



ENDEMISM AND BIOGEOGRAPHY OF NEW ZEALAND PLECOPTERA (INSECTA)

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ABSTRACT

New Zealand has 4 families of Plecoptera: Austroperlidae (1 genus); Eusteniidae (1 genus); Gripopterygidae (12 genera); Notonemouridae (7 genera). All genera are endemic except *Notonemoura* which is shared with Australia. Within New Zealand there are 4 South Island endemic genera; none on North Island or Snares; 1 each on Stewart Island, Campbell Island and Auckland Islands. Species endemic to islands are: North and South and Stewart Islands - 5 species from 5 genera; North and South Islands - 16 species from 5 genera; North Island - 7 species from 6 genera; South Island - 60 species from 16 genera; all of South Island and Stewart Island - 1 species; Stewart Island - 2 species from 2 genera; Snares - 1 species; Auckland Islands - 4 species from 1 genus; Campbell Island - 2 species from 1 genus. There are no stoneflies on the Chatham and Antipodes Islands. A full list of the 104 described species is given.

Keywords: Endemism; Plecoptera; New Zealand subregion

INTRODUCTION

In the past 40 years because of an upsurge in collecting and publication on the stonefly fauna of New Zealand and its Subantarctic Islands, there is now sufficient knowledge of the systematics and distribution of our fauna to give a reasonable picture of its endemism and biogeography. At present a database for our Plecoptera is being constructed but because many records are pre-computer it will be some time before it is completed. The information gathered here came from the unfinished database, my collection records, Illies (1974) and a number of my publications as follows: McLellan (1977, 1991, 1993, 1996, 1997, 1998, 1999, 2000a, 2000b, 2003a and 2003b).

Because distribution maps for all of the species involved would be too numerous for publication, the abbreviations of the collection areas of Crosby et al. (1998) are shown after each species name. The reader may then note distribution from Figure 1 (a map of the islands of the New Zealand Subregion) and Figures 2 and 3 which show the collection areas and their abbreviations.

Other abbreviations used are: CMNZ (Canterbury

Museum, Christchurch, New Zealand); DSIR (Department of Scientific and Industrial Research); DOC (Department of Conservation); MUNZ (Massey University, Palmerston North, New Zealand); NZAC (New Zealand Arthropod Collection Landcare Research, Auckland, New Zealand); OMNZ (Otago Museum, Dunedin, New Zealand); UCNZ (University of Canterbury, Christchurch, New Zealand); VUNZ (Victoria University, Wellington, New Zealand).

SUMMARY OF THE NEW ZEALAND SUBREGION FAUNA

All genera and species are endemic to New Zealand, apart from genus *Notonemoura*, shared with Australia, but with species endemic to each country. Zelandoperlinae (Gripopterygidae) is the only endemic higher taxon. There are 104 described species and about 20 undescribed. The total fauna will be over 120 and may exceed 130. A checklist of the described species is given in Appendix A. The following 4 families placed in two suborders of Plecoptera occur in the New Zealand Subregion:

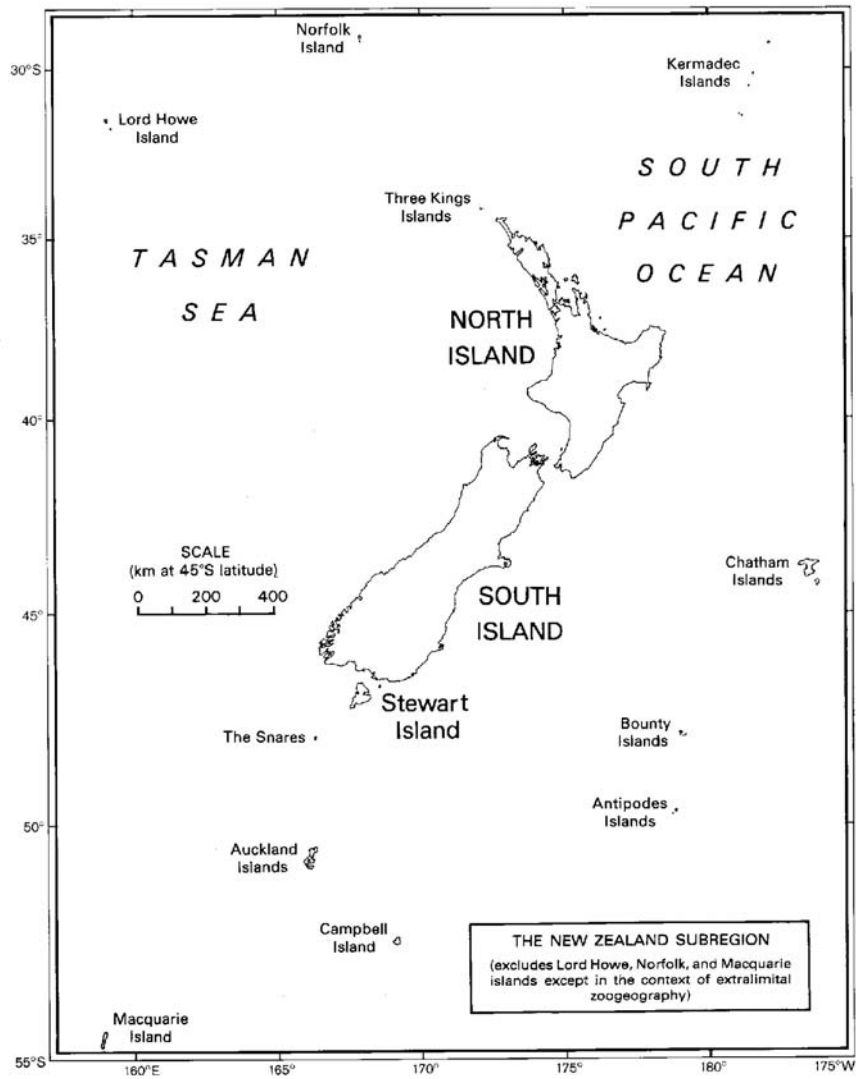


Fig. 1. Map of New Zealand subregion.

Suborder Antartoperlaria Zwick, 1973

Family Austroperlidae Tillyard, 1921: *Austroperla cyrene* Newman is the only representative.

Family Eustheniidae Tillyard, 1921: Genus *Stenoperla* with four species occurs.

Family Gripopterygidae Enderlein, 1909: Subfamily Zelandoperlinae McLellan, 1977 (10 genera and 38 species) and Subfamily Antartoperlinae Enderlein, 1909 (2 genera and 34 species) occur.

Suborder Arctoperlaria Zwick, 1973

Family Notonemouridae Ricker, 1950: 7 genera and 29 species are known.

SPECIES COMMON TO NORTH, SOUTH AND STEWART ISLANDS

Five widespread species, one from each of five genera, are found throughout the three main islands and on some smaller islands. Strangely, *Zelandobius*, the most speciose genus does not show this distribution. This group includes *Austroperla cyrene*, *Stenoperla prasina*, *Zelandoperla decorata*, *Megaleptoperla diminuta*, *Acroperla trivacuata*.

SPECIES FOUND ON NORTH AND SOUTH ISLANDS

Sixteen species from seven genera are known. Some species are widespread but others are uncommon, or their distribution is unclear due to a lack of records. The widespread species are marked with ^w. Some species, like *Spaniocercoides hudsoni*, are found only in the south of the North Island and north of the South Island. Note that the largest component is the 8 species from the largest New Zealand genus *Zelandobius*.

Zelandoperla agnetis^w, *Zelandoperla fenestrata*^w, *Megaleptoperla grandis*^w, *Nesoperla fulvescens*^w, *Zelandobius confusus*^w, *Zelandobius albofasciatus* (RI, NN, BR, FD, SL), *Zelandobius furcillatus*^w, *Zelandobius gibbsi* (WN, BR, MC, OL), *Zelandobius illiesi* (ND, TO, WA, WN, NN, BR), *Zelandobius macburneyi*^w, *Zelandobius truncus* (TK, WN, MC, CO, OL, DN), *Zelandobius unicolor* (TO, BR, NC, WD, OL, CO, FD), *Cristaperla fimbria* (RI, WN, NN, BR, NC, MC, WD), *Spaniocerca zelandica*^w, *Spaniocercoides cowleyi* (TK, RI, WN, NN, BR, WD, FD, CO, SL), *Spaniocercoides*

hudsoni (WA, WN, SD, BR).

SPECIES FOUND ON SOUTH AND STEWART ISLANDS

Six species show this pattern but two of these, *Stenoperla maclellani* (SD, MB, KA, NN, BR, WD, NC, MC, SC, MK, FD, CO, OL, DN, SL, SI) and *Taraperla ancilis* (NN, MC, CO, DN, SL, SI) are found throughout the two islands whereas four species, *Zelandoperla tillyardi* (WD, SC, CO, OL, DN, SL, SI), *Zelandobius kuscheli* (FD, CO, DN, SL, SI), *Z. uniramus* (SC, CO, OL, DN, SL, SI) and *Cristaperla waharoa* (CO, OL, DN, SL, FD, SI), are known from the southern half of South Island and all of Stewart Island.

SPECIES ENDEMIC TO A SINGLE ISLAND

North Island

Seven species from six genera show the low degree of endemism of this island found in other groups, e.g. *Hydropeza* (Diptera: Empididae) and Blephariceridae (Diptera). This group includes *Stenoperla hendersoni* (BP, WN, TO, TK), *Taraperla pseudocyrene* (TO, WN), *Halticopterla gibbsi* (RI, WI, WN), *Notonemoura winstanleyi* (WO, BP, WN), *Omanuperla hollowayae* (WA, WN), *Spaniocercoides foxi* (TK, RI, WN), *Spaniocercoides watti* (ND, WO).

South Island

Sixty species from 16 genera are found only on South Island. Much of this greater speciation in the south originated during the Pleistocene ice age when a number of refugia occurred at different times during that period. One example of this happened when the southern half of South Island and Stewart Island were divided from the north by glaciers and their barren aprons of outwash gravels extended to the sea on west and east coasts. This formed a barrier in the middle of South Island with greater speciation south of this barrier, especially in our largest genus *Zelandobius*, so that 13 of its 27 species are found in this southern region.

Below the species are grouped based on endemism to particular areas of the island.

Widespread Alpine/Subalpine Species: Seven species show this pattern including *Spaniocercoides howesi* (MB, NC, NN, WD, SC, FD, CO, OL, and SL), *Taraperla howesi* (NN, BR, MB, NC, MC, WD, SC, and OL), *Stenoperla helsoni* (BR, MB, WD, NC, MC),

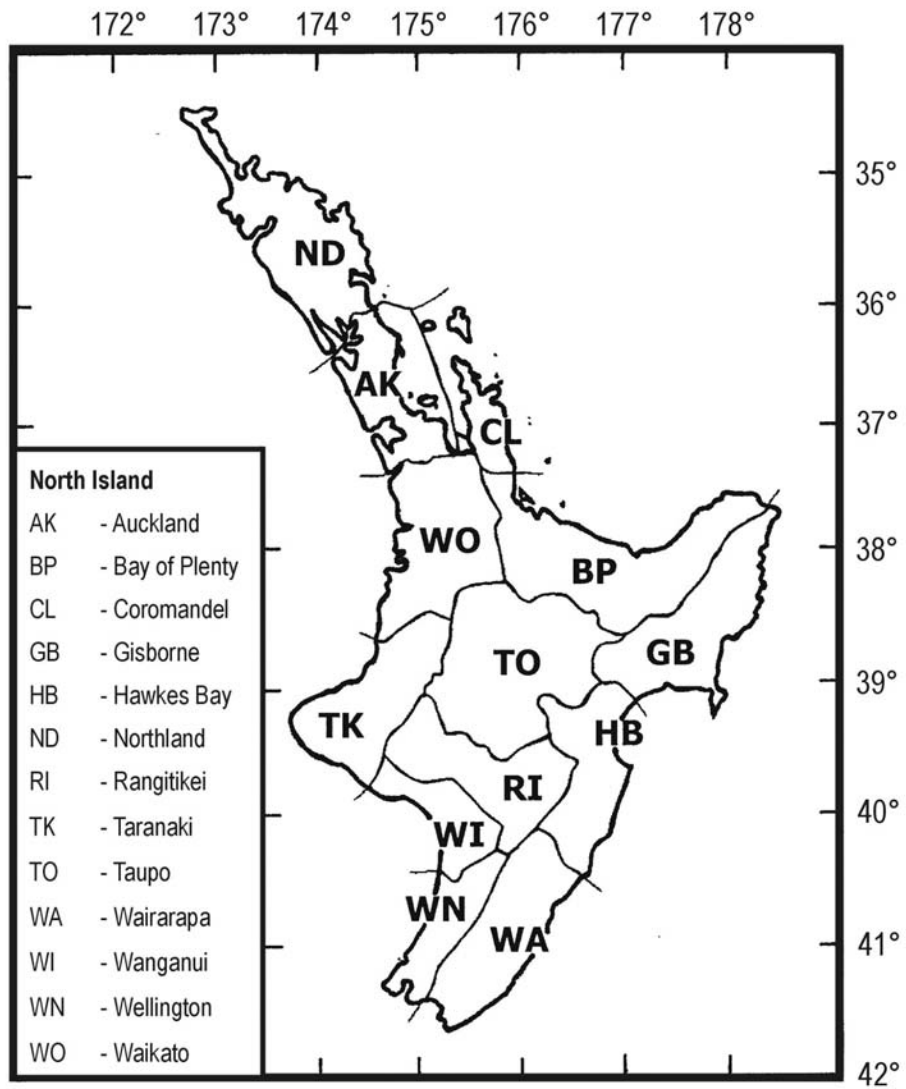


Fig. 2. Map of Area Codes of North Island.

Zelandobius childi (BR, NC, SC, CO, OL), *Zelandobius cordatus* (BR, NC, MC, FD, OL), *Zelandobius patricki* (NN, MB, MC, CO, FD, OL), *Zelandobius pilosus* (NC, MB, MC, WD, MK, CO, OL) .

Alpine Species Restricted to Northern South Island: Six species show this pattern including *Apteryoperla nancyae* (NN), *Vesicaperla kuscheli* (NN), *Holcoperla jacksoni* (BR, NN, NC), *Vesicaperla substirpes* (BR), *Vesicaperla eylesi* (NN, MB), *Notonemoura latipennis* (BR, NN, NC, WD) .

Lowland to subalpine species Restricted to Northern South Island: Seven species show this pattern including *Acroperla samueli* (NN, BR, WD), *Zelandobius ngaire* (BR, MB), *Halticoperla viridans* (NN, BR, WD, NC), *Notonemoura alisteri* (NN, BR, NC, WD), *Omanuperla bruningi* (NN, BR, WD), *Spaniocercoides philpotti* (NN, BR), *Spaniocercoides townsendi* (NN)*.

*There is a single record of a male from FD but this may be a new but similar species.

Species Restricted to central Southern Alps & western outliers: Seven species show this pattern including *Acroperla christinae* (WD), *Vesicaperla townsendi* (WD), *Zelandobius peglegensis* (NC, WD, MC, SC), *Acroperla spiniger* (NC/WD), *Spaniocerca hamishi* (WD), *Spaniocerca minor* (NC, SC, WD), *Zelandobius jacksoni* (NC/WD).

Species Restricted to Banks Peninsula: Only one species *Zelandobius wardi* shows this distribution.

Apart from this stonefly species and a *Zelandoperla* species not yet fully investigated, there are other endemics on the peninsula. One well known one is the blepharicerid *Neocurupira chiltoni*.

Species Restricted to WD, OL, FD: Only one species *Zelandoperla denticulata* shows this distribution.

Species Restricted to southern half of South Island: Six species show this pattern including *Zelandoperla pennulata* (SC, MK, CO, OL, FD, DN, SL), *Holcoperla magna* (WD, FD, OL, CO), *Spaniocerca longicauda* (FD, CO, OL, DN, SL), *Spaniocerca zwicki* (CO, OL, DN, SL), *Halticoperla tara* (WD, FD, CO, OL, DN, SL), *Cristaperla eylesi* (FD, WD, OL, SL).

Species Restricted to southern half of South Island and Stewart Island: Four species show this pattern including *Zelandoperla tillyardi* (southern WD, SC, CO, OL, DN, SL, SI), *Zelandobius kuscheli* (FD, CO, DN, SL, SI), *Zelandobius uniramus* (SC, CO, OL, DN,

SL, SI), *Cristaperla waharoa* (CO, OL, DN, SL, FD, SI).

Species Restricted to DN, SL: Only one species *Taraperla johnsi* shows this distribution.

Species Restricted to FD, OL and SL: Two species show this pattern including *Acroperla flavescens* and *Holcoperla angularis*.

Species Restricted to DN: Only one species *Nesoperla patricki* shows this distribution.

Species Restricted to FD: Nine species show this pattern including *Apteryoperla monticola*, *Apteryoperla illiesi*, *Apteryoperla ramsayi*, *Apteryoperla tillyardi*, *Vesicaperla dugdalei*, *Zelandobius brevicauda*, *Zelandobius dugdalei*, *Notonemoura spinosa*, *Otehiwi sagittarius*.

Species Restricted to FD and CO: Only one species *Zelandobius takahe* shows this distribution.

Species Restricted to CO: Six species show this pattern including *Vesicaperla celmisia*, *Vesicaperla trilinea*, *Zelandobius alatus*, *Zelandobius inversus*, *Zelandobius mariae*, *Zelandobius auratus*.

Species Restricted to CO and OL: Only one species *Zelandobius montanus* shows this distribution.

Species Restricted to areas in WD, FD and MK: Two species show this pattern including *Spaniocerca acuta* (endemic to MK and south-east WD) and *Spaniocercoides jacksoni* (endemic to WD and most likely northern FD).

Species Restricted to WD and FD: Only one species *Notonemoura hendersoni* shows this distribution.

Species Restricted to all of South Island and Stewart Island: Two species show this pattern including *Stenoperla maclellani* (SD, MB, KA, NN, BR, WD, NC, MC, SC, MK, FD, CO, OL, DN, SL, SI) and *Taraperla ancilis* (NN, MC, CO, DN, SL, SI).

Stewart Island

Two apterous terrestrial species, *Apteryoperla lakiula* and *Rakiuraperla nudipes*, are endemic to Stewart Island.

Auckland Island

One endemic genus with four species, *Aucklandobius complementarius* (winged adults and aquatic nymphs), *A. gressitti* (apterous adults and aquatic nymphs), *A. kuscheli* (apterous adults and terrestrial nymphs) and *A. turbotti* (apterous adults and terrestrial nymphs), occurs on this island.

Campbell Island

One endemic genus with two species, *Rungaperla*

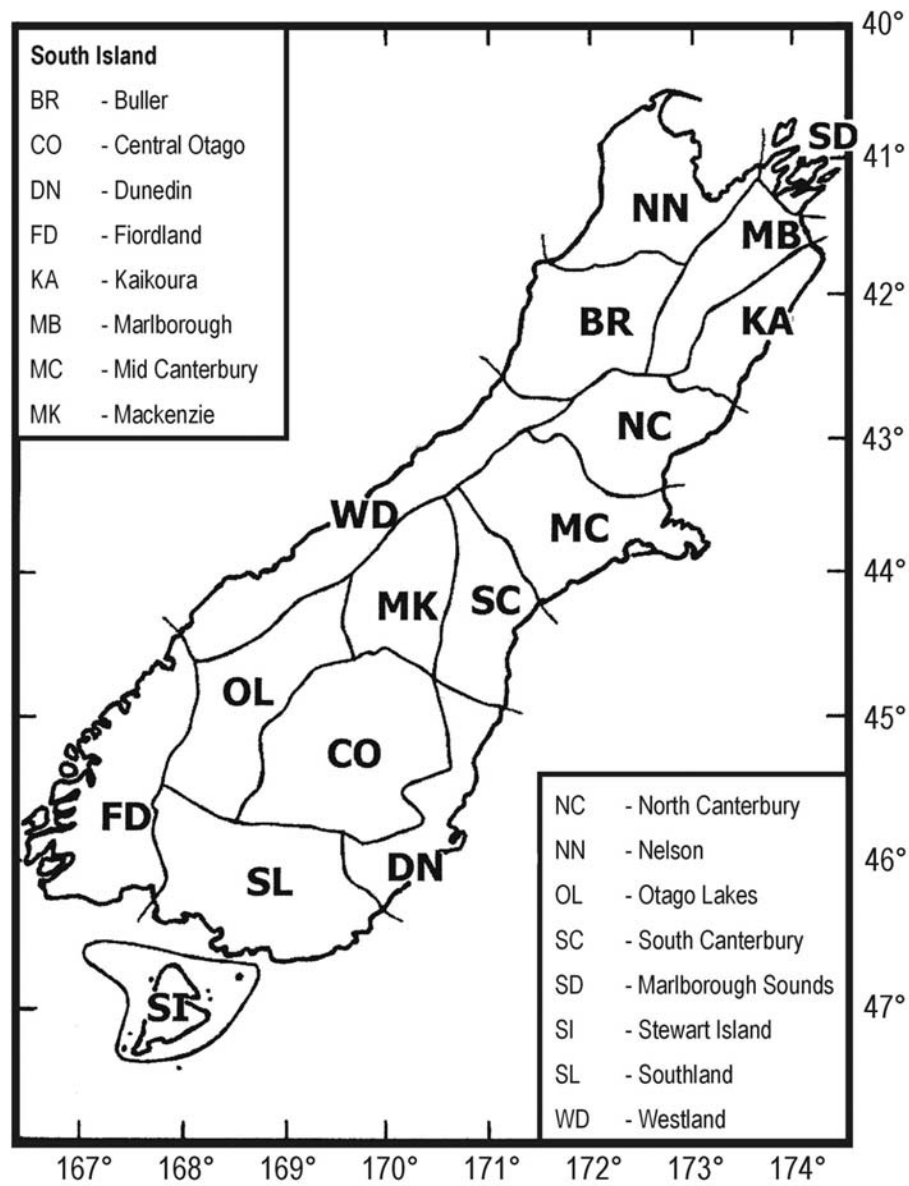


Fig. 3. Map of Area Codes of South Island.

campbelli (apterous adults and terrestrial nymphs) and *R. longicauda* (apterous adults and aquatic nymphs), occurs on this island.

The Snares

Nesoperla johnsi, a brachypterous species with aquatic nymphs is the only stonefly known from The Snares.

ACKNOWLEDGEMENTS

I am indebted to all the collectors of material examined in particular the following: The team in the 1960s and 1970s, at Entomology Division DSIR (T. K. & B. G. Crosby, J. S. Dugdale, B. A. Holloway, G. Kuschel, J.G. R. McBurney, G. W. Ramsay, J.I. Townsend, A. K. Walker, and J. C. Watt). From that era to the present, A. C. Harris (OMNZ), P. M. Johns (UCNZ) and G. W. Gibbs (VUNZ). In more recent years J. B. Ward, T. R. Hitchings and S. J. Morris (CMNZ), I. M. Henderson (MUNZ), W. J. Crawford (Taupo), E. Edwards (DOC, Invercargill) and B.H. Patrick (OMNZ) whose collecting changed the southern half of the South Island from a plecopteran terra incognita to the best known part of New Zealand's stonefly world. I thank T. K. Crosby (NZAC) for permission to use the New Zealand area codes maps. Much of this contribution was made possible by the database work done by K. J. Collier (Environment Waikato, Hamilton, New Zealand).

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APPENDIX A

A list of the described species of Plecoptera of the New Zealand Region.

SUBORDER ANTARCTOPERLARIA Zwick, 1973

FAMILY AUSTROPERLIDAE Tillyard, 1921

Genus *Austroperla* Needham, 1905
Austroperla cyrene (Newman) 1845

FAMILY EUSTHENIIDAE Tillyard, 1921

Genus *Stenoperla* McLachlan, 1866
Stenoperla helsoni McLellan, 1996 (males short winged)
Stenoperla hendersoni McLellan, 1996
Stenoperla maclellani Zwick, 1979

Stenoperla prasina (Newman, 1845)

FAMILY GRIPOPTERYGIDAE Enderlein, 1909

Subfamily Zelandoperlinae McLellan, 1977

Tribe Zelandoperlini McLellan, 1977

Genus *Zelandoperla* Tillyard, 1923

Zelandoperla agnetis McLellan, 1967

Zelandoperla decorata Tillyard, 1923

Zelandoperla denticulata McLellan, 1967

Zelandoperla fenestrata Tillyard, 1923

Zelandoperla pennulata McLellan, 1967

(micropterous)

Zelandoperla tillyardi McLellan 1999

Genus *Rungaperla* McLellan, 1977

Rungaperla campbelli (Illies, 1963) (apterous)

Rungaperla longicauda (Illies, 1963) (apterous)

Tribe Megaleptoperlini McLellan 1977

Genus *Megaleptoperla* Tillyard, 1923

Megaleptoperla diminuta Kimmins, 1938

Megaleptoperla grandis (Hudson, 1913)

Tribe Acroperlini McLellan, 1977

Genus *Acroperla* McLellan, 1977

Acroperla flavescens (Kimmins), 1938

Acroperla christinae McLellan 1998

Acroperla spiniger (Tillyard, 1923)

Acroperla samueli McLellan, 1977

Acroperla trivacuata (Tillyard, 1923)

Genus *Apteryoperla* Wisely, 1953 (all spp. Apterous)

Apteryoperla monticola Wisely, 1953

Apteryoperla illiesi McLellan, 1977

Apteryoperla nancyae McLellan, 1977

Apteryoperla ramsayi McLellan, 1977

Apteryoperla tillyardi McLellan, 1977

Apteryoperla lakiuila McLellan, 2003

Genus *Aucklandobius* Enderlein, 1909

Aucklandobius complementarius Enderlein, 1909

Aucklandobius gressitti Illies, 1963 (apterous)

Aucklandobius kuscheli (Illies, 1974) (apterous)

Aucklandobius turbotti (Illies, 1963) (apterous)

Genus *Holcoperla* McLellan, 1977 (all apterous)

Holcoperla angularis (Wisely, 1953)

Holcoperla jacksoni McLellan, 1977

Holcoperla magna McLellan 1983

Genus *Nesoperla* Tillyard, 1923

Nesoperla fulvescens Tillyard, 1923 (micropterous to apterous in North Island alpine zone, fully winged elsewhere)

Nesoperla johnsi McLellan, 1977 (micropterous)

Nesoperla patricki McLellan, 2003 (apterous)

Genus *Rakiuraperla* McLellan, 1977

Rakiuraperla nudipes McLellan 1977 (apterous)

Genus *Taraperla* McLellan, 1998

Taraperla ancilis (Harding and Chadderton) 1995

Taraperla howesi (Tillyard) 1923

Taraperla pseudocyrene McLellan 1998

Taraperla johnsi McLellan, 2003 (apterous)

Subfamily Antarctoperlinae Enderlein 1909

Genus *Vesicaperla* McLellan, 1967

Vesicaperla dugdalei McLellan, 1977 (apterous)

Vesicaperla eylesi McLellan, 1977 (apterous)

Vesicaperla kuscheli McLellan, 1977 (apterous)

Vesicaperla substirpes McLellan, 1967 (apterous)

Vesicaperla townsendi McLellan, 1977 (vestigial wings)

Vesicaperla celmisia McLellan, 2003 (apterous)

Vesicaperla trilinea McLellan, 2003 (apterous)

Genus *Zelandobius* Tillyard, 1921

Confusus Group

Zelandobius alatus McLellan, 1993

Zelandobius albofasciatus McLellan, 1993

Zelandobius brevicauda McLellan, 1977 (apterous)

Zelandobius childi McLellan, 1993

Zelandobius confusus Tillyard, 1923

Zelandobius cordatus McLellan, 1993

Zelandobius dugdalei McLellan, 1993

Zelandobius foxi McLellan, 1993

Zelandobius gibbsi McLellan, 1993
Zelandobius illiesi McLellan 1969
Zelandobius inversus McLellan, 1993
Zelandobius jacksoni McLellan, 1993
Zelandobius kuscheli McLellan, 1993
Zelandobius macburneyi McLellan, 1993
Zelandobius mariae McLellan, 1993
Zelandobius montanus McLellan, 1993
Zelandobius ngaire McLellan, 1993
Zelandobius patricki McLellan, 1993
Zelandobius peglegensis McLellan, 1993
Zelandobius takahe McLellan, 1993
Zelandobius wardi McLellan, 1993

Furcillatus Group

Zelandobius auratus McLellan, 1993
Zelandobius furcillatus Tillyard, 1923
Zelandobius pilosus Death, 1990
Zelandobius truncus McLellan, 1993
Zelandobius unicolor Tillyard, 1923
Zelandobius uniramus McLellan, 1993

SUBORDER ARCTOPERLARIA

Zwick, 1973

FAMILY NOTONEMOURIDAE Ricker, 1950

Austrocercella Group

Genus *Spaniocerca* Tillyard, 1923

Spaniocerca acuta McLellan, 1991
Spaniocerca bicornuta McLellan, 1987
Spaniocerca hamishi McLellan 2000
Spaniocerca longicauda McLellan, 1977
Spaniocerca minor Kimmins, 1938
Spaniocerca zelandica Tillyard, 1923
Spaniocerca zwicki McLellan, 1991

Genus *Otehiwi* McLellan, 2003

Otehiwi sagittarius McLellan, 2003

Notonemoura Group

Genus *Halticoperla* McLellan and Winterbourn, 1968

Halticoperla gibbsi McLellan, 1991
Halticoperla tara McLellan, 1991
Halticoperla viridans McLellan and Winterbourn, 1968

Genus *Notonemoura* Tillyard, 1923

Notonemoura alisteri McLellan, 1968
Notonemoura hendersoni McLellan 2000
Notonemoura latipennis Tillyard, 1923 (has winged or micropterous populations)
Notonemoura spinosa McLellan, 1991
Notonemoura winstanleyi McLellan, 1991

Spaniocercoides Group

Genus *Cristaperla* McLellan, 1972

Cristaperla eylesi McLellan, 1991
Cristaperla fimbria (Winterbourn, 1965)
Cristaperla waharoa McLellan, 1991

Genus *Omanuperla* McLellan, 1972

Omanuperla bruningi McLellan, 1972
Omanuperla hollowayae McLellan, 1991

Genus *Spaniocercoides* Kimmins, 1938

Spaniocercoides cowleyi (Winterbourn, 1965)
Spaniocercoides foxi McLellan, 1984
Spaniocercoides howesi McLellan, 1984
Spaniocercoides hudsoni Kimmins, 1938
Spaniocercoides jacksoni McLellan, 1991
Spaniocercoides philpotti Winterbourn, 1965
Spaniocercoides townsendi McLellan, 1984
Spaniocercoides watti McLellan, 1984

Received 22 November 2005, Accepted 22 February 2006,
Published 8 March 2006

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Digitale Literatur/Digital Literature

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Jahr/Year: 2006

Band/Volume: [02](#)

Autor(en)/Author(s): McLellan Ian

Artikel/Article: [Endemism and biogeography of New Zealand Plecoptera \(Insecta\). 15-23](#)