



## 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:

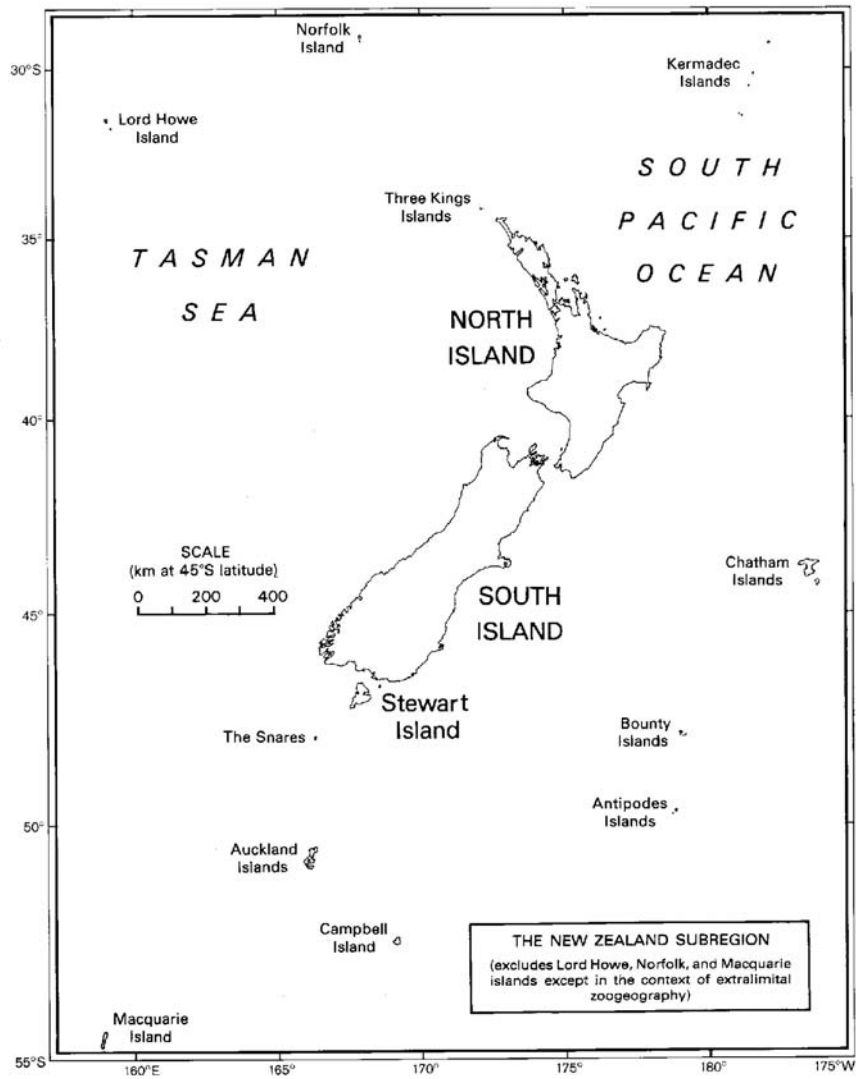


Fig. 1. Map of New Zealand subregion.

#### **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 <sup>w</sup>. 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*<sup>w</sup>, *Zelandoperla fenestrata*<sup>w</sup>, *Megaleptoperla grandis*<sup>w</sup>, *Nesoperla fulvescens*<sup>w</sup>, *Zelandobius confusus*<sup>w</sup>, *Zelandobius albofasciatus* (RI, NN, BR, FD, SL), *Zelandobius furcillatus*<sup>w</sup>, *Zelandobius gibbsi* (WN, BR, MC, OL), *Zelandobius illiesi* (ND, TO, WA, WN, NN, BR), *Zelandobius macburneyi*<sup>w</sup>, *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*<sup>w</sup>, *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),

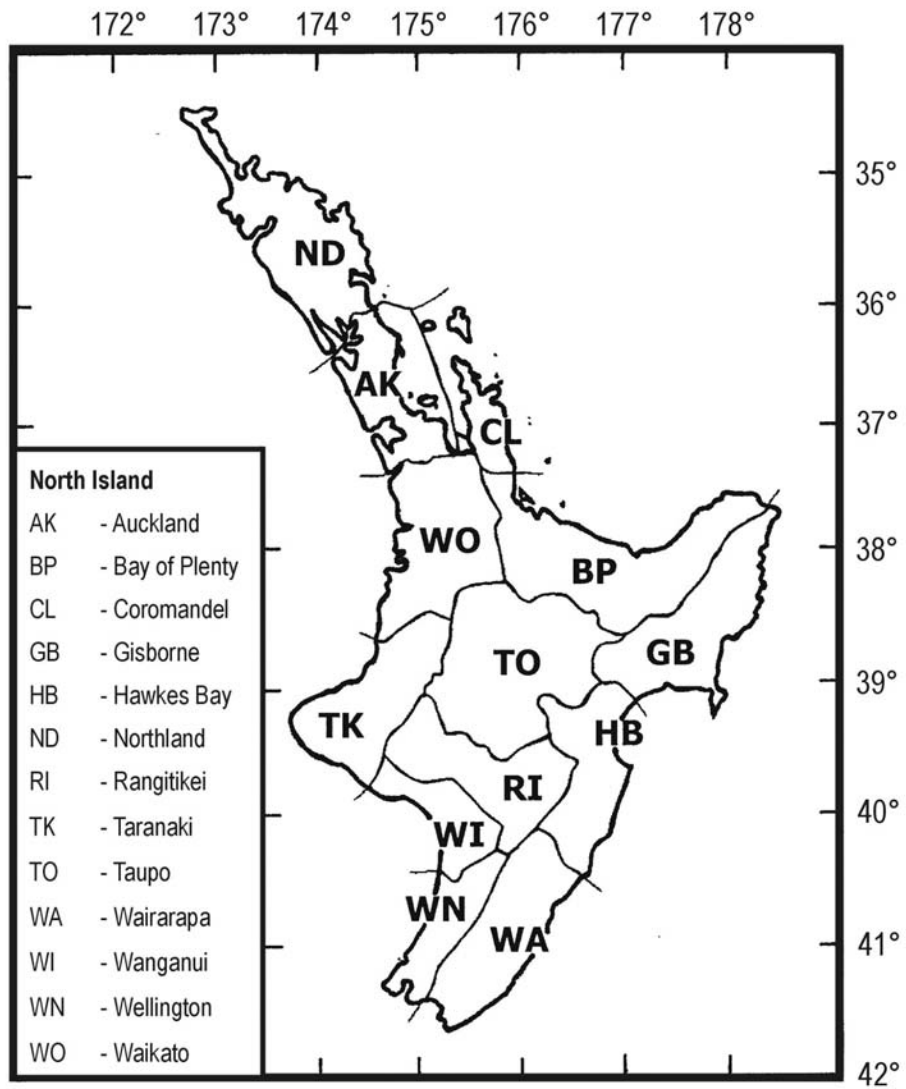


Fig. 2. Map of Area Codes of North Island.

*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*

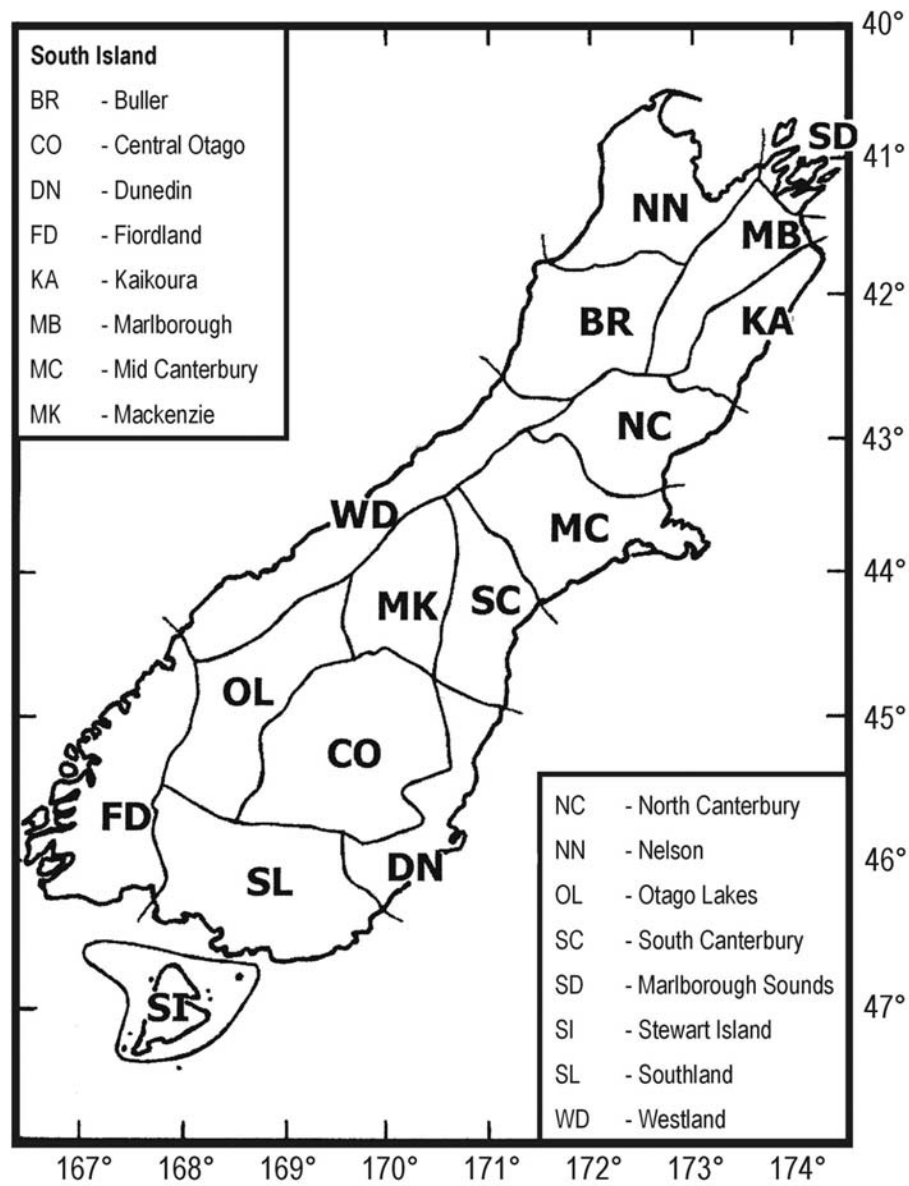


Fig. 3. Map of Area Codes of South Island.



*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.

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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

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