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**FRESHWATER
MACROINVERTEBRATES
OF POTENTIAL
CONSERVATION INTEREST**

by

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FRESHWATER MACROINVERTEBRATES OF POTENTIAL CONSERVATION INTEREST

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ABSTRACT

A literature search and interviews with specialists were carried out to compile a list of native freshwater macroinvertebrates that are of potential conservation interest on mainland New Zealand (surface and underground waters) and on offshore islands. Mainland taxa were considered to be of potential conservation interest if their known distribution is separated by >1 ecological regions and/or is restricted to 3 regions, and/or if they are infrequently encountered and not frequently abundant. Offshore island species were considered to be of potential conservation interest if they were not found on mainland New Zealand (including Stewart Island). A total of 38 freshwater macroinvertebrate taxa were recorded as being restricted to off-shore islands. Twenty-one taxa of interest were identified in underground waters; 12 of these are gastropod molluscs. For surface waters of mainland New Zealand, 180 taxa conformed to at least one of the above criteria. These included 60 Trichoptera, 42 Diptera, 19 Plecoptera and 18 Crustacea. Relevant references and notes on known distribution, ecology, biology, taxonomy and type localities are presented.

1. INTRODUCTION

There are hundreds of species of native aquatic invertebrates in New Zealand, many belonging to endemic families and/or genera (McLellan 1975a, Forsyth and Lewis 1987). In addition to the 447 species of aquatic and semi-aquatic insects listed by Wise (1973), there are also 32 species of freshwater Mollusca (Powell 1979), over 188 species of freshwater Crustacea (Chapman and Lewis 1976), and numerous other species in less well known groups (e.g., leeches, worms). New species are still being encountered and there are undoubtedly many yet to be discovered and described.

Determining the conservation status of these freshwater invertebrates is fraught with difficulties because of sparse knowledge (and even sparser published material) on the larval taxonomy, distribution and ecology of many species. Despite the paucity of information, some species are known to have localised or disjunct distributions, and/or to be infrequently encountered by entomologists and limnologists. This information could provide useful clues to the conservation status of aquatic invertebrates.

This report collates data on the known distribution and ecology of aquatic invertebrates that are considered to be of potential conservation interest because they fulfil one or more criteria relating to distribution and abundance (see Methods) based on available information at the time of writing. The report is intended to lay the basis for increased understanding of the conservation status of aquatic invertebrates. As more data become available, species will undoubtedly be added to or deleted from this list. No attempt has been made at this stage to rank species because of the lack of information on criteria used for determining priorities for the recovery of threatened taxa in the wild (as used for other species by the Department of conservation). Ultimately, I hope that this report will stimulate debate on the subject and encourage the publication of future records so that it will be possible to understand more fully the conservation needs of aquatic invertebrate species.

2. METHODS

A search of the literature and interviews with specialists were conducted to obtain information on freshwater invertebrates that conformed to the criteria listed below.

1. NATIVE MACROINVERTEBRATES COLONISING SURFACE FRESHWATERS OF MAINLAND NEW ZEALAND

Criteria: a) Restricted - known distribution restricted to ≤ 3 regions (see below)
 b) Restricted and disjunct - ≤ 3 regions and known locations separated by $>$ region
 c) Uncommon - infrequently encountered and not usually abundant

2. NATIVE MACROINVERTEBRATES RESTRICTED TO UNDERGROUND FRESHWATERS OF MAINLAND NEW ZEALAND

Criteria: as above

3. NATIVE FRESHWATER MACROINVERTEBRATES ON OFFSHORE ISLANDS

Criterion: a) Restricted - New Zealand distribution restricted to off-shore islands.

Distribution was assessed using Ecological Regions (McEwen 1987). A cutoff level of three regions was selected to define species with restricted mainland distributions because the boundaries of several regions (usually three) can occur in close proximity. The relevance of Ecological Regions to the distribution of freshwater fauna is not known (Collier and McColl 1992); a Department of Conservation research contract is currently addressing this question. Much of the distributional data presented in the report is derived from catches of adult insects because their taxonomy is often better known than for the larvae. Where larval habitat was not known, larvae were assumed to be aquatic if adults were associated with freshwater.

Species are listed taxonomically within sections, and relevant information on distribution, taxonomic distinctiveness, habitat and biology is also presented. Some species have not

been formally described, and these are indicated in the text as "sp.a", "sp.bU etc. Information on any known specialisations or threats that could cause the species to decline is given and type localities are named where they could be located from the literature. The criteria that each species¹ was thought to fulfil are listed, and references sighted and discussions held during the collation of this report are noted for each species. An index to families considered in the following list can be found on page 45.

3. RESULTS

3.1 Native macroinvertebrates colonising surface freshwaters of mainland New Zealand

Surface freshwaters include lakes, ponds and tarns which are surrounded by land and can range from only a few metres to several kilometres across. Rivers and streams are usually permanently flowing waterways ranging from small channels a metre or less in width to large channels many metres across. Some small streams and ponds may dry up for part of the year. Seepages often feed small streams and wetlands which may form in depressions or where free-drainage is impeded. Seepages and ponds containing high levels of nitrogenous waste (e.g., seal wallows) were not considered to be freshwater habitats for the purposes of this review. Cold water springs occur where groundwater that has been flowing along an impervious rock layer emerges at the surface (Williams 1979). Hot water springs are usually associated with areas of high volcanic or tectonic activity, and the waters emerging from them often have low pH and high concentrations of dissolved metals (Vincent and Forsyth 1987). Some human activities also generate freshwater habitats such as roadside ditches, reservoirs and farm ponds.

Phylum ARTHROPODA

Class INSECTA

Order EPHEMEROPTERA (mayflies)

Family LEPTOPHLEBIIDAE

Arachnocolus phillipsi - EASTERN NORTHLAND (Wairau River), AUCKLAND (Waitakere Range), COROMANDEL (Kauaeranga R. tributary, Great Barrier Island). May be more widespread. Slow flowing parts of streams on leaves, wood, stones and vegetation trailing into water.

- TL Cascade Stream, Auckland

- Restricted

- Towns 1983, 1987, Towns and Peters 1979a, Winterbourn and Gregson 1989

Isothraulus abditus - AUCKLAND (Waitakere Ranges), COROMANDEL (Little Barrier and Great Barrier Islands). Occurs on vegetation or under stones buried in algal detritus in pools and slow-flowing parts of streams. May be most common in intermittently flowing streams.

¹ Readers are asked to pass on to the author any corrections or additions.

- TL Waitakere River near Andersons Track
- Restricted
- Towns 1987, Towns and Peters 1979a, Winterbourn and Gregson 1989

?Isotbraulus Sp. - TAINUI (Mt Pirongia), COROMANDEL (Kauaeranga Ranges).

- Restricted
- Towns and Peters 1979a, Summerhayes 1983

Penniketellus insolitus - HAWDON (~rthur's Pass). Larvae not known.

- Known only from type locality.
- TL Edwards Valley, Arthur's Pass
- Restricted
- Towns 1983, Towns and Peters 1979a

?Penniketellus sp. - HAWDON (Arthur's Pass). Based on discovery of female subimago that differed slightly from *P. insolitus*. Larvae not known.

- Restricted, uncommon
- Towns and Peters 1979a

Zephlebia planulata - TAINUI (Mt Pirongia), KING COUNTRY (Waitomo). Adults collected in limestone cavern of Waitomo system. Larvae found in Rangitukia Stream, Mt Pirongia.

- TL Glow-worm grotto, Waitomo Caves
- Restricted
- Summerhayes 1983, Towns 1983

Order PLECOPTERA (stoneflies)

Family GRIPOPTERYGIDAE

Acroperla samueli - NORTH-WEST NELSON (Mt Glasgow; Goulard Downs; Flora Saddle), NORTH WESTLAND (Buller Gorge), ASPIRING (Routeburn Flats), FIORD (Wild Natives River, Otago Lakes). Larvae not known. Most adults collected from alpine and subalpine localities, but Buller Gorge material in a stony bush stream. Rare according to McLellan.

- TL St Patrick Basin, Mt Glasgow, 45 km NE of Westport
- Uncommon
- McLellan 1977, 1990, pers. comm.

Apteryoperla illiesi - FIORD (near Homer Tunnel).

- TL upper Hollyford River, near Homer Tunnel
- Restricted
- McLellan 1977. 1990

Nesoperla Sp. - EGMONT (Mt Taranaki). Late instar larvae occur out of water.

- Restricted
- Henderson pers. comm.

Zelandobius brevicauda - FIORD. Larvae and male adult not known.

- TL Wolfe Burn Flat, Turret Range near Lake Manapouri (950 m asl)
- Restricted
- McLellan 1977. 1990

Zelandobius illiesi - Scattered localities throughout North Island from Northland to Wellington, and on west coast of South Island. Small lowland forested streams, often on decaying tree ferns.

Specimen keying out to *Z. illiesi* found in a stream draining open cast coal mining area near Ohura, Taranaki, with moderate flow over stony substrate interspersed with silt and coal.

- TL Ohika-nui River bridge, Buller Gorge
- Uncommon
- Collier and Winterbourn 1989, Fowles pers. wmm., Gibbs pers. wmm., McLellan 1969, 1990, pers. comm., Winterbourn pers. wmm., Winterbourn and Gregson 1989

Zelandoperla fenestrata pennulata - CENTRAL OTAGO, LAMMERLAW. Swift flowing streams through tussock grassland on slopes of Old Man, Pisa, Rock and Pillar and Lammermoor Ranges. Brachyptemus subspecies of *Z. fenestrata*.

- TL Gorge Creek, Old Man Range
- Restricted
- McLellan 1967, pers. comm.

Family NOTONEMOURIDAE

Cristaperla eylesi - FIORD, ASPIRING, SOUTHLAND HILLS (Takitimu Mountains). Larvae not known.

- TL Takahe Valley
- Restricted
- McLellan 1991, pers. comm.

Halticoperla gibbsi - TARARUA, RUAHINE (Whangawahia hut).

- TL stream below Dundas Hut, Tararua Ranges
- Restricted
- McLellan 1991

Notonemoura alisteri - NORTH-WEST NELSON, NORTH WESTLAND, HAWDON. 10 rainforest up to subalpine zone. Larvae in splash zones of steep streams or in seepages between rock strata and on vertical rock faces.

- TL Waimea Creek, Westport.
- Restricted
- McLellan 1968, 1972, 1975a, 1990, 1991, Winterbourn and Gregson 1989

Notonemoura spinosa - FIORD. Larvae not known.

- TL Wilmot Pass
- Restricted
- McLellan 1991

Notonemoura winstanleyi - WAIKATO/NORTHERN VOLCANIC PLATEAU, TARARUA. Probably exists between these areas where collecting effort has been low. Lowlands to alpine.

- TL Dundas Basin, Tararua
- Restricted and disjunct
- McLellan 1991, pers. comm.

Omanuperla bruningi - SOUNDS-WELLINGTON (Marlborough Sounds), NORTH-WEST NELSON, NORTH WESTLAND, SPENSER. Larvae not known but may live underground. Adults found close to small streams with sand/mud substrates and tree-roots and fallen vegetation in channels in beech-podocarp forest on river terraces. Also in streams with beds of limestone and quartz grit.

- TL Norris Creek No.2, O'Connor's Farm below Buller Gorge
- Uncommon
- McLellan 1972, 1990, 1991

Omanuperla hollowayae - TARARUA. Alpine to subalpine (940-1300 m asl). Larvae not known.
- TL Pukemoremore Basin, Tamrua Ranges
- Restricted
- McLellan 1991

Spaniocerca acuta - MACKENZIE. Larvae not known.
- TL Parsons Stream, Lake Ohau
- Restricted
- McLellan 1991

Spaniocercooides foxi - E GMONT, TARARUA. Larvae found in streams draining alpine bogs 1000-1370 m asl. Larvae may live underground. Tararua Ranges specimens have shorter wings than those on Mt Taranaki.
- TL Manganui Ski Field, Mt Taranaki
- Restricted and disjunct
- McLellan 1984, 1990, 1991

Spaniocercooides jacksoni - OLIVINE. Small streams. Known only from type locality. Larvae not known.
- TL streams of Jackson River, tributary of Arawata River.
- Restricted, uncommon
- McLellan 1991

Spaniocercooides philpotti . NORTH-WEST NELSON, NORTH WESTLAND, SPENSER. Larvae in small forested weedy streams and seepages up to 1100 m asl. Abundant on the Coal Plateau.
- TL Lake Rotoroa
- Restricted
- McLellan 1984, 1990, 1991, Winterbourn 1965, Winterbourn and Gregson 1989

Spaniocercooides townsendi - NORTH-WEST NELSON (mountains from Pikiiruna Ranges in Abel Tasman National Park to Domett Ranges in north-west Nelson Forest Park). Larvae not known.
- TL Moa Park, Canaan Plateau, Abel Tasman National Park
- Restricted
- McLellan 1984, 1990, 1991

Spaniocercooides watti - WEST NORTHLAND. Larvae may live underground in stony streams.
- TL banks of Waipoua River near Forest Park Headquarters
- Restricted
- McLellan 1984, 1990, 1991

Order TRICHOPTERA (caddisflies)

Family HYDROPSYCHIIDAE

Diplectrona bulla -Sporadically distributed in North Island. Infrequently encountered. Larvae not known.
- TL Waimarino, near Erua
- Uncommon
- Henderson 1985, pers. comm., Norrie 1969, Winterbourn and Gregson 1989, Wise 1958

Family HYDROPTILIDAE

Paroxyethira kimminsi - AUCKLAND (Waitakere Ranges), TARARUA (Gollans Stream), NORTH WESTLAND. May be more widespread. On sides of stones in quieter parts of streams where larvae

may feed on algal mats and diatoms.

- TL Cascade Stream, Swanson
- Restricted and disjunct
- Cowie 1983, Henderson 1985, pers. wmm., Leader 1972, Winterbourn and Gregson 1989, Wise 1990

Family ECNOMIDAE

Ecnomina zealandica - AUCKLAND (Cascade Stream), TARANAKI, EGMONT (see below) SOUNDS-WELLINGTON (Hutt Valley), WHATAROA (recorded as Ecnomidae). Known from only two adult specimens, although unassociated larvae have been collected. Larvae keying out to this taxon are common inhabitants amongst weed in a small lowland stream in the Waitara catchment, near Mt Taranaki. Probably New Zealand's rarest caddisfly according to Henderson. Only member of family in New Zealand.

- TL Kauri Gully, Auckland
- Uncommon
- Collier and Wakelin 1992, Collier and Winterbourn 1987, Cowley 1978, Fowles pers. comm.
- Henderson 1985, Towns 1978, Winterbourn and Gregson 1989, Wise 1958, 1990

Family PHILOPOTAMIDAE

Cryptobiosella furcata - TARARUA. Small forested streams.

- TL Te Matawai Hut
- Restricted, uncommon
- Henderson 1983, 1985, pers. comm., McFarlane 1990, Winterbourn and Gregson 1989

Cryptobiosella bastata - EGMONT (Mt Taranaki). Small forested (mixed podocarp) streams with seepages nearby. Larvae not known.

- TL Waiweranui Stream
- Restricted, uncommon
- Henderson 1983, 1985, pers. comm., Winterbourn and Gregson 1989

Cryptobiosella spinosa - TARARUA (Rimutaka Ranges). Small forested streams. Larvae not known.

- TL south of Whakanui Track
- Restricted
- Henderson 1983, 1985, Winterbourn and Gregson 1989

Cryptobiosella tridens - SOUNDS-WELLINGTON. Small forested streams.

- TL unnamed stream in Ngawhakawhiti Bay, Pelorous Sound
- Restricted
- Henderson 1983, 1985, pers. comm., Winterbourn and Gregson 1989

Hydrobiosella aorere - NORTH-WEST NELSON. Larvae not known. Adults in beech-podocarp forest in Aorere River catchment at 460 m asl. Small steep streams with little surface flow. Similar to *H. tonela*.

- TL Heapby Track
- Restricted, uncommon
- Henderson 1983, 1985, pers. comm., Mosely and Kimmins 1953

Neobiosella irrorata - EASTERN NORTHLAND, AUCKLAND. This species could not be recognised by Henderson (1985).

- TL Whangarei
- Restricted, uncommon
- Henderson 1985, pers. comm., Wise 1958, 1990

Xenobusella motueka - NORTH-WEST NELSON. Larvae not known. Swift waters in pine, grassland and beech forest.

- Holotype Pearse River, tributary of Motueka River
- Restricted, uncommon
- Henderson 1983, 1985, pers. comm.

Family POLYCENTROPIDAE

Polyplectropus impluvii - EASTERN NORTHLAND, WESTERN NORTHLAND, AUCKLAND (Mangere, Western Springs), CENTRAL VOLCANIC PLATEAU (Turangi).

- TL domestic water tank in Mangare
- Uncommon
- Henderson 1985, pers. comm., Wise 1962, 1990

Polyplectropus pubia - KAIKOURA. Known only from holotype. Not rediscovered at type locality despite several visits.

- TL Education Reserve, Puhipuhi
- Restricted, uncommon
- Henderson 1985, McFarlane 1956, Ward pers. comm.

Polyplectropus sp.x - WHATAROA (Wesley Creek). Only member of genus in New Zealand.

- Restricted
- Ward pers. comm.

Family HYDROBIOSIDAE

Atrachorema mangu - WESTERN NORTHLAND, AUCKLAND, NORTH-WEST NELSON (one female found from Blue Duck Stream, Karamea). Larvae not known. Very rare according to McFarlane.

- TL south end of Mangamuka Gorge at confluence of two streams
- Restricted and disjunct, uncommon
- Henderson 1985, pers. comm., McFarlane 1964, 1990, Norrie 1969, Ward pers. comm., Wise 1990

Atrachorema macfarlanei - ASPIRING. Larvae not known.

- TL Routeburn near the lodge
- Restricted
- Ward 1991

Atrachorema tuarua - Southern tip of North Island and scattered locations in northern half of South Island. Larvae not known. Very rare according to McFarlane.

- TL McGrath's Creek, Arthur's Pass
- Uncommon
- Henderson 1985, pers. mmm., McFarlane 1966, Ward pers. comm.

Costachorema hebdomon - CENTRAL OTAGO (Rock and Pillar Range), LAKES (Rastus Burn), FIORD (Homer Tunnel).

- TL Homer Forks near Homer Tunnel
- Restricted
- Henderson 1985, McFarlane and Cowie 1981, Ward pers. comm.

Edpercivalia banksiensis - BANKS. Larvae known but not described.

- TL hilltop, Banks Peninsula
- Restricted
- Henderson 1985, Linklater 1991, McFarlane 1990

Edpercivalia borealis - EASTERN NORTHLAND, AUCKLAND (Titirangi), UREWERA (Waikaremoana).

- TL Titirangi, Auckland
- Restricted and disjunct, uncommon
- Henderson 1985, pers. comm., McFarlane 1951b, Wise 1990

Edpercivalia harrisoni - FIORD (Murchison Mountains). Known only from holotype.

- TL Plateau Creek (990 m asl)
- Restricted, uncommon
- Henderson 1985, Ward pers. comm.

Edpercivalia spaini - Wellington and western side of South Island. Widely scattered. Wellington record from McFarlane's notebook but specimen not seen; not subsequently recorded from Wellington.

- TL Mt Magister, Westland
- Uncommon
- Henderson 1985, pers. comm., McFarlane 1951b

Edpercivalia sp.a - NORTH-WEST NELSON, NORTH WESTLAND. Similar to *E. shandi*.

- Restricted
- Henderson 1985

Edpercivalia sp.b - FIORD (Wilmot Pass). High altitudes. Known only from a single male.

- Restricted, uncommon
- Henderson 1985

Edpercivalia sp.x . CENTRAL OTAGO (Rock and Pillar Range), FIORD (Cleddau River). Larvae not known.

- Restricted and disjunct
- Ward pers. comm.

Edpercivalia sp.y - OTAGO COAST (Swampy Summit).

- Restricted
- Ward pers. comm.

Hydrobiosis falcis - EGMONT (Mt Taranaki), TONGARIRO (Mt Ruapehu), UREWERA (Waikaremoana). Morphologically similar to *H. styracine*.

- TL Whakapapanui Stream (c. 1000 m asl)
- Restricted
- Henderson 1985, Wise 1958

Hydrobiosis silvicola - Scattered through parts of the central North Island and throughout South Island. Also recorded in Northland but this record is considered dubious (not reported there by Wise 1990). Central North Island records based on identifications of larvae. Montane species requiring small, shaded, stable streams. Also occurs in cold, shingly rivers. Rare according to McFarlane.

- TL not given
- uncommon
- Cowie 1980,1983, Cowley pers. comm., Fowles pers. comm., Henderson 1985, McFarlane 1951a,b,

Neurochorema pilosum - CENTRAL OTAGO, GORE, CATLINS.

- TL Pomahaka River near Clydevale
- Restricted
- Henderson 1985

Neurochorema sp.a - NORTH-WEST NELSON (Heaphy Track). Closely related to *N. fosteri* and *N. armstrongi*.

- Restricted
- Henderson 1985

Psilochorema acheir - FIORD (Lake Eraser, Homer Tunnel), RAKIURA.

- TL Mill Creek, Roy's Bay, northern arm of Patterson Inlet
- Restricted
- Henderson 1985, McFarlane and Cowie 1981

Psilochorema embersoni - FIORD (Secretary Island, Murchison Mountains), LAKES. Similar to *P. nemorale*.

- TL McKenzie Bum, Murchison Mountains
- Restricted
- Henderson 1985, Ward pers. comm., Wise 1982

Psilochorema foliobarbax - PUKETERAKI/HAWDON. Known only from type locality. Not re-caught there despite many visits.

- TL junction of Andrews and Waimakariri Rivers
- Restricted, uncommon
- Henderson 1985, McFarlane 1956, Ward pers. comm.

Tiphobiosis montana - NORTH-WEST NELSON (Goulard Downs), WHATAROA (Franz Josef), PUKETERAKI (Craigieburn), LAKES (Queenstown area), ASPIRING (Harris Saddle). Nelson record may be dubious according to Wise. Swampy areas in subalpine localities. Not uncommon on *Schoenus* wetlands, but usually rare.

- TL Ben Lomond, Queenstown
- Uncommon
- Henderson 1985, McFarlane 1951a, McFarlane and Cowie 1981, Patrick pers. comm., Tillyard 1324, Wise 1970

Tiphobiosis plicosta - Scattered throughout North Island.

- TL Kiri Kiri Stream, Ohauti Rd., Tauranga
- Uncommon
- Henderson 1985, pers. comm., McFarlane 1960, McFarlane and Cowie 1981, Norrie 1969, Ward pers. comm.

Tiphobiosis salmoni - NORTH-WEST NELSON (Cobb Valley, Lake Sylvester, Moa Park), FIORD (Homer Tunnel). May be more widespread at high altitudes in the South Island.

- TL cirque above Homer Tunnel
- Restricted and disjunct, uncommon
- Henderson 1985, pers. comm., McFarlane and Cowie 1981, Ward 1991

Tiphobiosis trifurca - AUCKLAND and SOUNDS-WELLINGTON in North Island, and scattered localities in northern half of South Island.

- TL Otira Gorge, Westland
- Uncommon
- Henderson 1985, pers. comm., McFarlane and Cowie 1981, Ward pers. comm., Wise 1990

Tiphobiosis sp.a - NORTH-WEST NELSON (Moa Park). Larvae not known.

- Restricted, uncommon
- Henderson 1985

Tiphobiosis sp.b - NORTH-WEST NELSON (Heaphy Track). Larvae not known.

- Restricted, uncommon
- Henderson 1985

Tiphobiosis sp.c - TARARUA, SOUNDS-WELLINGTON. Larvae not known,

- Restricted, uncommon
- Henderson 1985

Tiphobiosis sp.d - TARARUA, SOUNDS-WELLINGTON. Larvae not known.

- Restricted, uncommon
- Henderson 1985

Tiphobiosis sp.y - BANKS.

- Restricted, uncommon
- Ward pers. comm.

Tiphobiosis sp.z - BANKS.

- Restricted, uncommon
- Ward pers. comm.

Trillochorema rakiura - RAKIURA. Known only from Paterson Inlet.

- TL stream entering Abrahams Bay
- Restricted
- Henderson 1985, McFarlane and Cawie 1981

Trillochorema sp.a - TARARUA. Adults caught in high altitude forests.

- Restricted
- Henderson 1985

Family KOKIRIIDAE

Kokiria miharo - NORTH-WEST NELSON, NORTH WESTLAND (Stillwater), NELSON (Motueka River). Stable sand banks in gently flowing streams, mountain tarns, backwaters (alpine-lowland). Can be locally abundant. Only member of family in New Zealand.

- TL Baxters Stream, 5 km south of Stillwater, Westland
- Restricted
- Cowley 1978, Henderson 1985, McFarlane 1964, 1990, McLellan 1975b, Nebioss 1974, Ward pers. comm., Winterbourn and Gregson 1989

Family PHILORHEITHRIDAE

Philorbeitrus sp.b - SOUNDS-WELLINGTON. Small spring-fed streams from 0-50 masl. Streams may be intermittent during summer and drain *Leptospermum* forest. Also known from streams draining broadleaf forest on Maud Island. Substrate includes clay, fine gravel, vegetation litter, mud and large flat stones.

- Restricted
- Henderson 1985

Philorbeitrus sp.C - LAMMERLAW (Lammerlaw Ranges). Brachypterous in both sexes.

- Restricted
- Patrick pers. comm.

Family HELICOPHIDAE

Alloeocentrella sp.a - SOUNDS-WELLINGTON. Female unknown.

- Restricted
- Henderson 1985

Alloeocentrella sp.b - EGMONT (Mt Taranaki), RUAHINE. Female and larvae unknown.

- Restricted and disjunct
- Henderson 1985

Alloeocentrella sp.c - NORTH-WEST NELSON, NELSON. Larvae known but not described.

- Restricted
- Henderson 1985

Family LEPTOCERIDAE

Oecestis iti - Scattered localities in northern half of North Island and central/southern South Island. Sluggish streams and lakes. Associated with *Ranunculus fluitans* in Upper Clutha.

- TL Lake Georgina, Canterbury.
- Uncommon
- Biggs and Malthus 1982, Cowley 1978, Henderson 1985, McFarlane 1964, Winterbourn and Gregson 1989, Ward pers. comm., Wise 1990

Family OECONESIDAE

Pseudoeconesus sp.b - TARARUA. Small (male wing length about 8 mm).

- Restricted
- Henderson 1985, Ward pers. comm.

Pseudoeconesus sp.C - OTAGO COAST (Swampy Summit, Dunedin). Brachypterous in both sexes.

- Restricted
- Patrick pers. comm.

Zelandopsyche maclellani - NORTH-WEST NELSON, NORTH WESTLAND. Beech forested streams. Incorporates roughly arranged leaf and twig fragments into its case. Feeds on decaying leaves. Difficult to distinguish larvae from *Z. ingens*.

- TL Fuschia Creek, lower Buller Gorge
- Restricted
- Cowie 1983, Henderson 1985, McFarlane and Cowie 1981, Tillyard 1921, Ward pers. comm., Winterbourn and Gregson 1989

Family CONOESUCIDAE

Olinga fumosa - OTAGO COAST (Leith, Waitati). Species could not be recognised by Henderson (1985).

- TL Waitati near Dunedin
- Restricted
- Patrick pers. comm., Wise 1958

Olinga jealle - HAWDON, CANTERBURY FOOTHILLS, PUKETERAKI. Species could not be recognised by Henderson (1985), and Winterbourn and Gregson (1989) found larvae difficult to distinguish from *O. feredayi*.

- TL Reservoir Bush, Cass
- Restricted

- Cowley 1978, Henderson 1985, McFarlane 1966

Pycnocentria sp.a - UREWERA (Mangapuwerawera Stream near Waikaremoana), HAWKES BAY (Makahu Saddle in Kawekas). Similar to *P. funerea*.

- Restricted
- Henderson. 1985

Pycnocentria sp.b - SOUNDS-WELLINGTON (Ngawhakawhiti Bay), NORTH-WEST NELSON (Flora Track, Fossil Creek). Slow streams with much submerged wood.

- Restricted
- Henderson 1985

Pycnocentria sp.x - LAMMERLAW (Lammemoor Range).

- Restricted
- Ward pers. comm.

Family CALOCIDAE

Helicopsyche bowesi - LAMMERLAW (Lammemoor Range), OTAGO COAST (Leith Valley), CATLINS (Tautuku River). Species could not be recognised by Henderson (1985).

- TL Dunedin
- Restricted
- Henderson 1985, Tillyard 1924, Ward pers. comm., Winterbourn and Gregson 1989

Order COLEOPTERA (beetles)

Family DYTISCIDAE

Rbantus plantaris - OTAGO COAST (Dunedin). Single specimen of doubtful origin.

- TL Dunedin
- Restricted, uncommon
- Forsyth and Lewis 1987, Ordish 1966

Copelatus australis - EASTERN NORTHLAND (Mokohinau Island), EAST CAPE (Ruatoria). Also found in Australia. May occur in brackish water as well as fresh water. One of the rarer species of beetles.

- TL Beverley, Western Australia
- Restricted and disjunct, uncommon
- Ordish 1966, pers. comm., Winterbourn and Gregson 1989

Family HYDRAENIDAE

Homalaena carinata - COROMANDEL (Great Barrier Island), SOUNDS-WELLINGTON. Near sea level.

- TL Tryphena Stream, Great Barrier Island
- Restricted and disjunct
- Ordish 1984

Homalaena nelsonensis - NELSON. >10 m asl.

- TL Maitai Valley
- Restricted
- Ordish 1984

Hydraena zelandica - SOUNDS-WELLINGTON, RICHMOND, CENTRAL OTAGO. 100 m asl. The most evolutionary advanced hydraenid species in New Zealand. Few specimens have been collected.

- TL Bryants Stream, Pelorous Valley
- Restricted and disjunct, uncommon
- Ordish 1984, pers. comm.

Orchymontia banksiana . BANKS. >200 m asl.

- TL Kaituna River
- Restricted
- Ordish 1984

Orchymontia bidentata - KING COUNTRY (Waitomo), UREWERA (Waikaremoana), RAKIURA. c. 335 m asl. Report from Stewart Island unconfirmed.

- TL small stream near Lake Waikaremoana
- Restricted and disjunct
- Chadderton 1990, Ordish 1984

Orchymontia crassifemur - NORTH-WEST NELSON, NORTH WESTLAND, SPENSER. 700-1030 m asl.

- Holotype Lewis Pass
- Restricted
- Ordish 1984

Orchymontia diltata - LAKES, CENTRAL OTAGO, TASMAN/D'ARCHIAC. 300-920 m asl.

- TL Black Birch Stream, Hooker Valley
- Restricted
- Ordish 1984

Orchymontia dugdalei - AUCKLAND. c. 600 m asl. Known from only three specimens collected.

- TL Kohukohunui, Hunua Range
- Restricted, uncommon
- Ordish 1984, pers. comm.

Orchymontia laminifera - OLIVINE/ASPIRING (Olivine Range). c. 1000 m asl. Low numbers.

- TL Simonin Pass, Olivine Range
- Restricted, uncommon
- Ordish 1984, pers. comm

Orchymontia latispina - NORTH-WEST NELSON, OLIVINE. 500-900 m asl.

- TL south of Surveyors Creek, Karamea Bluff
- Restricted and disjunct
- Ordish 1984

Podaena glabriventris - COROMANDEL (Great Barrier Island), MANAWATU GORGE, TARARUA. 0-100 m asl.

- TL Ohau River, Manawatu
- Restricted and disjunct
- Ordish 1984

Podaena kuscheli - WHATAROA. 600 m asl.

- TL Hercules Creek, Mt Hercules
- Restricted
- Ordish 1984

Order HEMIPTERA (water bugs)

Family SALDIDAE

Saldula Stoneri - NORTHERN VOLCANIC PLATEAU, TONGARIRO, WHATAROA (Welcome Flat).

Lives on edges in thermal waters.

- TL Rotorua
- Restricted and disjunct
- Winterbourn 1968, 1973a, Winterbourn pers. comm., Winterbourn and Gregson 1989

Order DIPTERA (two-winged flies) (excluding Chironomidae)

Family TIPULIDAE

Aphrophila flavopygialis - NORTH WESTLAND. Larvae not known but probably stream dwelling.

- TL Blackball
- Restricted
- Johns pers. comm.

Aphrophila triton - NORTH WESTLAND. Larvae not known but probably stream dwelling.

- TL Greymouth
- Restricted
- Johns pers. comm.

Austrotipula budsoni - Scattered in North and South Islands. Larvae not known but some adults associated with lake shores. Largest tipulid in New Zealand. Only member of genus in New Zealand. Adults subject to wasp predation.

- TL Wellington
- Uncommon
- De Jong 1987, Johns pers. comm.

Dicranomyia megastigmosa - Scattered in South Island. Larvae not known, but adults associated with waterfalls and riffles.

- TL Ben Lomond, Queenstown
- Uncommon
- Edwards 1923, Johns pen. comm.

Dicranomyia monilicornis - Distribution not known. Poorly known. Adults associated with freshwater margins.

- TL Christchurch
- Uncommon
- Edwards 1923, Hutton 1899, Johns pers. comm.

Dicranomyia nelsoniana - NORTH-WESTNELSON. Not recollected at type locality. Adults associated with freshwater margins.

- TL Mt Arthur Tablelands
- Restricted, uncommon
- Johns pers. comm.

Dicranomyia nephelodes - TONGARIRO (Ohakune). Only known from type locality. Adults associated with freshwater margins.

- TL Ohakune

- Restricted
- Johns pers. comm.

Dicranomyia torrens - CENTRAL VOLCANIC PLATEAU. Larvae not known but adults associated with forested streams.

- TL Ohakune
- Restricted
- Johns pers. comm.

Dicranota sp. - SOUTHLAND HILLS (Takitimu Range). Larvae not known but adults associated with cold alpine wetlands.

- Restricted
- Johns pers. comm.

Paralimnophora skusei kumarensis - NORTH-WEST NELSON, NORTH WESTLAND. Larvae not known but adults are slow-moving swamp predators.

- TL Kumara, Westland
- Restricted
- Johns pers. comm.

Gynoplista pedestris - CANTERBURY PLAINS. Confined to wet swamp land in vicinity of Christchurch. Large numbers collected earlier this century. Adults wingless.

- TL Spreydon, Christchurch
- Restricted
- Alexander 1924, Johns pers. comm.

Gynoplista trogliphila - NORTH-WEST NELSON. Adults collected in upper dry levels of caves close to entrance. Larvae unknown but probably predatory. Unlikely that larvae occur in mud and gravels of cave waters because of the lack of food there.

- TL Wet Neck Cave, Paturau
- Restricted
- Alexander 1962, Johns 1991, pers. comm.

Pedicia arthuriana - HAWDON (Arthur's Pass). Larvae not known. Adults associated with cold alpine wetlands.

- TL Arthur's Pass
- Restricted
- Johns pers. comm.

Zelandotipula fuva - Widespread, Collected from margins of shallow forest streams.

- TL Nelson
- Uncommon
- Johns pers. comm.

Zelandotipula sp.a - RAKIURA. Larvae not known. Adults found in seepages, open bogs and sedge habitats.

- Restricted
- Forsyth and Lewis 1987, Johns pers. comm.

Zelandotipula sp.b - LOWRY (Hurunui River), PUKETERAKI (Cass), CANTERBURY FOOTHILLS. Larvae not known. Adults occur in open streams and are abundant in modified habitats.

- Restricted
- Johns pers. comm.

Zelandotipula sp.c - OLIVINE, ASPIRING. Known only from Jackson Bay area. Larvae not known.
- Restricted
- Johns pers. comm.

Zelandotipula sp.d - OTAGO COAST. Known only from Leith Valley. Larvae not known but adults associated with forest seepages. Adults brachypterous.
- Restricted
- Johns pers. comm.

Family TANYDERIDAE

Mischoderus marginatus - TARARUA (Wainuiomata). Only known locality. Larvae not known but adults associated with clean stony stream.
- TL Wainuiomata
- Restricted
- Johns pers. comm.

Mischoderus neptunus - TARARUA (Wainuiomata). Only known locality. Larvae not known but adults associated with clean stony stream.
- TL Wainuiomata
- Restricted
- Johns pers. comm.

Mischoderus varipes - LAKES (Lake Wakatipu). Only known locality. Larvae not known but adults associated with clean stony stream.
- TL Bold Peak, Lake Wakatipu
- Restricted
- Johns pers. comm.

Mischoderus sp.a - WHATAROA (Wanganui River near Harihari). Larvae found under stones and logs on shingle banks in regularly flooded area.
- Restricted
- Johns pers. comm.

Mischoderus sp.b - CANTERBURY PLAINS (Christchurch). Larvae probably occur in fine pebble sand in clean stream water.
- Restricted
- Johns pers. comm.

Mischoderus sp.C - OTAGO COAST. Larvae not known but adults associated with clean stony streams.
- Restricted
- Johns pers. comm.

Mischoderus sp.d - PAREORA (Geraldine). Larvae not known but adults associated with clean stony streams.
- Restricted
- Johns pers. comm.

Family BLEPHARICERIDAE

Neocurupira chiltoni - BANKS. Widely distributed, especially on the eastern part of the peninsula where water flow is sufficient to keep rocks clear of algal growths. Stony streams at water velocities of 0.3-1.2 m.s⁻¹ and at 0-350 m asl.

- TL Pumu Stream
- Restricted
- Craig 1969, McLellan 1975a, Winterbourn and Gregson 1989

Neocurupira rotalapiscus - OTAGO COAST. Larvae similar to *N. budroni*.

- TL Sheppards Stream, Waipouri Falls, Dunedin
- Restricted
- Craig 1969

Notboboraita micrognathia - NORTH WESTLAND.

- TL Fuchsia Creek, lower Buller Gorge.
- Restricted
- Craig 1969, Winterbourn and Gregson 1989

Austrosimulium albovelatum - CANTERBURY FOOTHILLS/PUKETERAKI, HERON. Open snow-fed rivers with rounded stones free of vegetation. May have only one hatch per year.

- TL North Ashburton River
- Restricted
- Death 1991, Dumbelton 1972, McLellan 1975a, Winterbourn and Gregson 1989

Austrosimulium laticorne alveolatum - CANTERBURY FOOTHILLS/PUKETERAKI (Porters Pass).

On stones in open lowland streams and large rivers.

- TL Porters Pass stream at 920 m asl
- Restricted
- Dumbelton 1972, Winterbourn and Gregson 1989

Austrosimulium multicornis fiordense - FIORD. Found south of Hollyford River and in both eastern (Glaisnock R.) and western (Stillwater R., L. Marchant) river systems. Taken on leaves dipping into water of large rivers. Low density population.

- TL Stillwater River
- Restricted, uncommon
- Dumbelton 1972, Winterbourn and Gregson 1989

Family CULICIDAE

Corethrella novaezealandiae - NORTH WESTLAND, WHATAROA. Larvae not known. Probably breeds on grassy margins of lakes.

- TL Otira, Westland
- Restricted
- Belkin 1968, Forsyth and Lewis 1987

Coquillettidia iracunda - Throughout North Island and northern half of western South Island. Permanent ground pools or swamps with aquatic vegetation and sometimes in sunny sheltered streambeds.

- Unable to locate TL
- Uncommon
- Belkin 1968, Dumbelton 1968, Winterbourn and Gregson 1989

Coquillettidia tenuipalpis - Throughout North Island and western South Island. Larvae not known. Pupae collected in shallow margins of ponds and small lakes choked with herbaceous and grassy vegetation, especially sedges and reeds.

- TL Ohakune
- Uncommon
- Belkin 1968, Dumbelton 1968, Winterbourn and Gregson 1989

Culex novaezelandiae - CATLINS. Coastal flax swamps and ground pools where native plant associations remain intact.

- TL Tahakopa, Catlins
- Restricted
- Dumbelton 1968, Pillai 1966, Winterbourn and Gregson 1989

Culex rotoruae - EASTERN NORTHLAND, NORTHERN VOLCANIC PLATEAU, TONGARIRO. Occurs in waters at pH 2-9 and at 17-36-C. Can occur in large numbers. An obligate thermophile according to Forsyth. Also found in cool streams according to Belkin, but this was based on erroneous information.

- TL Kuirau Hot Springs, Rotorua
- Restricted and disjunct
- Belkin 1968, Dumbelton 1968, Forsyth 1983, pers. comm., Vincent and Forsyth 1987, Winterbourn pers. comm., Winterbourn and Gregson 1989

Family DIXIDAE

Neodixa minufo - NELSON. Adult male only known. Swept from shrubs in a pond near a creek.

- TL Nelson
- Restricted, uncommon
- Belkin 1962, 1968, Forsyth and Lewis 1987, Winterbourn and Gregson 1989

Nothodixa otagoensis - CANTERBURY PLAINS, WHATAROA, LAKES. Pupae and larvae not known.

- TL Ben Lomond, Queenstown
- Restricted and disjunct
- Belkin 1962, 1968, Winterbourn and Gregson 1989

Nothodixaphilpotti - NELSON. Larvae not known. Adults collected sweeping along a mountain stream.

- TL Nelson
- Restricted
- Belkin 1962, 1968, Winterbourn and Gregson 1989

Nothodixa septentrionalis - WAIKATO, UREWERA/WAIROA. Margins of small hill or mountain streams with moderate to strong current.

- TL Te Aroha
- Restricted and disjunct
- Belkin 1962, 1968, Winterbourn and Gregson 1989

Family SCIOMYZIDAE

Eulimnia philpotti - NELSON, NORTH-WEST NELSON, NORTH WESTLAND. 0-600 m asl. Adults found in partly-shaded marshes that retain slow-flowing water throughout the year. Larvae prey on molluscs which is unusual for this family. Also unusual because larvae spend most of time submerged and become amphibious only in third instar. Only member of genus in South Island. More information on development and feeding in Barnes (1980).

- TL Aniseed Valley, Nelson
- Restricted
- Barnes 1980, Forsyth and Lewis 1987

Family EPHMRIDAE

Ephydrella thermarum - NORTHERN VOLCANIC PLATEAU, CENTRAL VOLCANIC PLATEAU, WHATAROA (Copeland River). Occurs in waters at 32-45°C on clumps of floating algae. Can be common.

- Unable to locate TL
- Restricted and disjunct
- James 1985, Winterbourn 1973a,b, Winterbourn and Gregson 1989

Order ODONATA (dragonflies)

Family COENAGRIONIDAE

Xanthonemis sinclairi - HAWDON (Arthur's Pass), D'ARCHIAC. Larvae live in shallow, flat-bottomed depressions, probably seepage-fed and subject to winter freezing. Unusual larval behaviour.

- TL tarn in valley of Louper Stream, Whitcombe Pass
- Restricted
- Moore 1989, Rowe 1987, Winterbourn pers. comm., Winterbourn and Gregson 1989

Class CRUSTACEA

Order TANAIDACEA (tanaid shrimps)

Family TANAIDAE

Tanais stanfordi - NORTHERN VOLCANIC PLATEAU (Rotoma Lakes). Abundant in Ohau Channel. Also found in brackish waters in Australia, Mexico, Japan and Argentina. Thought to have been brought over on the feet of migratory ducks in the 1960s.

- Unable to locate TL
- Restricted - Chapman and Lewis 1976, Winterbourn pers. comm.

Order NOTOSTRACA (tadpole shrimps)

Family TRIOPSIDAE

Lepidurus apus viridis - Scattered throughout New Zealand. Also present in Tasmania and parts of coastal Australia. Mostly in temporary ponds, sometimes in permanent ponds, swamps and ditches. Produces resistant eggs to survive periods when habitat is dry and can synthesise haemoglobin to withstand low oxygen levels. Benthic dwelling. Omnivorous. No males found in New Zealand where species appears to be hermaphroditic. Can reach maturity within four weeks in spring. Habitat threatened due to draining of temporary ponds and swamps. Vulnerable to predation due to relatively large size and slow swimming speeds.

- Unable to locate TL
- Uncommon
- Chapman and Lewis 1976, Stout 1964, 1969, pers. comm.

Order ISOPODA (isopods)

Family ASSELLIDAE

Assellus sp. - KAIPARA. Recorded from dune lake. Deep orange red in colour.

- Restricted, uncommon
- Chapman and Lewis 1976

Family IODETEIDAE

Austridotea annectans - CANTERBURY PLAINS (Lake Ellesmere, Leeston Drain), CATLINS, RAKIURA. One of the top four foods of eels in Lake Ellesmere. Not uncommon.

- Unable to locate TL
- Restricted and disjunct
- Chadderton 1990, pers. comm., Chapman and Lewis 1976, Marshall 1974, Ryan 1986

Austridotea benhami - OTAGO COAST, CATLINS (1 site), RAKIURA (Stewart Island and Codfish Island).

- Unable to locate TL
- Restricted, uncommon
- Chadderton 1988, 1990, pers. comm., Chapman and Lewis 1976

Family PHREATOICIDAE

Notarnphisopus benhami - RAKIURA. Under moss and debris in a tiny creek flowing through extremely dense tree-fern scrub and discharging into Horseshoe Bay. Several specimens taken at outlet just above high water mark.

- Unable to locate TL
- Restricted
- Chapman and Lewis 1976, Nicholls 1944

Notamphisopus dunedinensis - OTAGO COAST. Found in streams.

- Unable to locate TL
- Restricted
- Chapman and Lewis 1976, Nicholls 1944

Notamphisopus flavius - GORE. Found in springs on river terraces and in backwaters of Oreti River.

- TL road to railway station near the Elbow, Lumsden
- Restricted
- Chapman and Lewis 1976, Nicholls 1944

Notamphisopus kirkii - RAKIURA. Found in freshwater lagoon on Ruapuke Island.

- Unable to locate TL
- Restricted
- Chapman and Lewis 1976

Notamphisopus littoralis - CATLINS. Found in springs and ditches within 100 m of sea shore.

- TL springs at The Reserve, Pounaweia
- Restricted
- Chapman and Lewis 1976, Nicholls 1944

Notamphisopus percevali - MAKAREWA (Invercargill and Drummond). Numerous in pond in mud at roots of rushes. Also found in cleaner water on *Elodea* and *Myriophyllum*.

- Unable to locate TL
- Restricted
- Chapman and Lewis 1976, Nicholls 1944

Order AMPHIPODA (amphipods)

Family COROPHIIDAE

Paracorophium lucasi - NORTHERN VOLCANIC PLATEAU (Lakes Rotorua and Rotoiti, Haumarana Springs), CANTERBURY PLAINS (Avon-Heathcote estuary, Lake Ellesmere). Shallow water on lake edges, but predominantly brackish water in Canterbury. Builds a tunnel. Common.

- TL Lake Rotoiti
- Restricted and disjunct
- Bamard 1972, Chapman and Lewis 1976, Winterbourn pers. comm.

Family EUSIRIDAE

Paracalliope karitane - SOUNDS-WELLINGTON (lower Hutt River), NELSON (Waikoropupu Springs). May be a brackish water species. Abundant in Puppu Springs, where it is gravid all year round due to constant water temperatures and where high NaCl content of water may make habitat suitable.

- TL lower Hutt River in pools and on willows and duckweed.
- Restricted
- Bamard 1972, Chapman and Lewis 1976, Michaelis 1974

Paraleptamphopus sp. - NORTH WESTLAND. Incorrectly identified as *P. caeruleus* by Collier and Winterbourn 1989 and Winterbourn and Collier 1987. Super-abundant in some acidic pakihī streams where it is closely associated with *Sphagnum*. Not found in streams draining through V-bladed pakihī.

- Restricted
- Collier and Winterbourn 1989, Winterbourn and Collier 1987

Family GAMMARIDAE

Phreatogammarus propinquus - SOUNDS - WELLINGTON (Rona Bay), RAKIURA.

- TL small pool on top on Mt Anglem, Stewart Island
- Restricted and disjunct
- Chapman and Lewis 1976, Chilton 1908

Family HYALELLIDAE

Chiltonia mihiwaka - OTAGO COAST, TE WAE WAE. Also found on Enderby, Auckland and Campbell Islands.

- TL Mt Mihiwaka, near Dunedin
- Restricted and disjunct
- Chapman and Lewis 1976, Chilton 1909, 1916, 1924, Hurley 1954

Chiltonia rivertonensis - TE WAE WAE, RAKIURA. Very common on Stewart Island. Small streams close to sea.

- TL freshwater stream, Riverton
- Restricted
- Chadderton 1988, 1990, Chapman and Lewis 1976, Hurley 1954

Order DECAPODA (decapods)

Family HYMENOSOMATIDAE

Halicarcinus lacustris - KAIPARA, AUCKLAND, WAIKATO. Also in south-eastern Australia, Norfolk and Lord Howe Islands. Coastal lakes and rivers. Common at some sites. Disappeared from dune lakes.

- Unable to locate TL
- Restricted
- Chapman and Lewis 1976, Chilton 1882a, Walker 1969, Winterbourn pers. comm.

Phylum MOLLUSCA Class GASTROPODA (gastropod snails)

Family HYDROBIIDAE

Paxillostium nanum - WESTERN NORTHLAND, EASTERN NORTHLAND. Seepages and shaded areas in small bush streams.

- Holotype seepage at head of bush stream 8 km south of Parakao at 200 m asl
- Restricted
- Gardner 1970, Powell 1979, Winterbourn 1973c

Family PLANORBIDAE

Glyptophysa variabilis - North and South Islands from north of Awanui to Fiordland. Previously known as *Physastra variabilis*. In lakes and ponds of South Island away from urban areas, but more widespread in North Island. Becoming replaced by the exotic *Physa acuta* in lowland areas. Declining in Lake Wanaka.

- Unable to locate TL
- Uncommon
- Dell 1956, Forsyth and Lewis 1987, Powell 1979, Stark 1981, Timms 1983, Winterbourn 1973c, pers. comm.

Family ANCYLIDAE

Ferrissia neozelanica - South Island. Also reported from Rangiteiki (Mokopua Stream). On weeds in ponds and streams.

- TL River Avon, Christchurch
- Uncommon
- Forsyth and Lewis 1987, Fowles pers. comm., Powell 1979, Winterbourn 1973c

Family LATIIDAE

Latia climoi - SOUNDS-WELLINGTON/TARARUA. Genus not recorded in South Island.

- TL Wellington
- Restricted
- Starobogatov 1986

Class BIVALVIA (bivalves)

Family HYRIIDAE

Cucumerunio websteri delli - EASTERN NORTHLAND. AUCKLAND. May be a recent immigrant from Australia, although Climo thinks it was probably there originally.

- TL Big Omaka River, Leigh
- Restricted
- Climo pers. comm., McMichael and Hiscock 1958, Powell 1979, Winterhoun 1973c

Cucumerunio websteri websteri - South of Auckland as far as Foxton.

- TL artificial field drain, Waiuku
- Uncommon
- Ponder 1970, Winterbourn 1973c

Phylum ANNELIDA
Class HIRUDWEA (leeches)

Family GLOSSIPHONIIDAE

Glossiphonia tasmaniensis - ASPIRING (Paringa River). Known only from type locality.

- TL Paringa River
- Restricted
- Mason 1974

Glossiphonia multistriata - CANTERBURY PLAINS, PUKETERAKI, MACKENZIE. Small lakes and slow-flowing rivers. Predatory.

- TL Avon River, Christchurch
- Restricted
- Mason 1974, Talbot and Ward 1987

Oligobdella novaezealandiae - AUCKLAND. Recorded only once on undersides of stones near lake margin

- TL Lake Takapuna
- Restricted, uncommon
- Mason 1974

Helobdella sp. . CENTRAL VOLCANIC PLATEAU (Lake Rotokawa). Occurs in water at pH 2.1

- Restricted
- Forsyth 1977

Class POLYCHAETA (polychaete worms)

Family NERIDAE

Namalycastis tiriteae - MANAWATU (Tiritea Stream). Small stream with large stable stones embedded in gravel and mud. Only three individuals collected in type series, and none others found despite intensive searching.

- TL Tiritea Stream
- Restricted, uncommon
- Winterbourn 1969

Phylum PLATYHELMINTHES
Class TURBELLARIA (flatworms)

Family TRICLADIDA

Dugesia sp. - NELSON. Known only from Puppu Springs. White with no eyes.

- Restricted
- Michaelis 1974

Spathula fontinalis - LOWRY, CANTERBURY PLAINS, CANTERBURY FOOTHILLS. Abundant in small spring-fed streams with a soft substrate, few stones and good growth of watercress, typically flowing through fairly flat country, sometimes through swamps.

- TL Rose Stream, Heathcote River, Christchurch
- Restricted
- Ball 1977, Nurse 1950

Spathula limicola - PUKETERAKI (Cass), CENTRAL OTAGO (Lindis Pass). Found in small stable streams which run across flat, slightly swampy ground. Streams have a muddy bottom, a few stones but no aquatic macrophytes. Temperature ranges from 2-25°C.

- TL Woolshed Hill, Cass
- Restricted and disjunct
- Ball 1977, Nurse 1950

Spathula neara - NORTH WESTLAND. Small seepage stream running down a rock face from a bog at about 900 m a.s.l. in open mountain-top country. Found under stones. Known only from type locality.

- TL seepage below Mire Road, Denniston
- Restricted
- Ball 1977

Family PRORHYNCHIDAE

Prorhynchus baswelli - CANTERBURY PLAINS.

- Unable to locate TL
- Restricted
- Percival 1945

Prorhynchus putealis - PUKETERAKI/CANTERBURY PLAINS, SOUTHLAND HILLS/MAKAREWA. Stable substrate and water conditions in trout redds.

- Unable to locate TL
- Restricted
- Percival 1945

Prorhynchus sp. - PUKETERAKI/CANTERBURY HILLS, SOUTHLAND HILLS/MAKAREWA. White with no eyes. Found with *P. pirfealis*.

- Unable to locate TL
- Restricted and disjunct
- Percival 1945

Phylum NEMERTINA
Class ENOPLA (nemertine worms)

Family PLECTONEMERTIDAE

Potamonemertes percivali - CANTERBURY PLAINS. Known only from type locality. Gravel bed and clay margins of river. Can be "fairly abundant". White with no eye. Occurs with *Prorhynchus putealis* and *P. haswelli*.

- Holotype Coe's ford, Selwyn River, Canterbury
- Restricted
- Hickman and Moore 1990, Johns pers. comm., Moore 1973

3.2 Native macroinvertebrates restricted to underground freshwaters of mainland New Zealand

Underground freshwater habitats in New Zealand are best known from the Canterbury Plains and Nelson areas. Water travelling through soluble rock promotes erosion and dissolution producing cavities. These cavities may enlarge to form extensive cave systems (Williams 1979), as has occurred in north-west Nelson and Waitomo in the North Island. Gravel floodplains may also have water flowing through them at considerable depths and distances from the river channel, providing habitat for underground animals (Stanford and Ward 1988). Artesian wells such as those in Canterbury are also home to an unusual subterranean fauna.

Phylum ARTHROPODA
Class INSECTA
Order COLEOPTERA (beetles)

Family DYTISCIDAE

Kuschelydrus phreaticus - NELSON. Alluvium in Waimea and Maitai River valleys at about 4 m. Larvae not known. Most common in summer but not as common as *P. hades*. Carnivorous.

- TL Livingstons Well, Waimea, Nelson
- Restricted
- Ordish 1976, pers. comm.

Phreatodessus hades - NELSON. Floodplain alluvium of Waimea and Maitai River valleys. Occur at about 4 m depth in lower reaches of the river. Most common in summer. The most abundant of the three subterranean coleopteran species. The most primitive of all known dytiscids. Carnivorous.

- TL Livingstons Well, Waimea, Nelson
- Restricted
- Ordish 1976, pers. comm.

Phreatodessus pluto - CANTERBURY PLAINS (Seadown south of Opihi River). Only one specimen collected after one year's pumping. Carnivorous.

- TL bore on Rua Pae farm, Dalgety Agri-research Station, Canterbury.
- Restricted, uncommon
- Ordish 1991, pers. comm.

Class CRUSTACEA
Order ISOPODA (isopods)

Family PHREATOICIDAE

Phreatoicus orarri - CANTERBURY PLAINS. Found in wells.

- TL Winchester, south Canterbury
- Restricted
- Chapman and Lewis 1976, Nicholls 1944

Phreatoicus typicus - CANTERBURY PLAINS. Abundant in moderately polluted (sewage) wells near Templeton.

- Unable to locate holotype site
- Restricted
- Chapman and Lewis 1976, Nicholls 1944, Sinton 1984, 1985

Neophreatoicus assimilis - CANTERBURY PLAINS. Found in wells.

- Unable to locate TL
- Restricted
- Chapman and Lewis 1976, Nicholls 1944

Order AMPHIPODA (amphipods)

Family GAMMARIDAE

Paracrangonyx compactus - CANTERBURY PLAINS. Reasonably common in moderately polluted aquifers near Templeton.

- TL pump at Eyreton, North Canterbury
- Restricted
- Chapman and Lewis 1976, Chilton 1882b, 1908, Sinton 1984, 1985

Paracrangonyx sp. - CANTERBURY PLAINS. Small numbers in moderately polluted aquifers near Templeton.

- Restricted
- Sinton 1984

Phreatogammarus fragilis - CANTERBURY PLAINS. Common in moderately polluted aquifers near Templeton. Also occurs in surface waters of Selwyn River.

- TL pump at Eyreton, North Canterbury
- Restricted
- Chapman and Lewis 1976, Chilton 1882b, 1908, Sinton 1984, 1985

Phylum MOLLUSCA
Class GASTROPODA (gastropod snails)

Family HYDROBIIDAE

Catapyrgus spelaeus - NORTH-WEST NELSON, NORTH WESTLAND. Restricted to Cenozoic limestones and marbles.

- TL Wetneck Cave, Paturau
- Restricted
- Climo 1974, Powell 1979

Hadopyrgus anops - NELSON, NORTH-WEST NELSON, NORTH WESTLAND. Caves and other underground waters.

- TL Lauria's well, Nelson city
- Restricted
- Climo 1974, Powell 1979

Hadopyrgus brevis - NELSON. Gravels in Waiiti (tributary of Waimea) and Maitai Rivers.

- TL Lauria's well, Nelson city
- Restricted
- Climo 1974, Powell 1979

Horatia klecakiana - NELSON (Riwaka River cave system). Only empty shells collected.

- TL West Balkans, Europe
- Restricted
- Climo 1977

Horatia nelsonensis - NELSON.

- TL cave entrance, Riwaka River
- Restricted
- Climo 1977

Kuschelila inflata - HAWKES BAY. Known only from holotype.

- TL MWD bore, Roys Hill, Napier
- Restricted, uncommon
- Climo 1974, Powell 1979

Kuschelila mica - NELSON. Waiiti and Maitai River gravels.

- TL Livingston's well, Waimea Plains
- Restricted
- Climo 1974, Powell 1979

Opacuincola caeca - NORTH-WEST NELSON (Takaka). Marble cave system. Known only from type locality.

- TL Gorge Creek cave, about 1 mile in from entrance
- Restricted
- Climo 1974, 1977, Powell 1979

Opacuincola kuscheli - NORTH-WEST NELSON, NORTH WESTLAND. Cave systems from Putarau to Inangahua.

- TL Bush Cave, Putarau
- Restricted

- Climo 1974, Powell 1979

Opacuincola troglodytes - KING COUNTRY. Known only from type locality. Not found alive. Closely related to *O. caeca*.

- TL Soda Springs off Wairona Rd., Aria, King Country
- Restricted
- Climo 1974, Powell 1979

Potamopyrgus subterraneus - CANTERBURY PLAINS, KAKANUI.

- TL Barton's property near Duntroon, Waitaki Valley
- Restricted
- Climo 1974, Powell 1979

Family PUNCTIDAE

Hydrophrea academia - NELSON (city), CANTERBURY PLAINS. Only member of genus in New Zealand.

- TL Waimakariri River alluvium at University of Canterbury.
- Restricted
- Climo 1970, Powell 1979

3.3 Native freshwater macroinvertebrates on offshore islands

New Zealand has over 500 offshore islands ranging from the subtropical Kermadec Islands at 29°S to the subantarctic Campbell Islands at 53°S. Aquatic habitats on these islands range from ponds and small to medium sized lakes, to relatively short rivers. Catchment areas for streams and rivers can be small, and they may dry up periodically. Wetlands can be common on some islands because of the reduced level of wetland drainage compared with mainland New Zealand and because rainfall can be high.

Phylum ARTHROPODA Class INSECTA Order EPHEMEROPTERA (mayflies)

Family LEPTOPHLEBIIDAE

Cryophlebia aucklandensis - Auckland Islands. Under rocks in small streams.

- TL rocky stream, Bivouac Hill, Mt Eden
- Restricted
- Peters 1971, Towns 1983, Towns and Peters 1979b

Order PLECOPTERA (stoneflies)

Family GRIPOPTERYGIDAE

Aucklandobius complementarius - Auckland Islands. Widespread on Auckland Island and Adams

Island in low elevation streams. Brachypterous population restricted to still-water habitat (Lake Turbott).

- TL Ranui Cove

- Restricted

- Illies 1963, 1964, 1974, McLellan 1977

Aucklandobius gressitti - Auckland Islands. Material collected recently from Port Ross.

- TL Bivouac Hill

- Restricted

- Illies 1974, McLellan pers. comm.

Nesoperla johnsi - The Snares.

- TL Penguin Creek

- Restricted

- McLellan 1977

Rungaperla longicauda - Campbell Islands.

- TL creek 2 miles from sea, Tucker Cove

- Restricted

- Illies 1963, 1964, 1974, McLellan 1977

Order TRICHOPTERA (caddisflies)

Family HYDROBIOSIDAE

Costachorema notoptera - Auckland Islands.

- TL Pond Stream, Enderby Island

- Restricted

- Henderson 1985, Wise 1972

Hydrobiosis lindsayi - Chatham Islands. The only *Hydrobiosis* species on the Chathams. Common.

- TL Waiparua

- Restricted

- Tillyard 1925, Henderson 1985, Wise 1970

Tiphobiosis kuscheli - Auckland Islands.

- TL Adams Island

- Restricted

- Henderson 1985, Wise 1972

Family LEPTOCERIDAE

Hudsonema sp. - Chatham Islands. Undescribed species.

- Restricted

- Henderson 1985

Oecetis chathamensis - Chatham Islands. Lakes and ponds. Common. Very similar to *O. unicolor*.

- TL The Ngaio

- Restricted

- Henderson 1985, Tillyard 1925, Ward pers. comm.

Order COLEOPTERA (beetles)

Family DYTISCIDAE

Liodessus oliveri - Kermadec Islands. Can be abundant.

- TL Denham Bay lagoon
- Restricted
- Ordish 1966, pers. comm.

Rbantus schauinslandi - Chatham Islands. Tolerates brackish water. Habitat and larvae not known.

- TL Waitangi, Chatham Island
- Restricted
- Ordish 1989, pers. comm.

Order DIPTERA (two-winged flies)

Family TIPULIDAE

Dicranomyia archeyi - Chatham Islands. Larvae not known. Adults associated with freshwater.

- TL Manganui, Chatham Islands
- Restricted
- Alexander 1924, Johns pers. comm.

Dicranomyia sp.a - Auckland Islands. Associated with freshwater seepages.

- Restricted
- Johns pers. comm.

Dicranomyia sp.b - Auckland Islands. Associated with freshwater seepages.

- Restricted
- Johns pers. comm.

Dicranomyia sp.c - Auckland Islands. Associated with freshwater seepages.

- Restricted
- Johns pers. comm.

Erioptera antipodarum - Antipodes Island. Freshwater seepages and seepages with high nitrogenous content near bird colonies.

- TL Antipodes Island
- Restricted
- Johns pers. comm.

Gynoplista chathamica - Chatham Islands. Adults associated with wet soils and seepages.

- TL Wharekauri
- Restricted
- Johns pers. comm.

Limonia sp.a - Auckland Islands. Larvae not known. Adults associated with freshwater seepages.

- Restricted
- Johns pers. comm.

Limonia Sp.b - Auckland Islands. Larvae not known. Adults associated with freshwater seepages.
- Restricted
- Johns pers. comm.

Limonia Sp.C - Auckland Islands. Larvae not known. Adults associated with freshwater seepages.
- Restricted
- Johns pers. comm.

Family EMPIDIDAE

Clinocera gressitti- Campbell Island. Larvae collected from moss on submerged stones in Tucker Cove.
- TL Tucker Cove stream
- Restricted
- Dumbelton 1966, Smith 1964

Family SIMULIIDAE

Austrosimulium campbellense - Campbell Island. Larvae and pupae numerous in streams, and some also found on submerged overhanging vegetation. Low altitude streams with high scrub covered banks.
- TL Tucker Cove
- Restricted
- Dumbelton 1972, McLellan 1975a

Austrosimulium vexans - Auckland Islands. Larvae and pupae occur on small rocks in low altitude forest streams with high scrub covered banks. Adults mostly found around the shore but not very abundant.
- TL Auckland Island
- Restricted
- Dumbelton 1972, Harrison 1964, Hutton 1901, McLellan 1975a

Family CHIRONOMIDAE

Chironomus antipodensis - Antipodes Island. Collected from pools and streams.
- TL *Callitriche-Montia* pool, Reef Point
- Restricted
- Sublette and Wirth 1980

Chironomus subantarcticus - Campbell Island, Auckland Islands. Collected from pools, streamlets and seal wallows.
- TL elephant seal wallow, Lookout Bay, Campbell Island
- Restricted
- Sublette and Wirth 1980

Eukiefferiella beveli - Campbell Island, Auckland Islands.
- TL Tucker Cove, Campbell Island
- Restricted
- Sublette and Wirth 1980

Kuschelius dentifer - Auckland Islands. Adults collected near stream.
- TL Magnetic Bay, Adams Island.
- Restricted
- Sublette and Wirth 1980

Mariodiamesa insularis - Campbell Island.

- Unable to locate TL
- Restricted
- Sublette and Wirth 1980

Parochlus rennelli - Antipodes Islands, Campbell Island, Auckland Islands. Adults collected alongside streams and near elephant seal wallows.

- TL Camp Cove, Campbell Island
- Restricted
- Sublette and Wirth 1980

Pterosis wisei - Auckland Islands, Campbell Island. Adults collected alongside streams.

- TL west end of Adams Island, Auckland Islands
- Restricted
- Sublette and Wirth 1980

Order ODONATA (dragonflies)

Family COENAGRIONIDAE

Xanthonema tuanuii - Chatham Islands, also Pitt Island. Larvae occur mostly amongst aquatic vegetation in sheltered parts of shaded streams and riverside pools, including brownwater streams. Adults widespread in bracken areas and forest clearings.

- TL brownwater forest stream on southern bank of Tukuatamatea River
- Restricted
- Rowe 1981, 1987, Winterbourn and Gregson 1989

Family LIBELLULIDAE

Tramea transmarina - Raoul Island, Kermadecs. Breeding population. Indo-Pacific distribution.

- Unable to locate TL
- Restricted
- Armstrong 1973, Rowe 1981, 1987, Winterbourn and Gregson 1989

Class CRUSTACEA Order AMPHIPODA (amphipods)

Family HYALELLIDAE

Chiltonia enderbyensis - Auckland Islands.

- TL freshwater pool not far from sea, Enderby Island
- Restricted
- Chapman and Lewis 1976, Hurley 1954

Phylum MOLLUSCA
Class GASTROPODA (gastropod snails)

Family HYDROBIIDAE

- Potamopyrgus dawbini* - Auckland Islands (Coleridge Tarn).
- TL Auckland Island
- Restricted
- Powell 1979

Phylum ANNELIDA
Class OLIGOCHAETA (worms)

Family PHREODRILIDAE

- Phreodrilus campbellianus* - Campbell Island.
- Unable to locate TL
- Restricted
- Brinkhurst 1971

- Phreodrilus litoralis* - Campbell Island.
- Unable to locate TL
- Restricted
- Brinkhurst 1971

Phylum NEMERTINA
Class ENOPLA (nemertine worms)

- Campbellonmertes johnsi* - Campbell Island. Pond. Grey with single longitudinal white stripe. Only member of genus.
- TL pond near Tucker Cove
- Restricted
- Hickman and Moore 1990, Moore and Gibson 1973

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5. REFERENCES

- Alexander C.P. 1924. Studies on the crane-flies of New Zealand: Part 1 - Order Diptera, Superfamily Tipuloidea. *Transactions and proceedings of the New Zealand Institute* 55 : 654.
- 1962. A new cave-inhabiting crane-fly (Tipulidae, Diptera) from New Zealand. *New Zealand Journal of Science* 5: 137-140.
- Armstrong, J.S. 1973. Odonata of the Kermadec Islands. *New Zealand Entomologist* 5: 277-283.
- Ball, I.R. 1977. A monograph of the genus *Spathula* (Platyhelminthes, Turbellaria, Tricladida). *Australian Journal of Zoology, Supplementary Series* 47: 1-43.
- Barnard, J.L. 1972. The marine fauna of New Zealand: algae-living littoral Gammaridea (Crustacea Amphipoda). *Bulletin of the New Zealand Department of Scientific and Industrial Research* 210.
- Barnes, J.K. 1980. Taxonomy of the New Zealand genus *Eulimnia*, and biology and immature stages of *E. philpotti* (Diptera: Sciomyzidae). *New Zealand Journal of Zoology* 7: 91-103.
- Belkin, J.N. 1962. *The mosquitoes of the South Pacific (Diptera: Culicidae)*. University of California Press, Berkeley. Vols 1 and 2.
- 1968. *The Culicidae of New Zealand*. Contributions of the American Entomological Institute 3.
- Biggs, B.J.F., and Malthus, T.J. 1982. Macroinvertebrates associated with various aquatic macrophytes in the backwaters and lakes of the Upper Clutha Valley, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 16: 81-88.
- Brinkhurst, R.O. 1971. *The aquatic Oligochaeta known from Australia, New Zealand, Tasmania, and the adjacent islands*. University of Queensland Press, Queensland.
- Chadderton, W.L. 1988. Faunal and chemical characteristics of some Stewart Island streams. *New Zealand Natural Sciences* 15: 43-50.
- 1990. *The ecology of Stewart Island freshwater communities*. Unpubl. M.Sc. thesis, University of Canterbury.
- Chapman, M.A., and Lewis, M.H. 1976. *An introduction to the freshwater Crustacea of New Zealand*. Collins. Auckland.
- Chilton, C. 1882a. Additions to the New Zealand Crustacea. *Transactions and proceedings of the New Zealand Institute* 14: 171-174.
- 1882b. On some subterranean Crustacea. *Transactions and Proceedings of the New Zealand Institute* 14: 174-180.

- 1908. The freshwater Amphipoda of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 41: 53-59.
- 1909. The fresh-water Amphipoda of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 41: 53-58.
- 1916. Some Australian and New Zealand Gammaridae. *Transactions and Proceedings of the New Zealand Institute* 49: 357-370.
- 1924. Some New Zealand Amphipoda No. 4. *Transactions and Proceedings of the New Zealand Institute* 55: 269-280.
- Climo, P.M. 1970. Two new species of punctid land snail from the South Island, New Zealand. *Transactions of the Royal Society of New Zealand (Biological Sciences)* 12: 209-212.
- 1974. Description and affinities of the subterranean molluscan fauna of New Zealand. *New Zealand Journal of Zoology* 1: 247-284.
- 1977. Notes on the New Zealand hydrobiid fauna (Molluscs: Gastropoda: Hydrobiidae). *Journal of the Royal Society of New Zealand* 7: 67-77.
- Collier, K.J., and McColl, R.H.S. 1992. Assessing the natural value of New Zealand rivers. In: *River conservation and management* (eds. P.J. Boon, P. Calow and G.E. Petts). John Wiley and Sons Ltd.
- Collier, K.J. and Wakelin, M.D. 1992. Drift of aquatic macroinvertebrate larvae in Manganuiateao River, central North Island, New Zealand. *New Zealand Natural Sciences* 19: 15-26.
- Collier, K.J., and Winterbourn, M.J. 1987. Faunal and chemical dynamics of some acid and alkaline New Zealand streams. *Freshwater Biology* 18: 227-240.
- 1989. Impacts of wetland afforestation on the distribution of benthic invertebrates in acid streams of Westland, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 23: 479-490.
- Cowie, B. 1980. *Community dynamics of the benthic fauna in a West Coast stream ecosystem*. Unpubl. Ph.D. thesis, University of Canterbury.
- 1983. Macroinvertebrate taxa from a southern New Zealand montane stream continuum. *New Zealand Entomologist* 7: 439-447.
- Cowley, D.R. 1978. Studies on the larvae of New Zealand Trichoptera. *New Zealand Journal of Zoology* 5: 639-750.
- Craig, D.A. 1969. A taxonomic revision of New Zealand Blephariceridae and the origin and evolution of the Australasian Blephariceridae (Diptera: Nematocera). *Transactions of the Royal Society of New Zealand Biological Sciences* 11: 101-151.
- De Jong, H. 1987. Some remarks on the New Zealand crane-fly taxon *Austrotigula* Alexander, 1920 (Diptera, Tipulidae). *New Zealand Journal of Zoology* 14: 95-98.

- Death, R.G. 1991. *Environmental stability: its effects on stream benthic communities*. Unpubl. Ph.D. thesis, University of Canterbury.
- Dell, R.K. 1956. Part I11 - The species previously assigned to the genera *Limnaea* and *Myxas*. Part 111 - The genus *Physastra*. *Transactions of the Royal Society of New Zealand* 84: 71-90.
- Dumbelton, L.J. 1966. Immature stages of two aquatic Empididae (Dipt.). *New Zealand Journal of Science* 9: 565-568.
- 1968. A synopsis of the New Zealand mosquitoes (Diptera: Culicidae) and a key to the larvae. *Tuatara* 16: 167-179.
- 1972. The genus *Austrosimulium* Tonnoir (Diptera: Simuliidae) with particular reference to the New Zealand fauna. *New Zealand Journal of Science* 15: 480-584.
- Edwards, F.W. 1923. A preliminary revision of the crane-flies of New Zealand (Anisopodidae, Tanyderidae, Tipulidae). *Transactions and Proceedings of the New Zealand Institute* 54: 265-352.
- Forsyth, D. 1977. The limnology of Lake Rotokawa and its outlet stream. *New Zealand Journal of Marine and Freshwater Research* 11: 525-539.
- 1983. The distribution of chironomids in geothermal waters in New Zealand. *Memoirs of the American Entomological Society* 34: 115.123
- and Lewis, M.H. 1987. Zoogeography: The invertebrates. In: *Inland Waters of New Zealand* (ed. A.B. Viner). DSIR Bulletin 241, DSIR Publishing, Wellington.
- Gardner, N.W. 1970. A new genus and species of freshwater snail (Hydrobiidae) from northern New Zealand. *Transactions of the Royal Society of New Zealand Biological Sciences* 12: 181-184.
- Harrison, R.A. 1964. Insects of Campbell Island. Diptera. *Pacific Insects Monograph* 7: 304-324.
- Henderson, I.M. 1983. A contribution to the systematics of New Zealand Philopotamidae (Trichoptera). *New Zealand Journal of Zoology* 10: 163-176.
- 1985. *Systematic studies of New Zealand Trichoptera and critical analysis of systematic methods*. Unpubl. Ph.D. thesis, Victoria University, Wellington.
- Hickman, J.L. and Moore, J. 1990. A new species from Tasmania of the freshwater hoplonemertean, *Potamonemertes*. *Papers and Proceedings of the Royal Society of Tasmania* 124: 51-59.
- Hurley, D.E. 1954. Studies on the New Zealand Amphipodan fauna, No.2. The Family Talitridae: The fresh-water genus *Chiltonia* Stebbing. *Transactions of the Royal Society of New Zealand* 81: 563-577.

Hutton, F.W. 1899. The Tipulidae, or crane-flies, of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 32: 22-51.

————— 1901. Synopsis of the Diptera brachyptera of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 33: 1-195.

Illies, J. 1963. The Plecoptera of the Auckland and Campbell Islands. *Records of the Dominion Museum* 4: 255-265.

————— 1964. Insects of Campbell Island. Plecoptera. *Pacific Insects Monographs* 7: 208-215.

————— 1974. Arthropods of the subantarctic islands of New Zealand 5. Plecoptera. *New Zealand Journal of Zoology* 1: 285-294.

James, M. 1985. Changes in the faunal composition of two thermal streams near Taupo, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 19: 439-443.

Johns, P.M. 1991. Distribution of cave species of north-west Nelson, Westland and Canterbury. *The Weta* 14: 11-21.

Leader, J.P. 1972. The New Zealand Hydroptilidae (Trichoptera). *Journal of Entomology (B)* 41: 191-200.

Linklater, W. 1991. *The riparian vegetation-stream macroinvertebrate relationship in small forest streams, Canterbury, New Zealand*. Unpubl. M.Sc. thesis, University of Canterbury.

McEwen, W.M. 1987. *Ecological regions and districts of New Zealand* (revised edition). Sheets 1-4. New Zealand Biological Resources Centre publication no. 5.

McFarlane, A.G. 1951a. Caddis fly larvae (Trichoptera) of the family Rhyacophilidae. *Records of the Canterbury Museum* 5: 267-289.

————— 1951b. Additions to the N.Z. Rhyacophilidae. *Records of the Canterbury Museum* 5: 255-265.

————— 1956. Additions to the New Zealand Trichoptera (Part 3). *Records of the Canterbury Museum* 7: 29-41.

————— 1960. Additions to the Trichoptera of New Zealand (Part 4). *Records of the Canterbury Museum* 7: 203-218.

————— 1964. A new endemic subfamily, and other additions and emendations to the Trichoptera of New Zealand (Part 5). *Records of the Canterbury Museum* 8: 55-79.

————— 1966. New Zealand Trichoptera (Part 6). *Records of the Canterbury Museum* 8: 137-161.

————— 1990. A generic key to later instar larvae of the New Zealand Trichoptera (caddisflies). *Records of the Canterbury Museum* 10: 25-38.

- and Cowie, B. 1981. Descriptions of new species and notes on some genera of New Zealand Trichoptera. *Records of the Canterbury Museum* 9: 353-385.
- McLellan, LD. 1967. New gripopterygids (Plecoptera) of New Zealand. *Transactions of the Royal Society of New Zealand; Zoology* 9: 1-15.
- 1968. A revision of the genus *Notonemoura* (Plecoptera: Notonemourinae). *Transactions of the Royal Society of New Zealand; Zoology* 10: 133-140.
- 1969. Revision of the genus *Zelandobius* (Plecoptera: Antarctoperlinae). *Transactions of the Royal Society of New Zealand Biological Sciences* 11: 25-41.
- 1972. Revisions and new taxa in New Zealand Notonemouridae (Insecta: Plecoptera). *New Zealand Journal of Marine and Freshwater Research* 6: 469-481.
- 1975a. The freshwater insects. In: *Biogeography and ecology in New Zealand* (Ed. G. Kuschel). Dr W. Junk publ., The Hague.
- 1975b. Habitat: mountain tam. *New Zealand's Nature Heritage* 3: 948.
- 1977. New alpine and southern Plecoptera from New Zealand, and a new classification of the Gripopterygidae. *New Zealand Journal of Zoology* 4: 119-147.
- 1984. A revision of *Spaniocercoides* Kimmins (Plecoptera: Notonemouridae), and descriptions of new species. *New Zealand Journal of Zoology* 11: 167-178.
- 1990. Distribution of stoneflies in New Zealand. In: *Mqflies and stoneflies* (ed. I.C. Campbell). Kluwer Academic Publ. pp. 135-140.
- 1991. *Notonemouridae (Insecta: Plecoptera)*. Fauna of New Zealand Series No. 22, DSIR Publishing, Wellington.
- McMichael, D.F., and Hiscock, I.D. 1958. A monograph of the freshwater mussels (Molluscs: Pelecypoda) of the Australian region. *Australian Journal of Marine and Freshwater Research* 9: 372-508.
- Marshall, J.W. 1974. *A biological investigation of the Leeston Drain, Canterbury, New Zealand*. Unpubl. M.Sc. thesis, University of Canterbury.
- Mason, J. 1974. Studies on the freshwater and terrestrial leeches of New Zealand - 1 Family Glossiphoniidae Vaillant. *Journal of the Royal Society of New Zealand* 4: 327-343.
- Michaelis, F.B. 1974. *The ecology of Waikoropupu Springs*. Unpublished Ph.D. thesis, University of Canterbury.
- Moore, J. 1973. A new genus of freshwater hoplonemertean from New Zealand. *Zoological Journal of the Linnean Society* 52: 187-202.
- Moore, J. and Gibson, R. 1973. On a new genus of freshwater hoplonemertean from Campbell Island. *Freshwater Biology* 2: 187-202.

- Moore, N.W. 1989. A visitor's observations on the dragonflies of New Zealand and their conservation. *New Zealand Entomologist* 12: 5-12.
- Mosely, M.E., and Kimmins, D.E. 1953. *The Trichoptera (caddisflies) of Australia and New Zealand*. London, British Museum (Natural History). 550 p.
- Neboiss, A. 1974. Additions to the family Kokiriidae (Trichoptera). *Victorian Naturalist* 91: 175-179.
- Nicholls, G.E. 1944. The Phreatoicoidea. *Papers and proceedings of the Royal Society of Tasmania* 1943: 1-157.
- Norrie, P.H. 1969. *The flight activity of Ephemeroptera and Trichoptera in a Waitakere stream*. Unpubl. M.Sc. thesis, University of Auckland.
- Nurse, F.R. 1950. Freshwater triclads new to the fauna of New Zealand. *Transactions of the Royal Society of New Zealand* 78: 410-417.
- Ordish, R.G. 1966. A systematic revision of the New Zealand water beetles (Coleoptera: Dytiscidae). *Records of the Dominion Museum* 5: 217-264.
- 1976. Two new genera and species of subterranean water beetle from New Zealand (Coleoptera: Dytiscidae). *New Zealand Journal of Zoology* 3: 1-10.
- 1984. *Hydraenidae (Insects: Coleoptera)*. Fauna of New Zealand Number 6, DSIR Publishing, Wellington.
1989. A new species of *Rhantus* from the Chatham Islands of New Zealand (Coleoptera: Dytiscidae). *New Zealand Journal of Zoology* 16: 147-150.
- 1991. A new species of phreatic water beetle (Coleoptera: Dytiscidae) from New Zealand. *National Museum of New Zealand Records* 3 (13): 131-134.
- Percival, E. 1945. The genus *Prorhynchus* in New Zealand. (Phylum Platyhelminthes, Class Turbellaria). *Transactions of the Royal Society of New Zealand* 75: 33-41.
- Peters, W.L. 1971. Entomology of the Auckland and other islands south of New Zealand: Ephemeroptera: Leptophlebiidae. *Pacific Insects Monograph* 27: 47-51.
- Pillai, J.S. 1966. *Culiseta novaeselandiae*, a new species of the subgenus *Climacura* Felt (Diptera: Culicidae: Culisetini), with notes on its ecology and development. *Transactions of the Royal Society of New Zealand Zoology* 8: 125-133.
- Ponder, W.F. 1970. The freshwater Mollusca of New Zealand. *Tune* 10: 12-35.
- Powell, A.W.B. 1979. *New Zealand Mollusca*. Collins, Auckland.
- Rowe, R.J. 1981. A new species of *Xanthocnemis* Tillyard (Odonata: Coenagrionidae) from the Chatham Islands, New Zealand. *Records of the Auckland Institute and Museum* 18: 205-209.

- 1987. *The dragonflies of New Zealand*. Auckland University Press, Auckland.
- Ryan, P.A. 1986. Seasonal and size related changes to the food of the short-finned eel, *Anguilla australis*, in Lake Ellesmere Canterbury, New Zealand. *Environmental Biology of Fishes* 15: 47-58.
- Sinton, L. 1984. The macroinvertebrates in a sewage polluted aquifer. *Hydrobiologia* 119: 161-169.
- 1985. Life in New Zealand's underworld. *Soil and Water* 2: 19-23.
- Smith, K.G.V. 1964. Insects of Campbell Island. Diptera: Empididae. *Pacific Insects Monographs* 7: 325-328.
- Stanford, J.A. and Ward, J.V. 1988. The hyporheic habitat of river ecosystems. *Nature* 335: 64 - 66.
- Starobogatov, Y.I. 1986. On the taxonomy of the gastropod molluscan genus *Lattia* (Gastropoda, Pulmonate, Lattidae). *Proceedings of the Zoological Institute, Leningrad* 148: 93-96.
- Stark, J.D. 1981. *Trophic inter-relationships, life-histories and taxonomy of some invertebrates associated with aquatic macrophytes in Lake Grasmere*. Unpubl. Ph.D. thesis, University of Canterbury.
- Stout, V.M. 1964. Studies on temporary ponds in Canterbury, New Zealand. *Verhandlungen der Internationale Vereinigung für Theoretische und Angewandte Limnologie XI*: 209-214.
- 1969. *The natural history of Canterbury*. (ed. G.A. Knox). A.H. and A.W. Reed Publ.
- Sublette, J.E., and Wirth, W.W. 1980. The Chironomidae and Ceratopogonidae (Diptera) of New Zealand's subantarctic islands. *New Zealand Journal of Zoology* 7: 299-378.
- Summerhayes, P. 1983. *Co-existence of seven species of Zephlebia (Ephemeroptera: Leptophlebiidae) in a Waikato stream*. Unpubl. M.Sc. thesis, University of Waikato.
- Talbot, J.M. and Ward, J.C. 1987. Macroinvertebrates associated with aquatic macrophytes in Lake Alexandrina. *New Zealand Journal of Marine and Freshwater Research* 21: 199-213.
- Tillyard, R.J. 1921. Studies of New Zealand Trichoptera or Caddis Flies No. 1. Descriptions of a new genus and species belonging to the family Sericostomatidae. *Transactions of the New Zealand Institute* 53: 346-350.
- 1924. Studies of New Zealand Trichoptera, or caddis flies: No. 2. Descriptions of new genera and species. *Transactions and Proceedings of the New Zealand Institute* 55: 285-314.
- 1925. Caddis flies (Order Trichoptera) from the Chatham Islands. *Records of the Canterbury Museum* 2: 276-284.

- Timms, B.V. 1983. Benthic macroinvertebrates of 7 lakes near Cass, high county, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 17: 37-49.
- Towns, D.R. 1978. Some little known benthic insect taxa from a northern New Zealand river and its tributaries. *New Zealand Entomologist* 6: 409-419.
- 1983. A revision of the genus *Zephlebia* (Ephemeroptera: Leptophlebiidae). *New Zealand Journal of Zoology* 10: 1-52.
- 1987. The mayflies (Ephemeroptera) of Great Barrier Island, New Zealand: macro- and micro-distributional patterns. *Journal of the Royal Society of New Zealand* 4: 349-361.
- and Peters, W.L. 1979a. New genera and species of Leptophlebiidae (Ephemeroptera) from New Zealand. *New Zealand Journal of Zoology* 6: 439-452.
- 1979b. Three new genera of Leptophlebiidae (Ephemeroptera) from New Zealand. *New Zealand Journal of Zoology* 6: 213-235.
- Vincent, W.F. and Forsyth, D.J. 1987. Geothermally influenced waters. In: *Inland waters of New Zealand* (ed. A.B. Viner). DSIR Bulletin No. 241, pp. 349-378.
- Walker, K. 1969. The ecology and distribution of *Halicarcinus lacustris* (Brachyura: Hymenosomatidae) in Australian inland waters. *Australian Journal of Marine and Freshwater Research* 20: 163-173.
- Ward, J.B. 1991. Two new species of New Zealand caddisflies (Trichoptera: Hydrobiosidae). *New Zealand Entomologist* 14: 15-21.
- Williams, D.D. 1979. Aquatic habitats of Canada and their insects. In: *Canada and its insect fauna* (ed. H.V. Danks). *Memoirs of the Entomological Society of Canada* No. 108: 211-234.
- Winterbourn, M.J. 1965. Studies on New Zealand stoneflies I. Taxonomy of larvae and adults. *New Zealand Journal of Science* 8: 253-284.
- 1968. The faunas of thermal waters in New Zealand. *Tuatara* 16: 111-122.
- 1969. A freshwater nereid polychaete from New Zealand. *New Zealand Journal of Marine and Freshwater Research* 3: 281-285
- 1973a. Ecology of the Copeland River warm springs, South Island, New Zealand. *Proceedings of the New Zealand Ecological Society* 20: 72-78.
- 1973b. The larvae of *Anacaena tepida* (Coleoptera: Hydrophilidae) from a Rotorua hot spring. *New Zealand Entomologist* 5: 171-174.
- 1973c. A guide to the freshwater Mollusca of New Zealand. *Tuatara* 20: 141-159.

- and Collier, K.J. 1987. Distribution of benthic invertebrates in acid, brownwater streams in the South Island of New Zealand. *Hydrobiologia* 153: 277-286.
- and Gregson, K.L.D. 1989. *Guide to the aquatic insects of New Zealand*. Bulletin of the Entomological Society of New Zealand 9.
- Wise, K.A.J. 1958. Trichoptera of New Zealand I. A catalogue of the Auckland Museum collection with descriptions of new genera and new species. *Auckland Institute and Museum Records* 5: 49-63.
- 1962. A new genus and three new species of Trichoptera. *Records of the Auckland Institute and Museum* 5: 247-250.
- 1970. Trichoptera of New Zealand 11. The present status of R.J. Tillyard's species of New Zealand Trichoptera, with notes on the type specimens. *Records of the Auckland Institute and Museum* 7: 201-215.
- 1972. Trichoptera of the Auckland Islands. *Records of the Auckland Institute and Museum* 9: 49-63.
- 1973. A list and bibliography of the aquatic and water associated insects of New Zealand. *Records of the Auckland Institute and Museum* 10: 143-187.
- 1982. Two new species of Trichoptera from the Murchison Mountains, South Island, New Zealand. *Records of the Auckland Museum* 19: 149-151.
- 1990. Lacewings and aquatic insects of New Zealand 5. Trichoptera of North Auckland. *Records of the Auckland Institute and Museum* 27: 185-194.

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