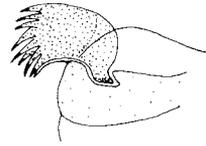


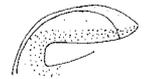
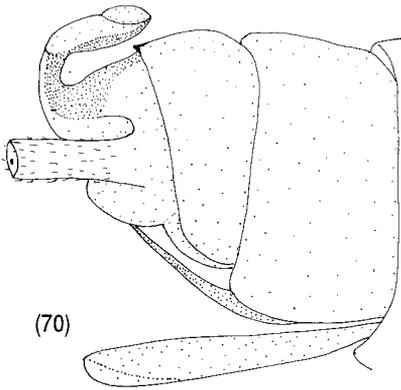
Fig. 51–66 Male genitalia, ventral: **51** *Cristaperla eylesi*; **52** *C. fimbria*; **53** *Halticoperla gibbsi*, ventral process; **54, 55** *H. tara* and *H. viridans*, ventral process and paraprocts; **56** *Noitonemoura latipennis*; **57** *N. winstanleyi*; **58** *Omanuperla bruningi* (paraprocts outlined); **59** *O. hollowayae*; **60** *Spaniocerca acuta*; **61** *S. bicornuta*; **62** *S. longicauda*; **63** *S. minor*; **64, 65** *S. zelandica*, and paraproct variation; **66** *S. zwicki*.



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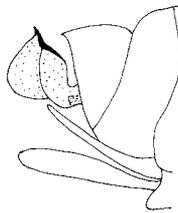


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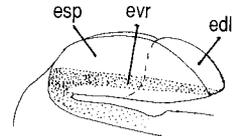


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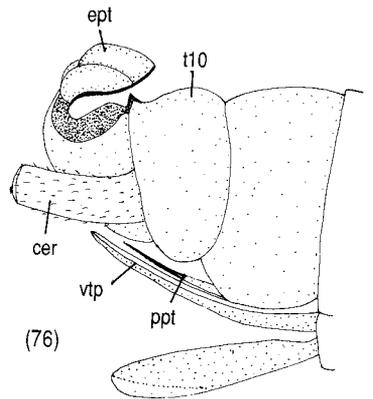
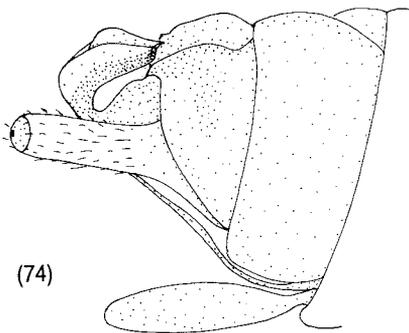
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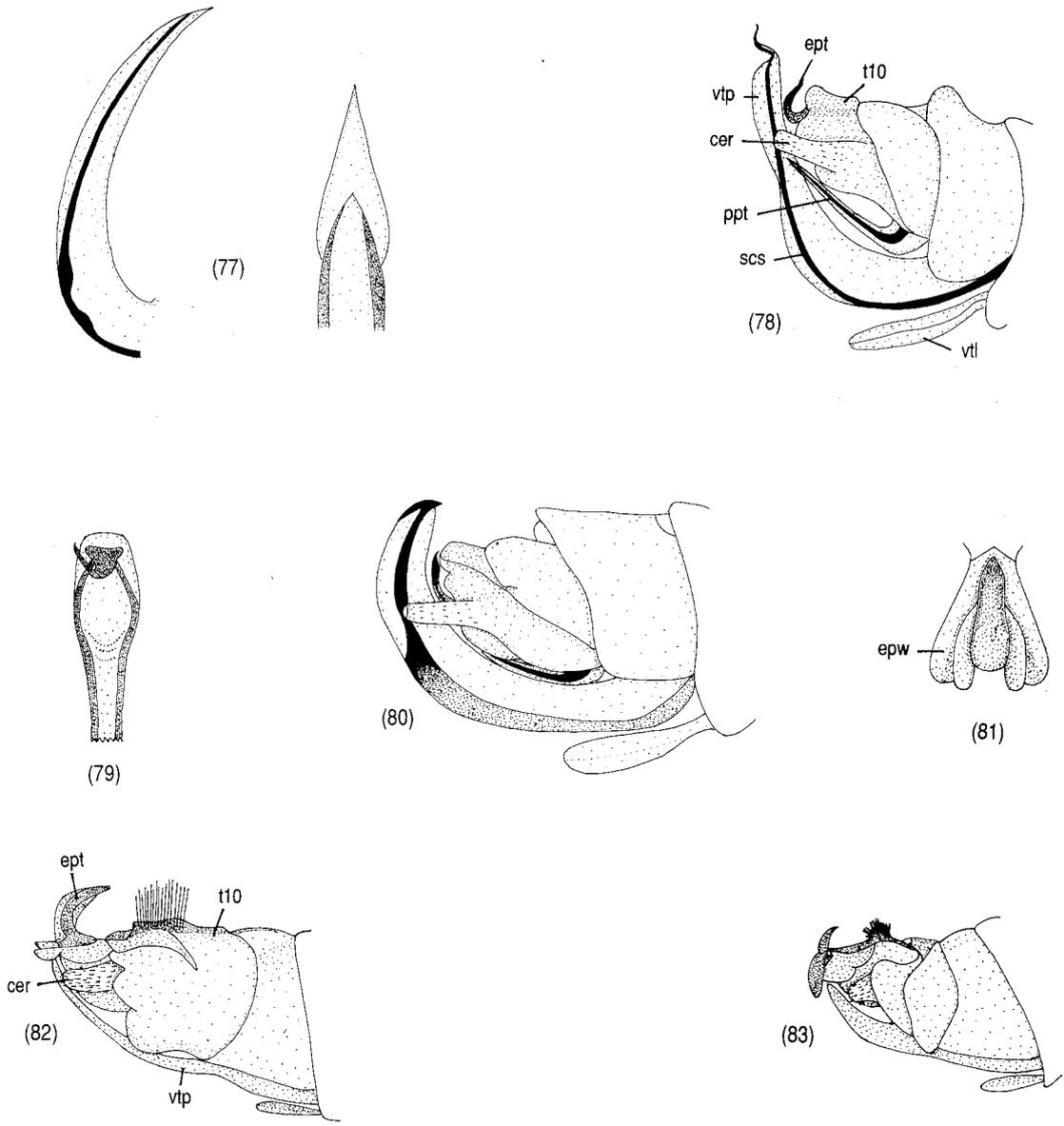
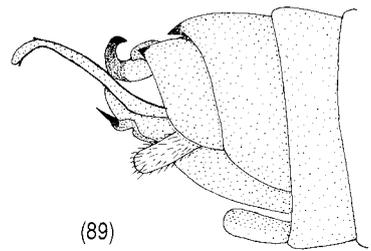
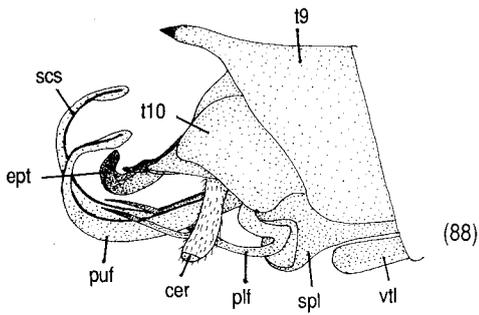
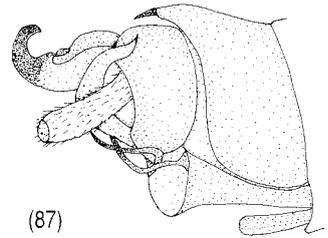
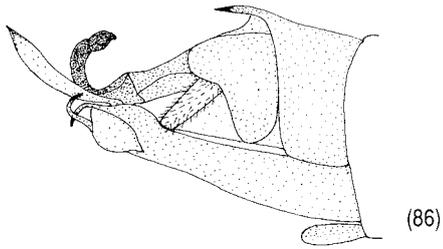
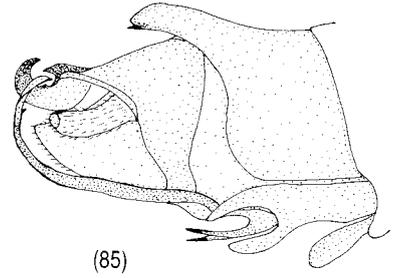
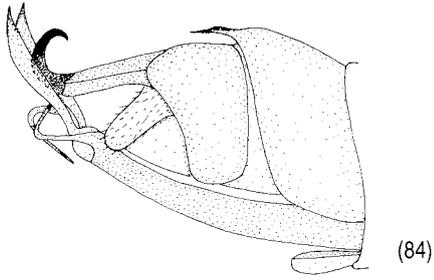
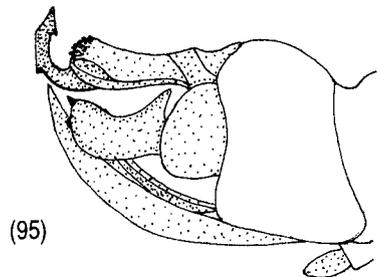
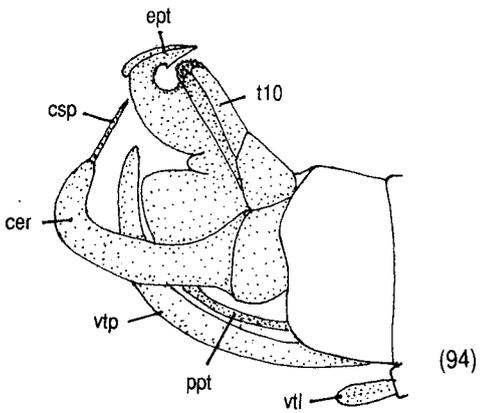
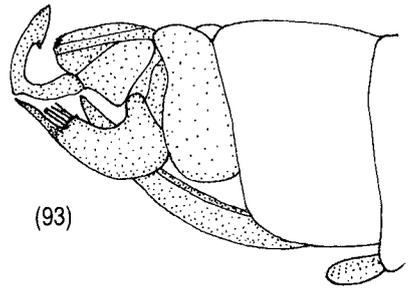
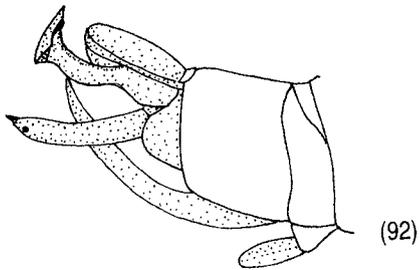
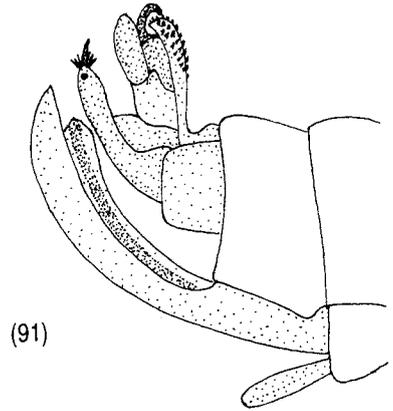
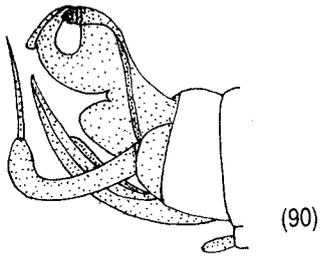


Fig. 67–95 Male genitalia, lateral (unless otherwise indicated): **67** *Cristaperla oylesi*; **68, 69** *C. fimbria*, and with epiproct retracted / extended; **70–73** *Halticoperla gibbsi*, with epiproct variation (71, 72) and internal detail (73); **74, 75** *H. tara*, and with epiproct partly extruded; **76** *H. viridans*; **77** *Notonemoura alisteri*, tip of ventral process, lateral and posterior; **78, 79** *N. latipennis*, and tip of ventral process, posterior; **80, 81** *N. winstanleyi*, and epiproct, posterior; **82** *Omanuperla bruningi*; **83** *O. hollowayae*.



Male genitalia, lateral (continued): 84 *Spaniocerca acuta*; 85 *S. bicornuta*; 86 *S. longicauda*; 87 *S. minor*;
 88 *S. zelandica*; 89 *S. zwicki*.; 90 *Spaniocercoides cowleyi*; 91 *S. foxi*; 92 *S. howesi*; 93 *S. hudsoni*;
 94 *S. philpotti*; 95 *S. townsendi*.



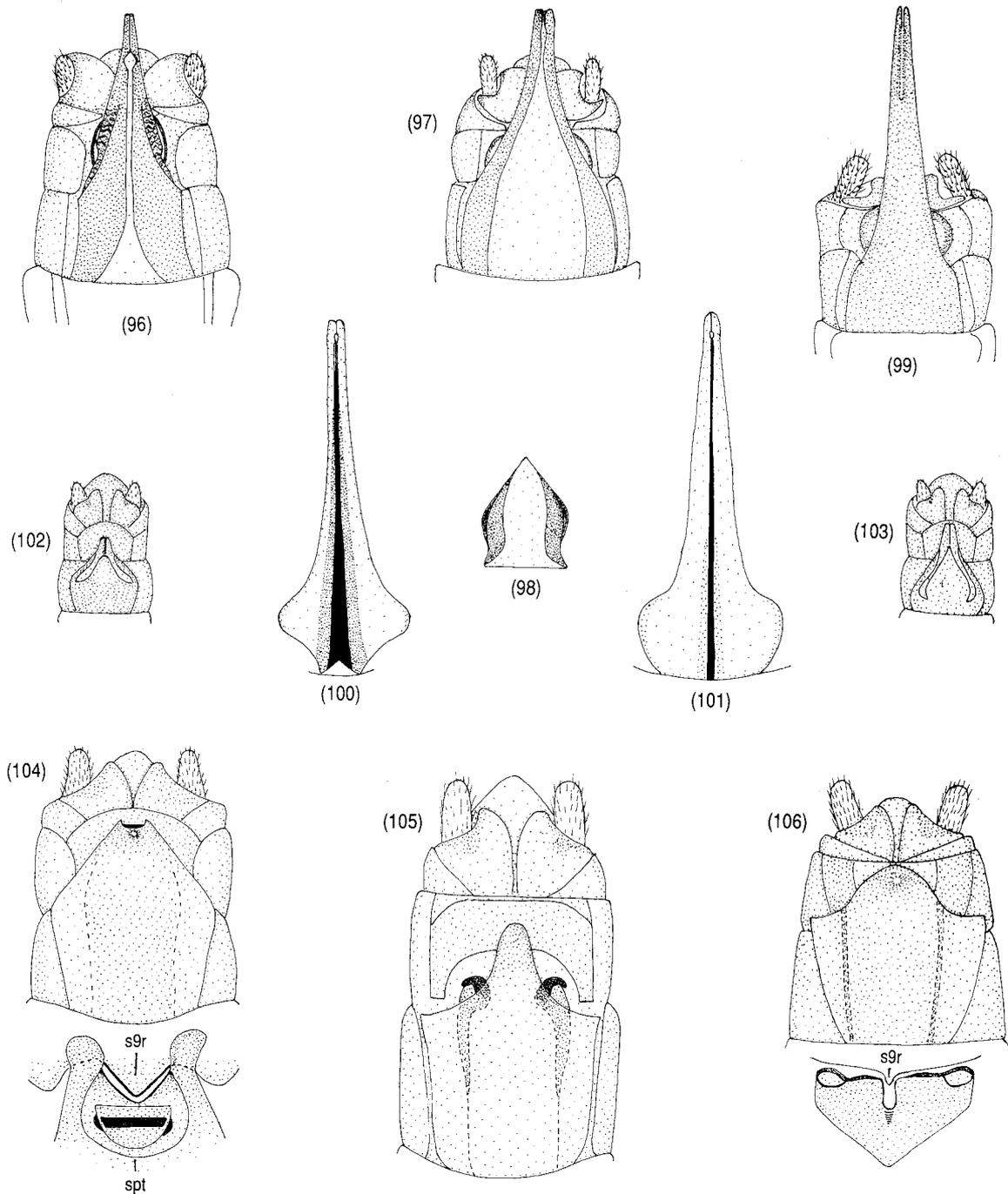
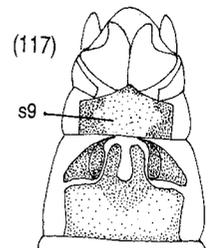
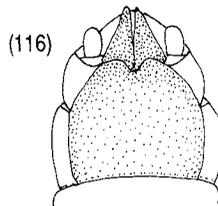
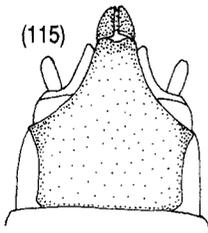
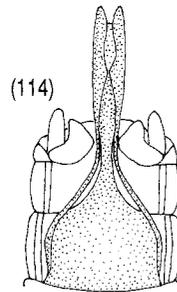
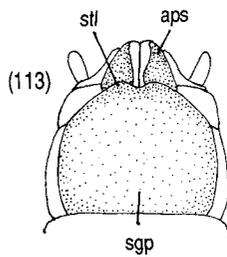
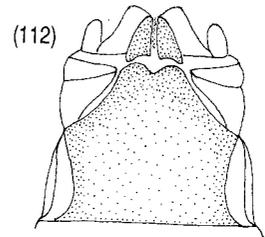
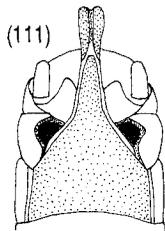
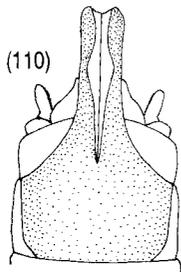
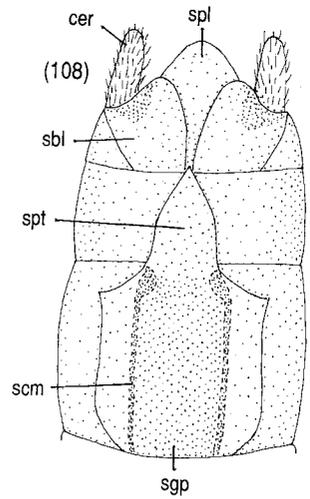
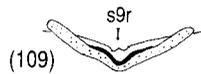
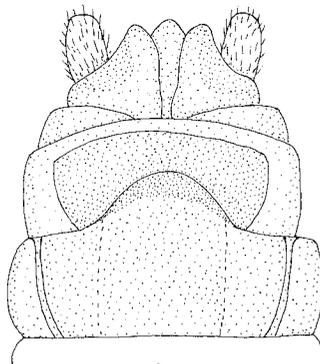
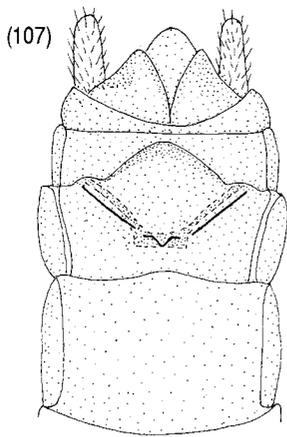


Fig. 96–117 Female genitalia, ventral (unless otherwise indicated): **96** *Cristaperla eylesi* (dorsal); **97, 98** *C. fimbria*, and sternite 9; **99** *C. waharoa*; **100, 101** *Notonemoura latipennis* and *N. winstanleyi*, ovipositor; **102** *Omanuperla bruningi*; **103** *O. hollowayae*; **104** *Spaniocerca acuta*, and ovipositor tip, posterior; **105** *S. bicornuta*; **106** *S. longicauda*, and ovipositor tip, posterior.



Female genitalia, ventral (continued): 107 *Spaniocerca minor*; 108 *S. zelandica*; 109 *S. zwicki*, and ovipositor tip, posterior; 110 *Spaniocercoides cowleyi*; 111 *S. foxi*; 112 *S. howesi*; 113 *S. hudsoni*; 114 *S. jacksoni*; 115 *S. philpotti*; 116 *S. townsendi*; 117 *S. watti*.

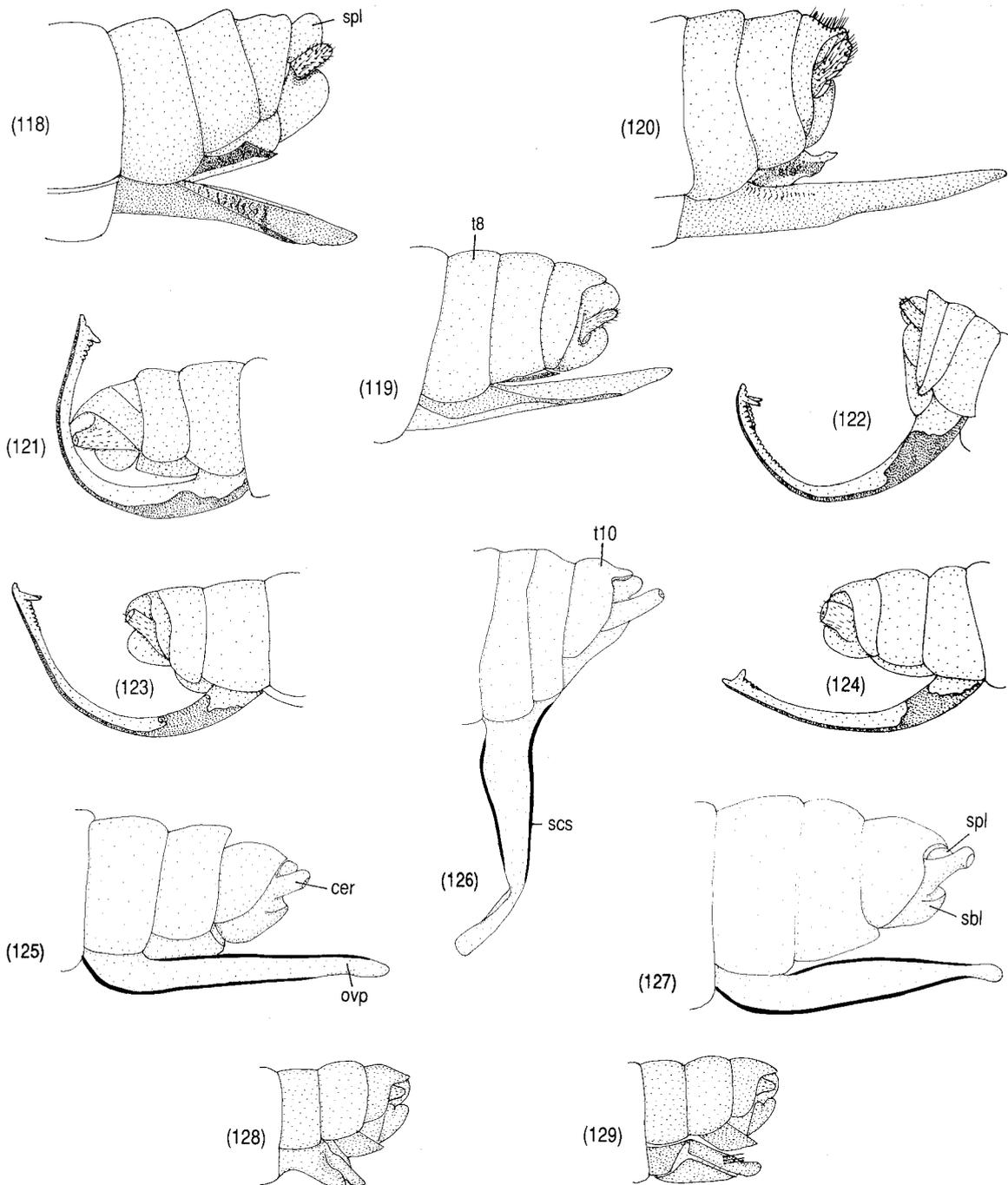
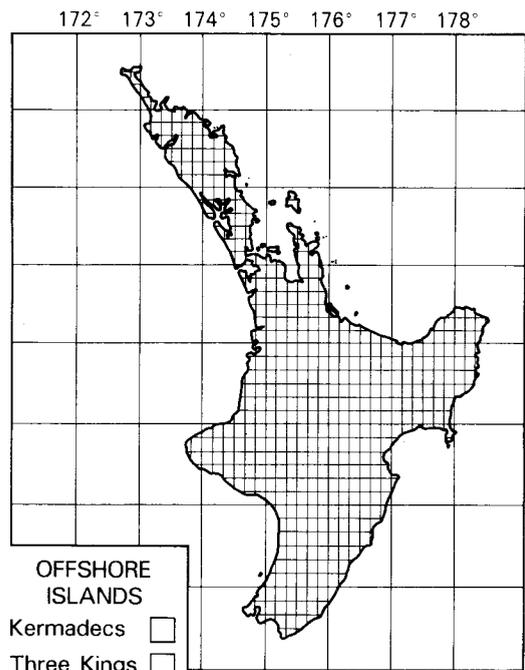
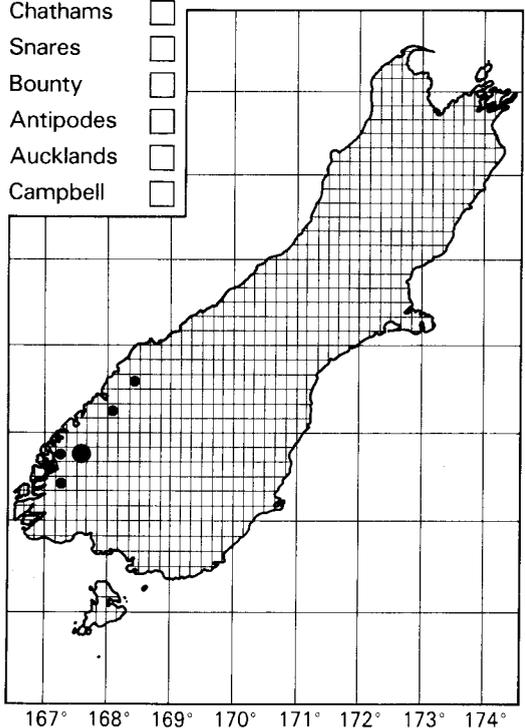


Fig. 118–129 Female genitalia, lateral: **118** *Cristaperla eylesi*; **119** *C. fimbria*; **120** *C. waharoa*; **121–124** *Halticoperla viridans*, unmated (**121**), mated with ovipositor depressed (**122**), mated with ovipositor normal (**123**), and variant with short ovipositor from Cora Lynn, NC (**124**); **125** *Notonemoura latipennis*; **126** *N. spinosa*; **127** *N. winstanleyi*; **128** *Omanuperla bruningi*; **129** *O. hollowayae*.

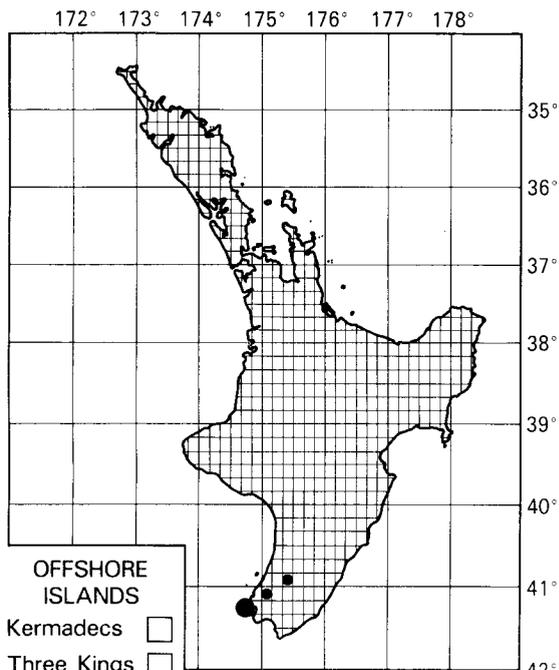
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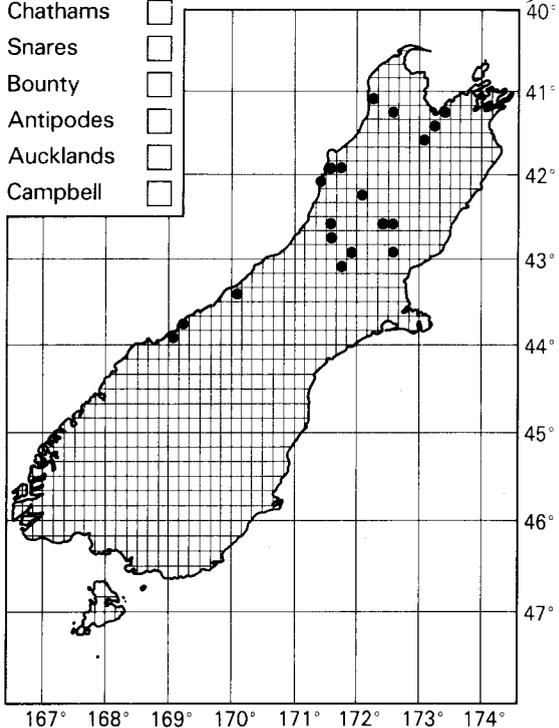
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 - Three Kings
 - Chathams
 - Snares
 - Bounty
 - Antipodes
 - Aucklands
 - Campbell



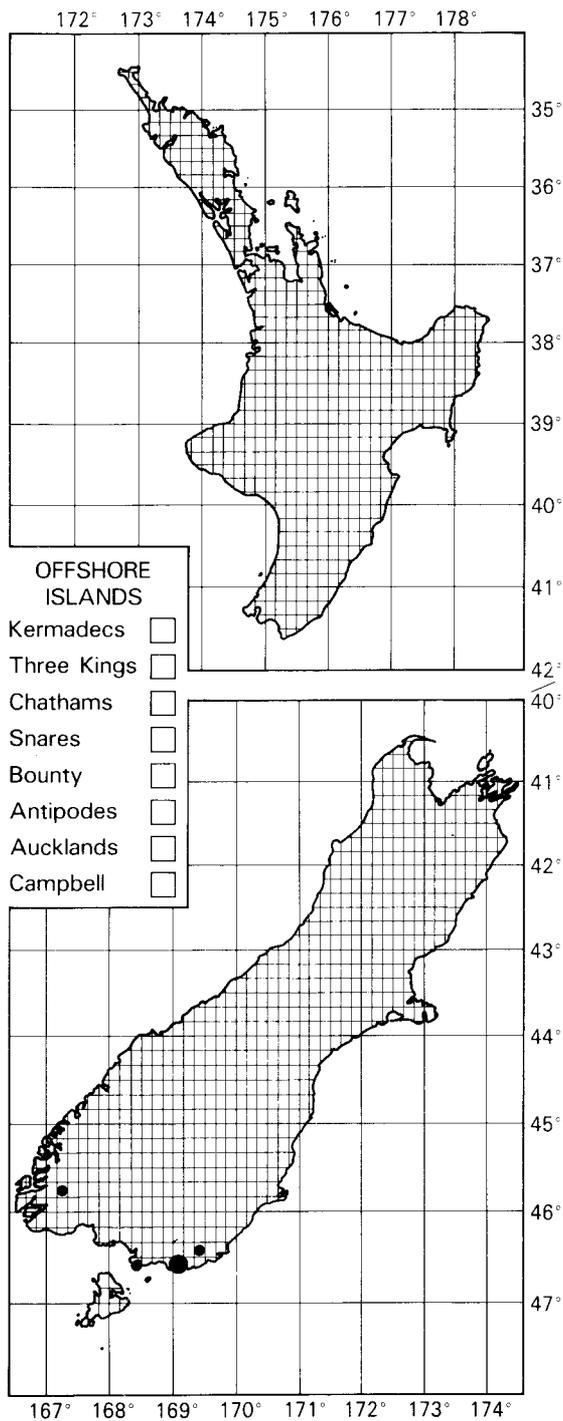
• Map 1 Collection localities, *Cristaperla eylesi* •



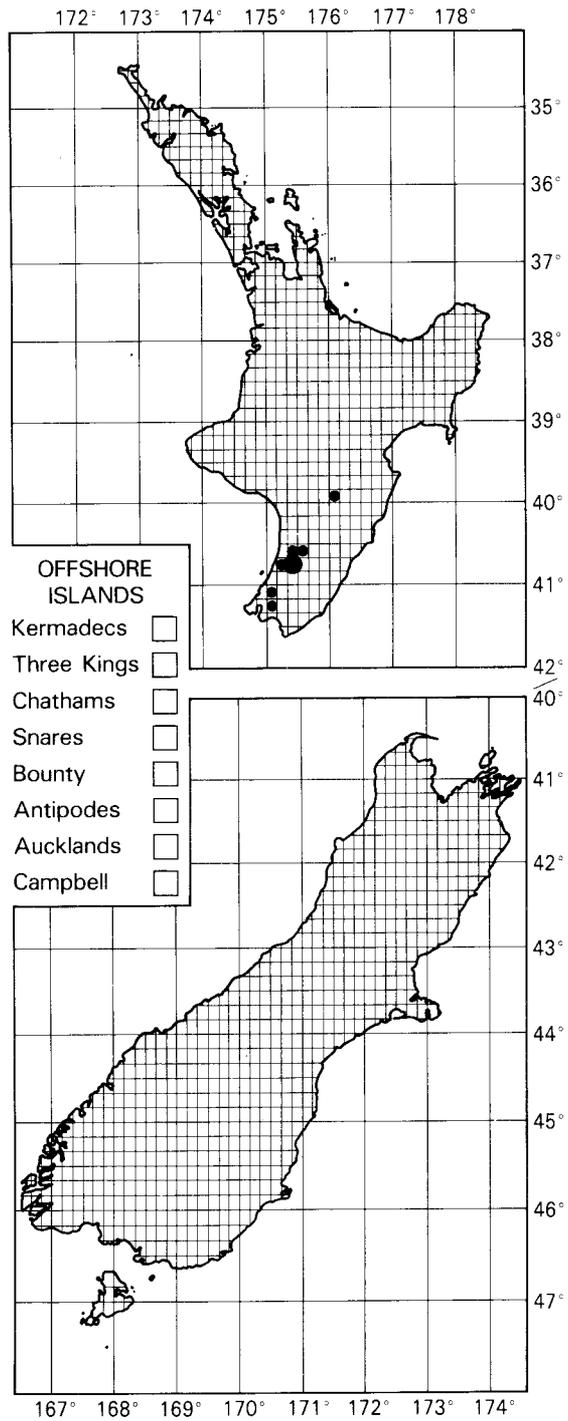
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 - Aucklands
 - Campbell



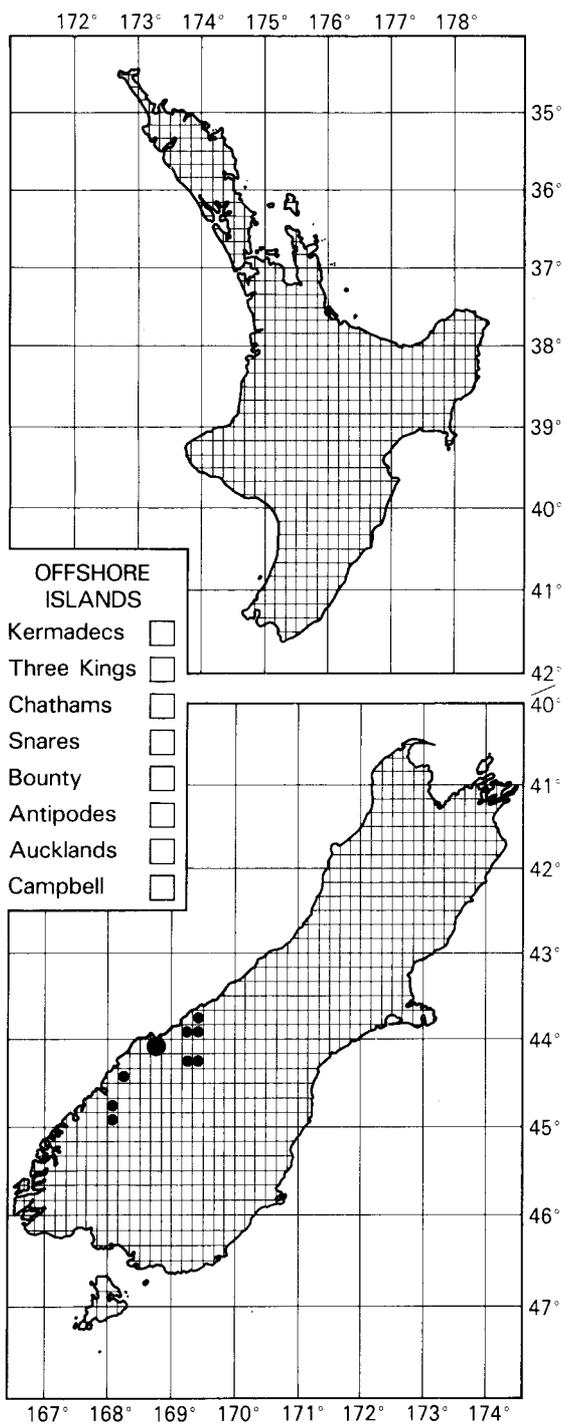
• Map 2 Collection localities, *Cristaperla fimbria* •



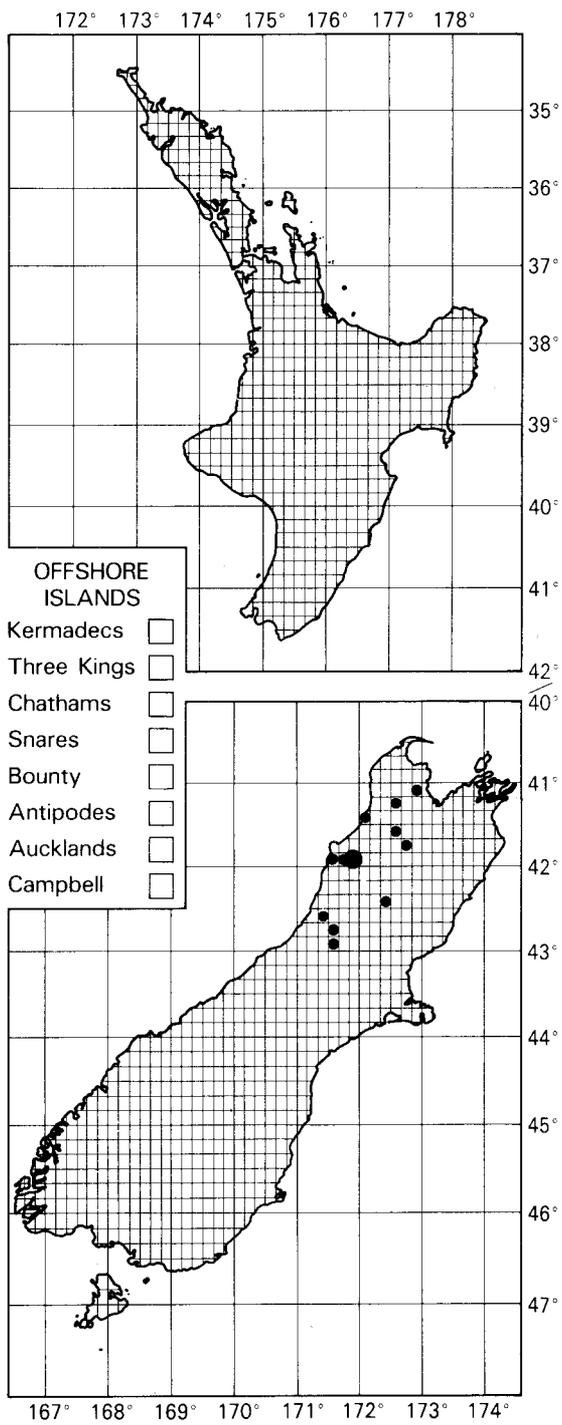
• Map 3 Collection localities, *Cristaperla waharoa* •



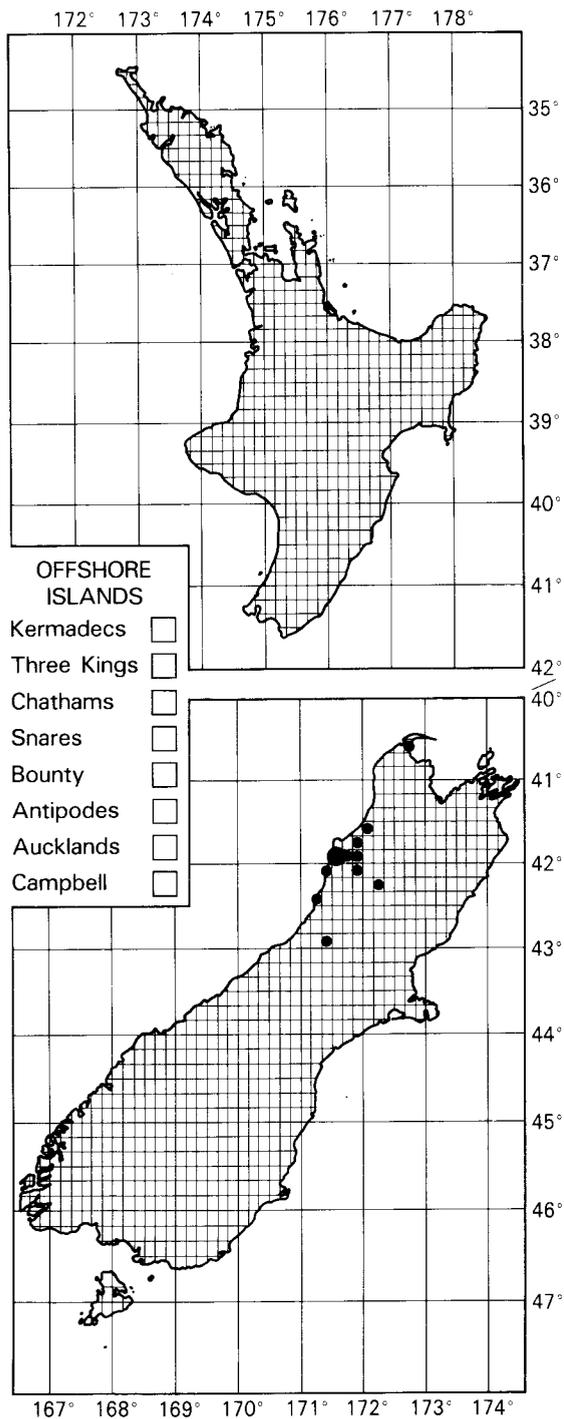
• Map 4 Collection localities, *Halticoperla gibbsi* •



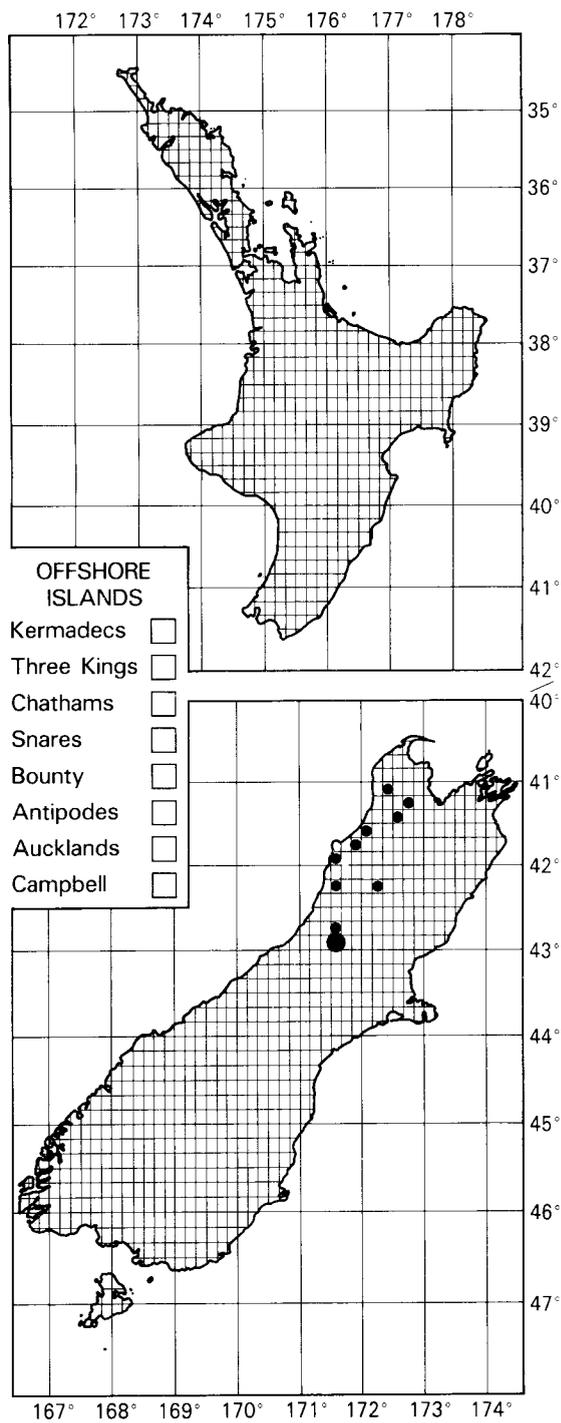
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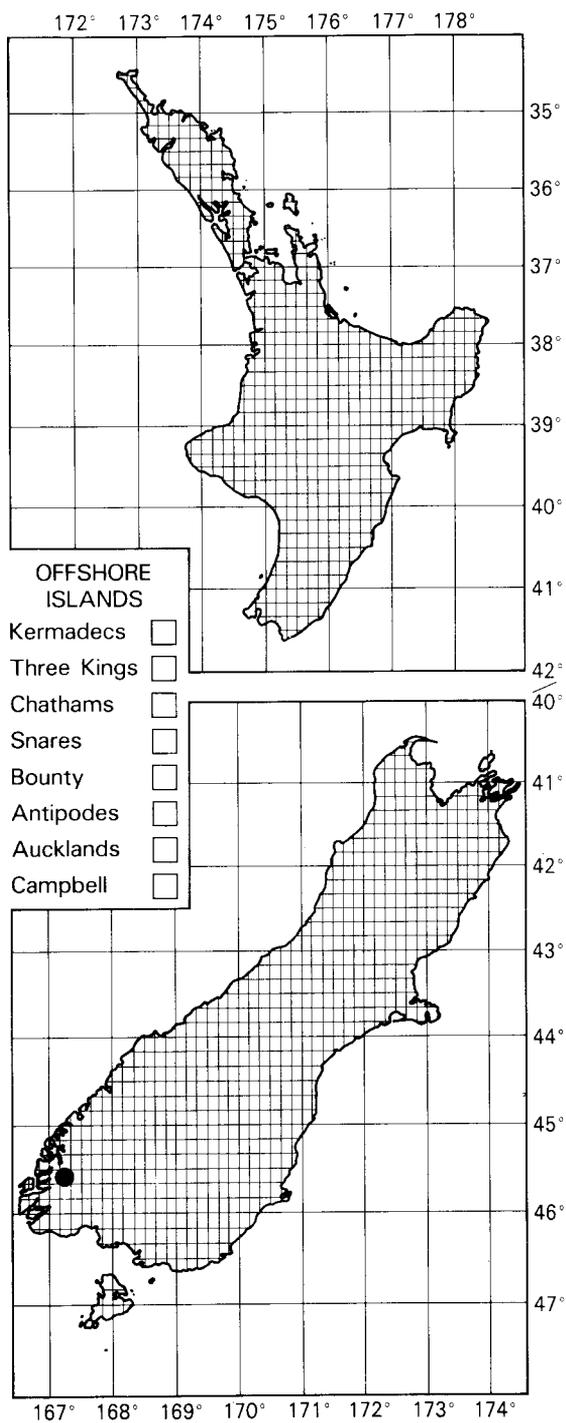
• Map 6 Collection localities, *Halticoperla viridans* •



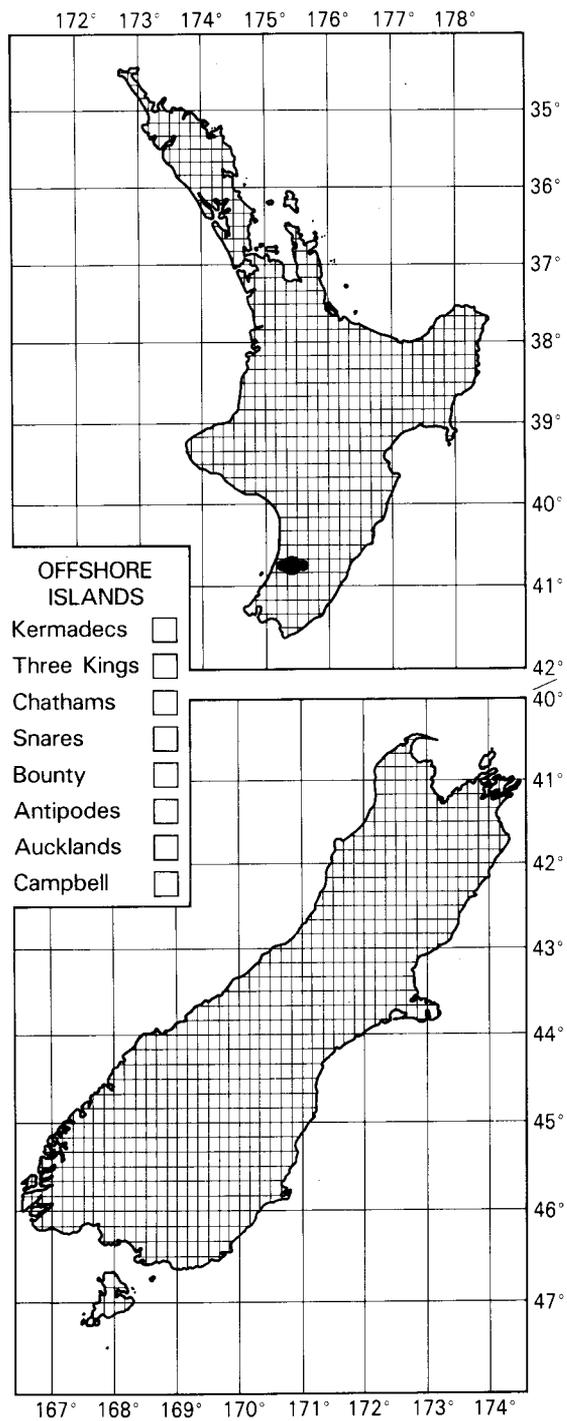
• Map 7 Collection localities, *Notonemoura alisteri* •



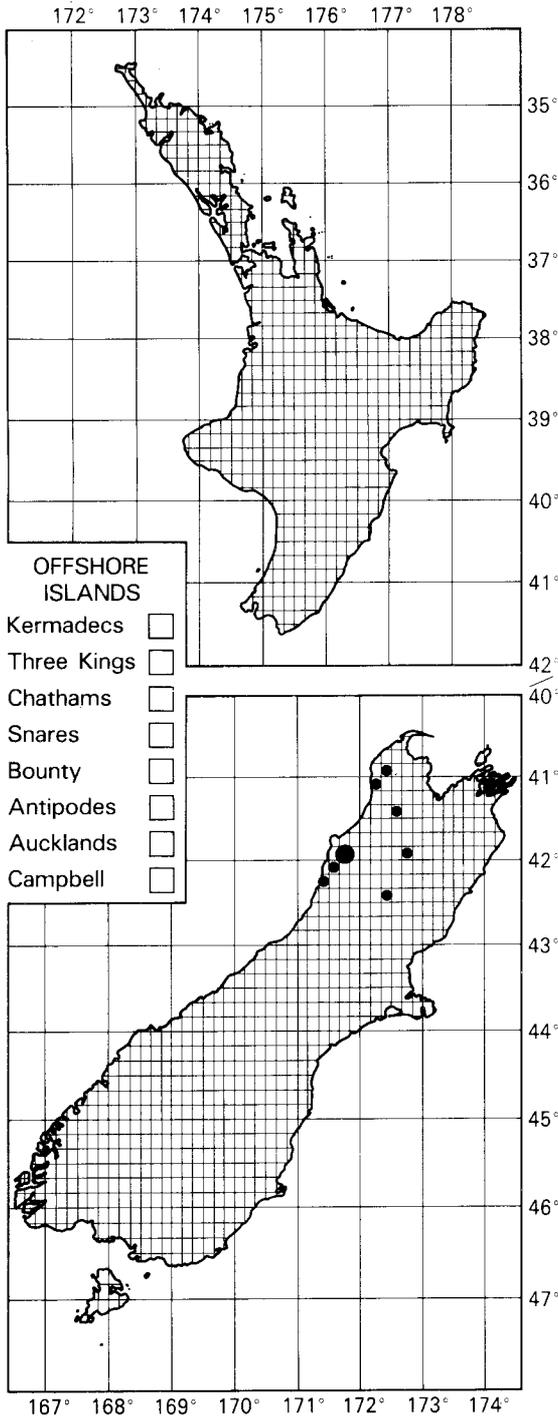
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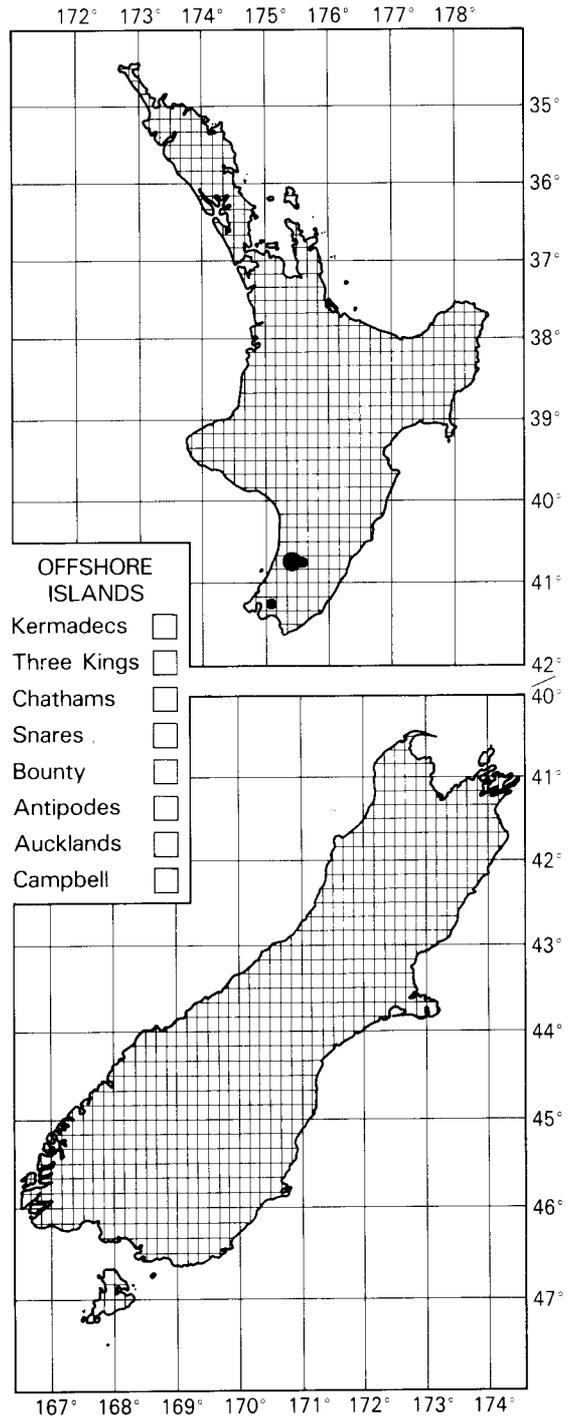
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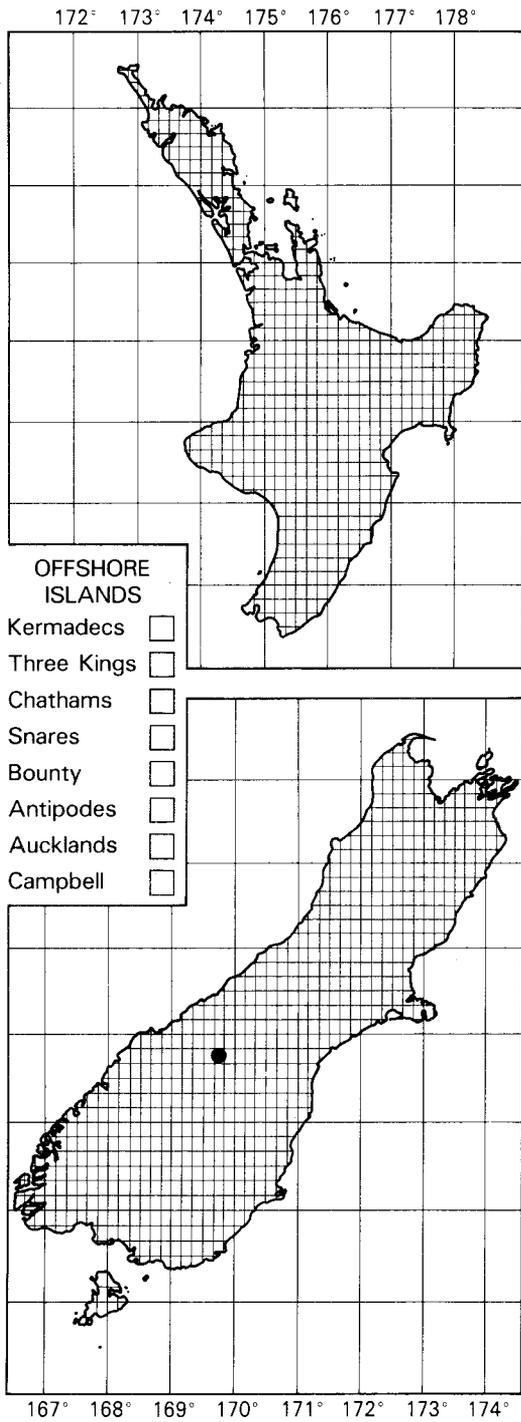
• Map 10 Collection localities, *Notonemoura winstanleyi* •



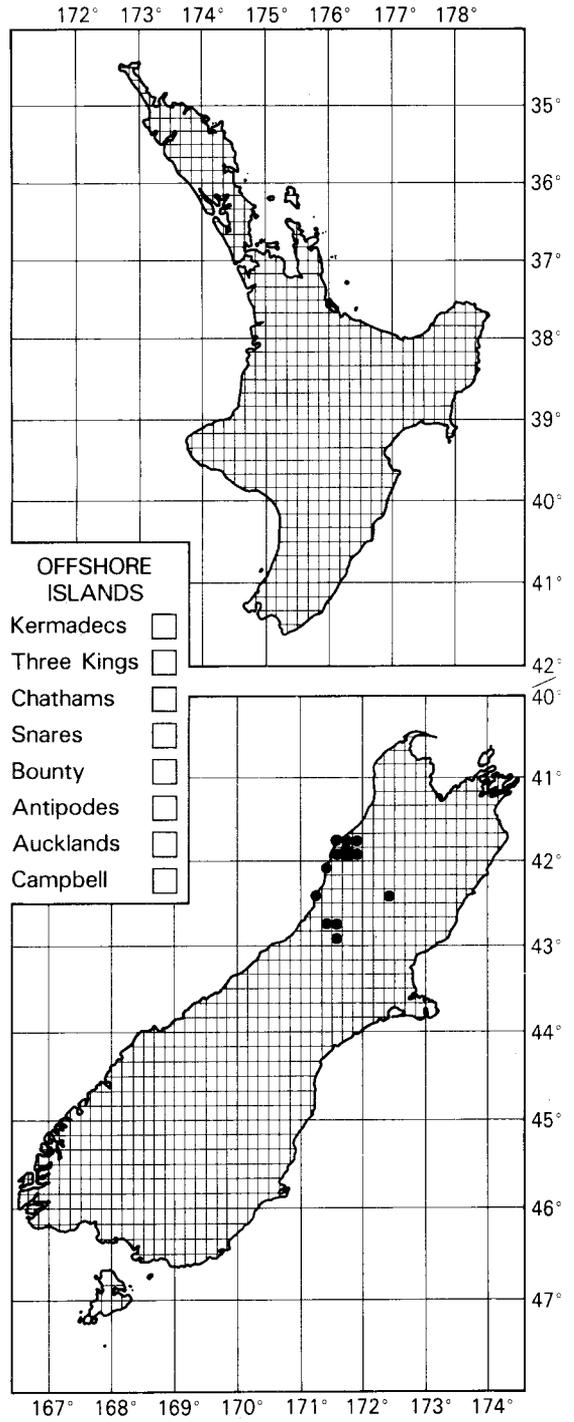
• Map 11 Collection localities, *Omanuperla bruningi* •



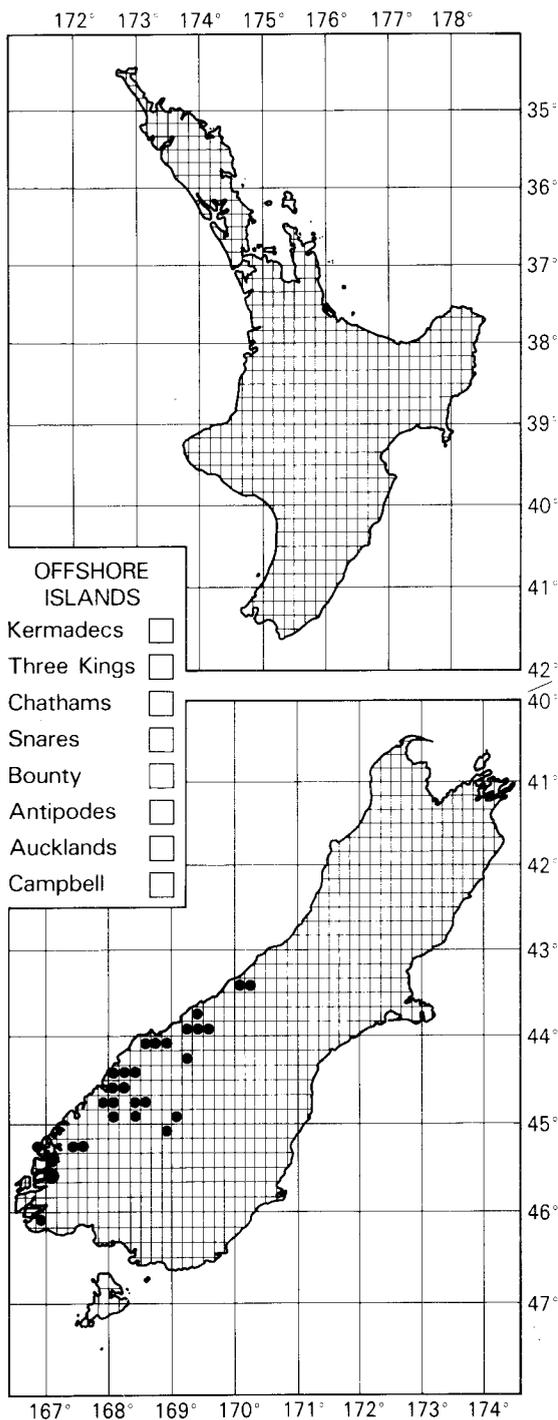
• Map 12 Collection localities, *Omanuperla hollowayae* •



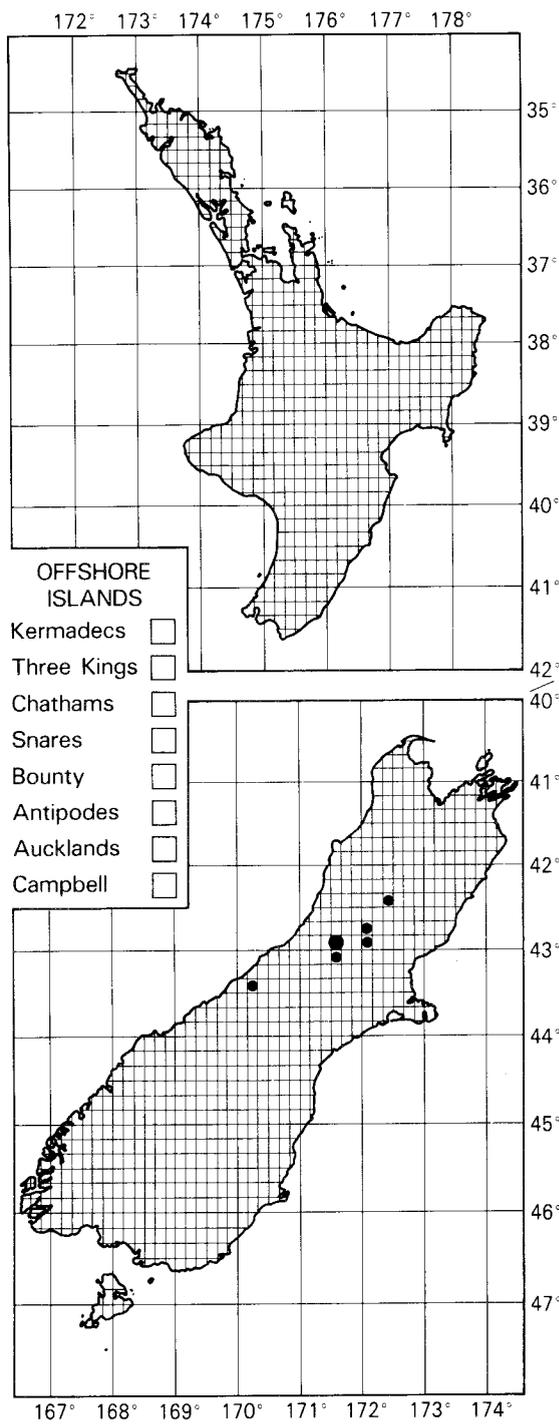
• Map 13 Collection localities, *Spaniocerca acuta* •



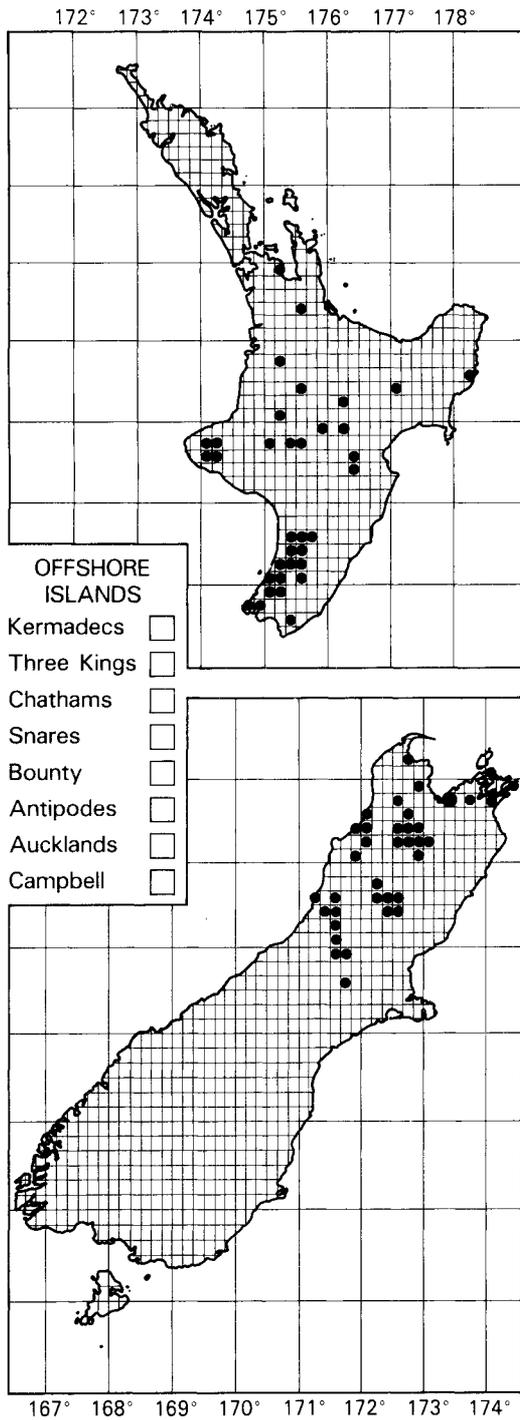
• Map 14 Collection localities, *Spaniocerca bicornuta* •



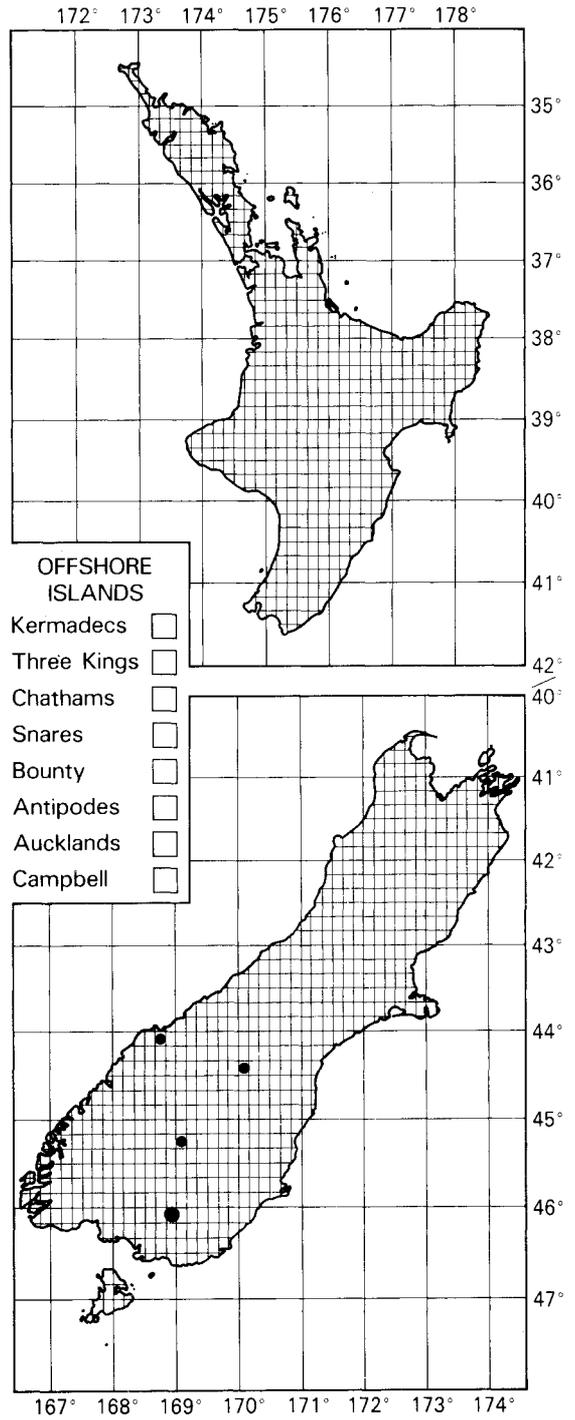
• Map 15 Collection localities, *Spaniocerca longicauda* •



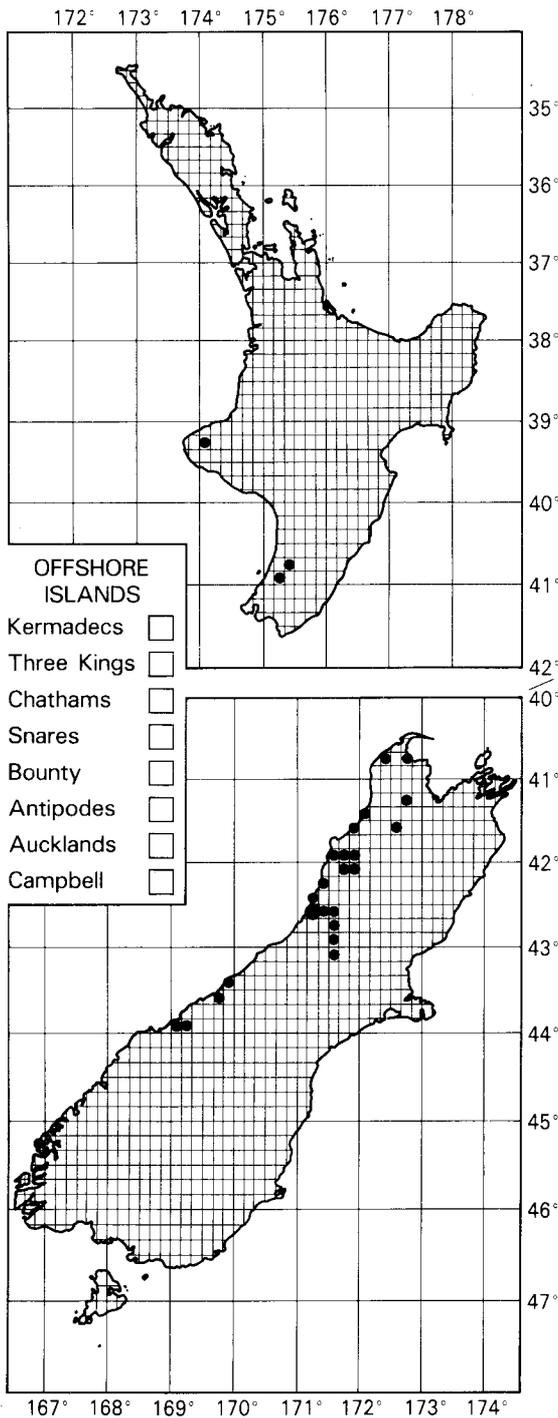
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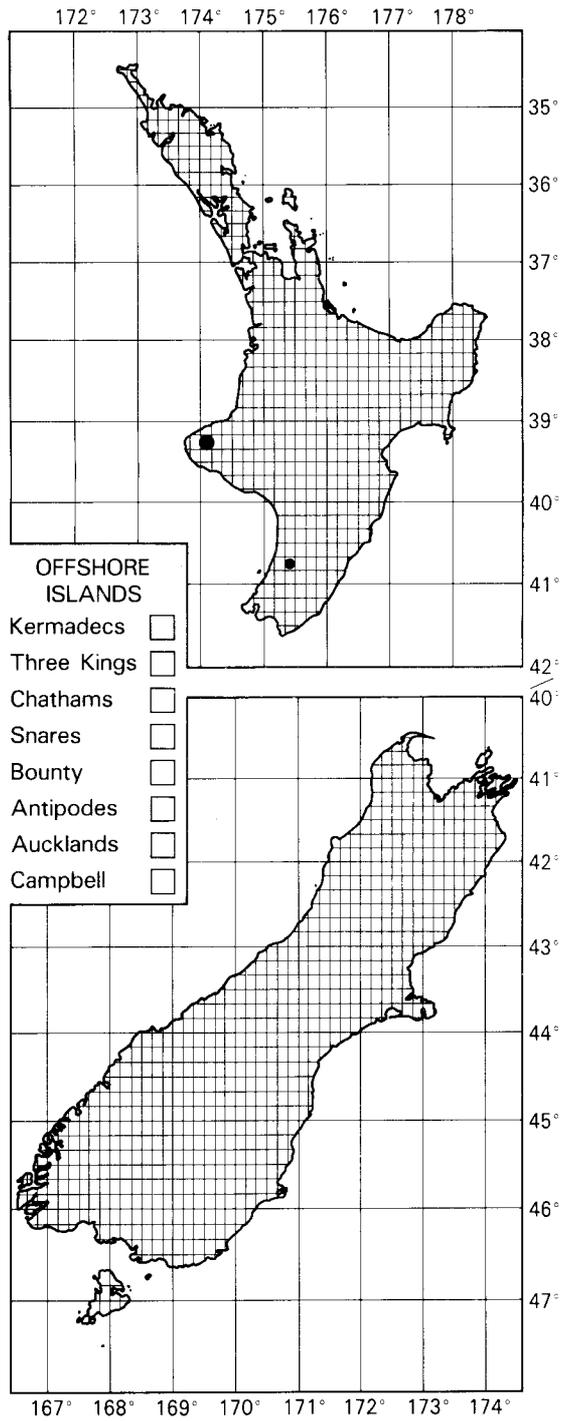
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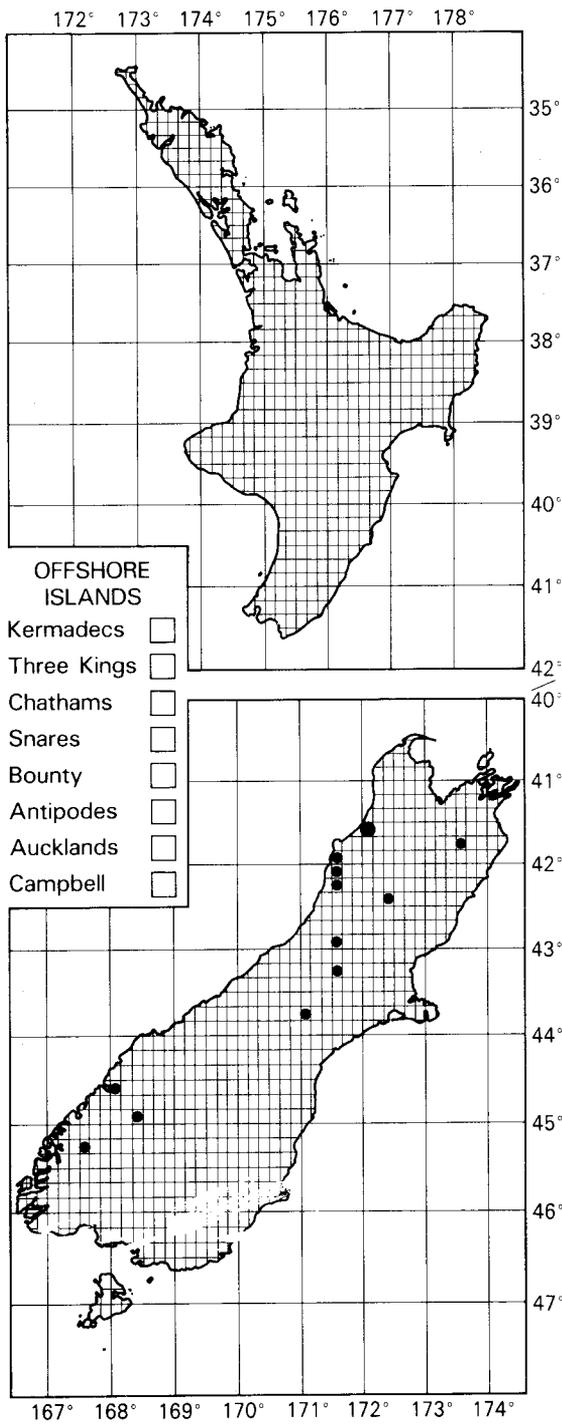
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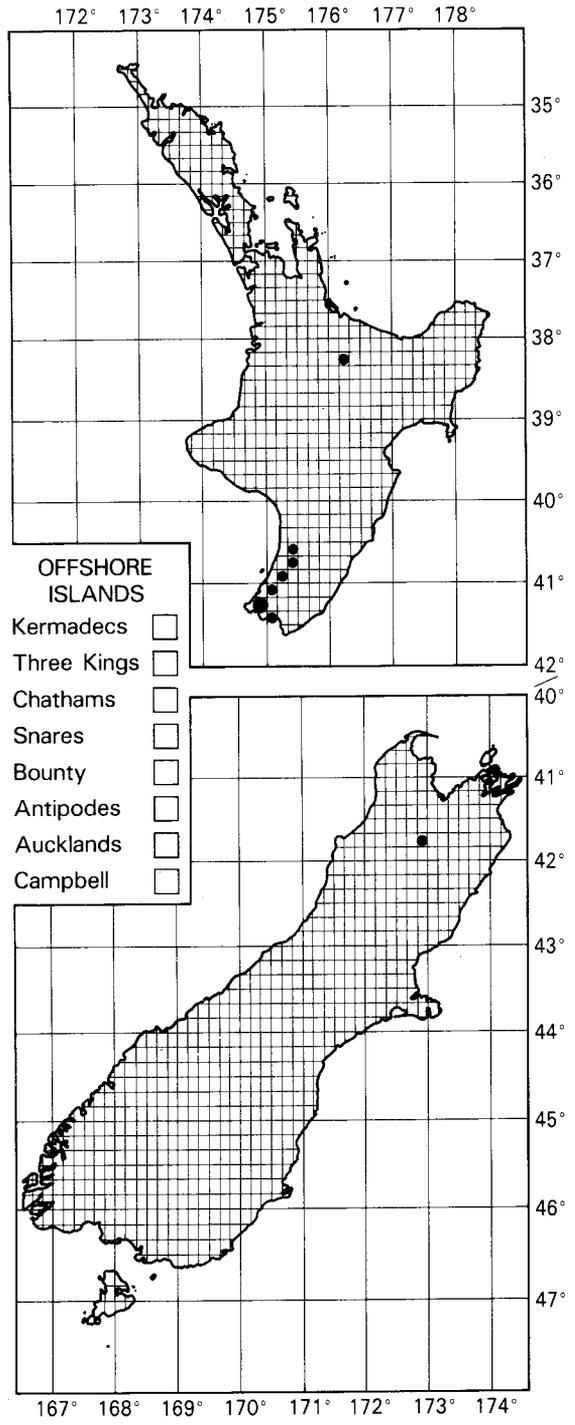
• Map 19 Collection localities, *Spaniocercoides cowleyi* •



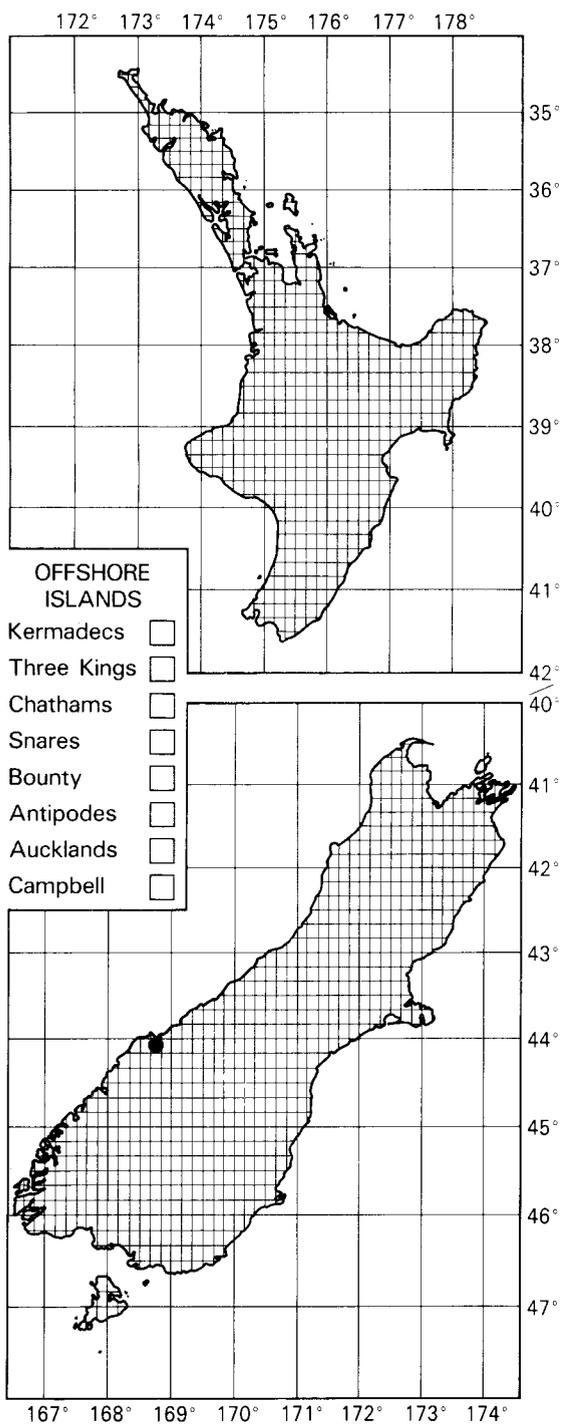
• Map 20 Collection localities, *Spaniocercoides foxi* •



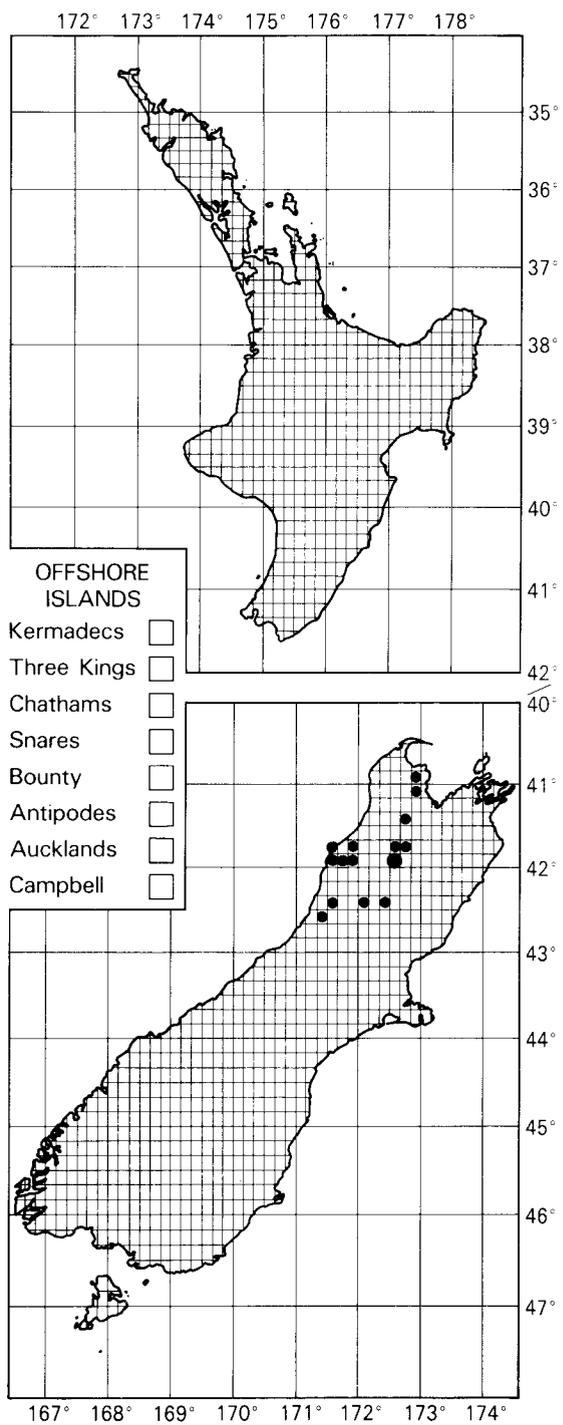
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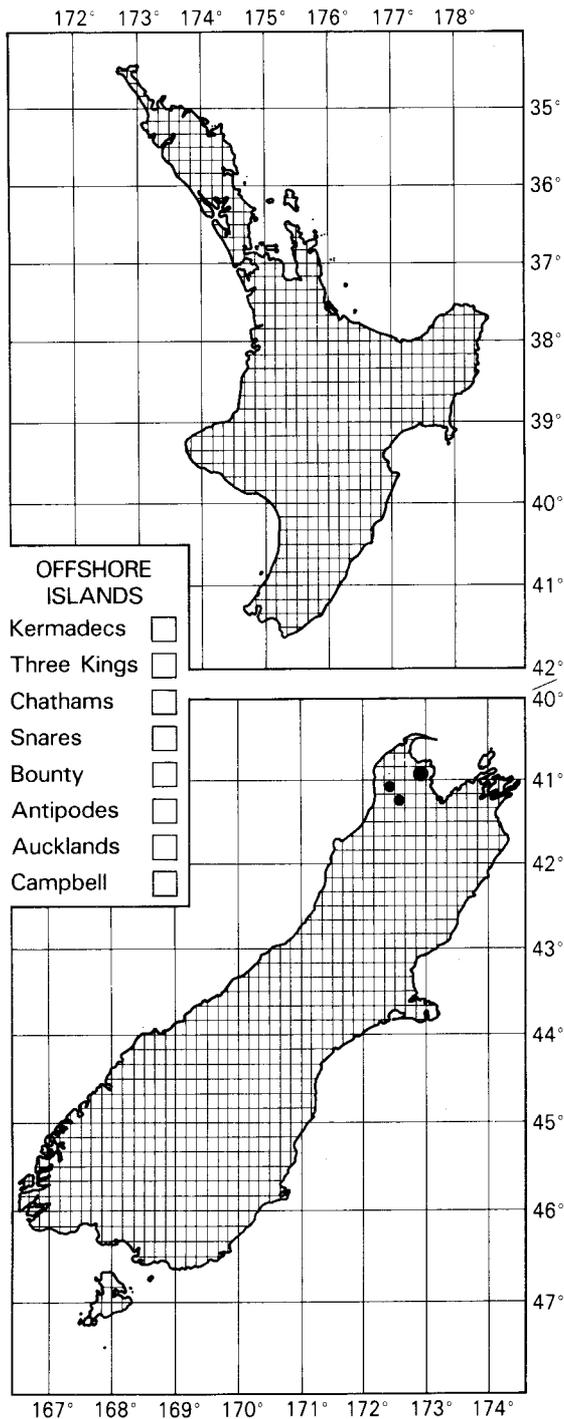
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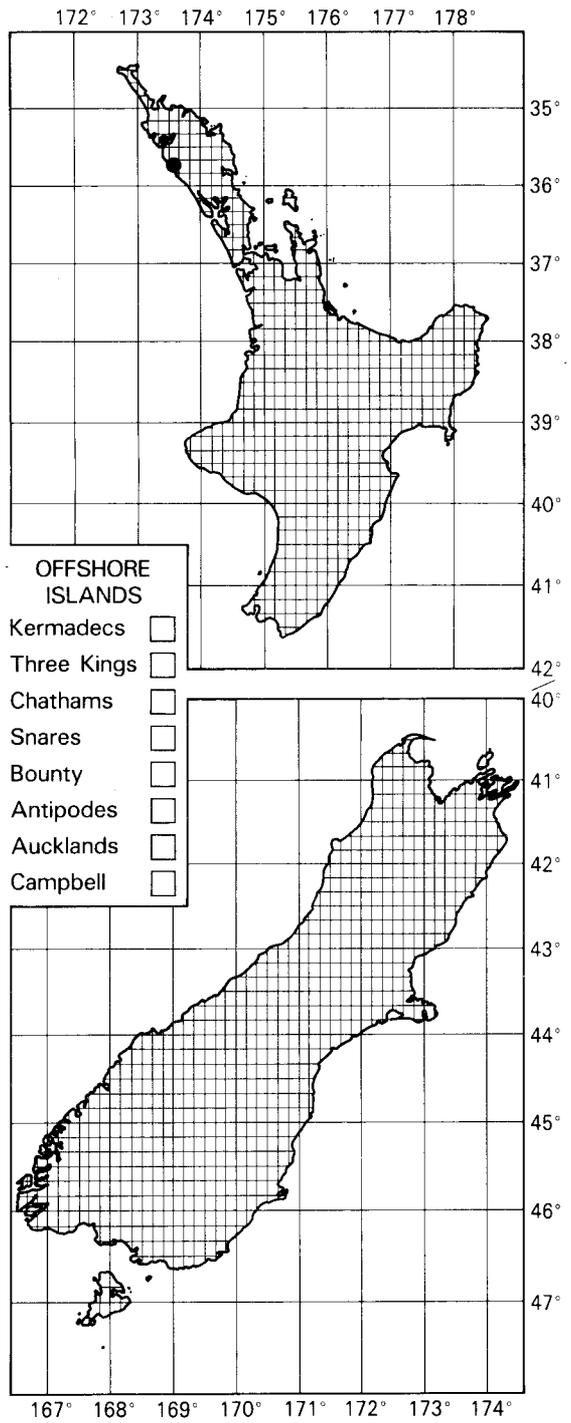
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This index covers the nominal taxa of Notonemouridae and related groups mentioned in the text, regardless of their current status in taxonomy. Page numbers in bold type denote descriptions of taxa, and in italic type illustrations. Suffixes are used to indicate keys (k) and distribution maps (m).

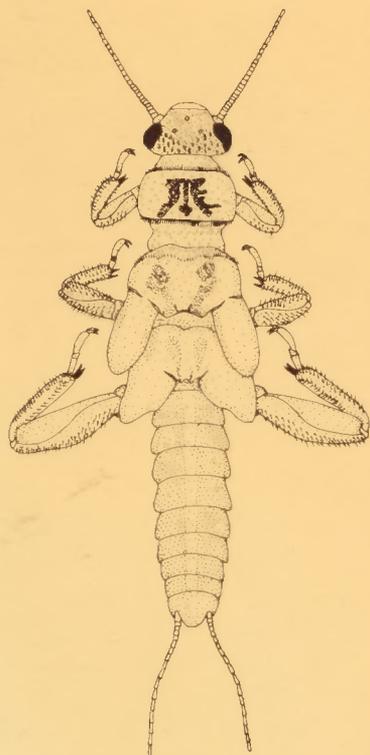
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Fauna of New Zealand

Ko te Aitanga Pepeke o Aotearoa

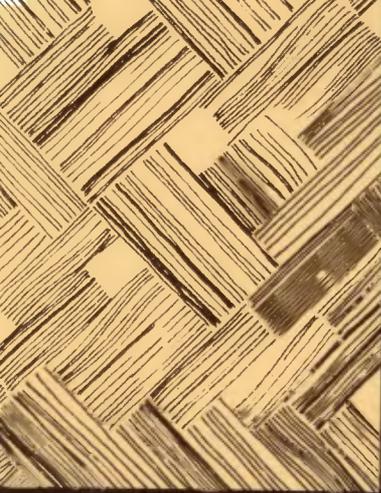


Number 22



Notonemouridae
(Insecta: Plecoptera)

I. D. McLellan



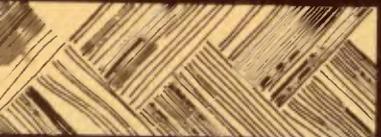
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INTRODUCTION



KEYS TO TAXA



DESCRIPTIONS



ILLUSTRATIONS



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