

Diversity of Adult Aquatic Insects in Hamilton Urban Streams and Seepages

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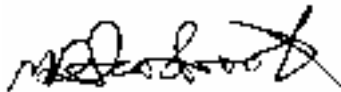
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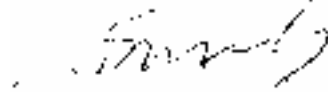
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Executive Summary

A total of 1713 adult mayflies and caddisflies representing 8 families, 16 genera, and 26 species were collected using UV light traps from nine sites in Hamilton City.

Caddisflies were by far the most abundant order of aquatic insect caught in terms of numbers and diversity, with 17 species caught at one site on the Kirikiriroa Stream.

Sampling of seepages in Hamilton city-scape increased the known biodiversity by over 30%. This included a species of caddisfly new to science. This species is only known from two male specimens collected from the Mangaiti Reserve, and highlights the role of seepages in contributing to biodiversity values in an urban environment.

No other species of special conservation significance were collected, but an additional 17 species of Trichoptera were recorded from Hamilton City for the first time, as were three species of mayfly. There are now 31 Trichoptera species known as adults from Hamilton City waterways.

The maintenance and preservation of vegetated gully systems throughout Hamilton City have protected seepage habitats. Remnant riparian vegetation and bank-side seepages within the city appear to provide refugia and suitable habitats for specialist species normally associated with small native forest streams and/or seepages. Therefore the biodiversity of these urban streams is potentially greater than is commonly found in cities.

1. Introduction

There is a paucity of information on aquatic invertebrate diversity in small, urban streams and seepages that drain into the Waikato River, within Hamilton's city limits. Collier & Smith (2006) noted that less than 1% of the publications from an international literature review were relevant to invertebrate faunas associated with seepage habitats. Environment Waikato wishes to ascertain the aquatic invertebrate biodiversity values within Hamilton City. As part of this, adult stages of the groups Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies), or as they are collectively known EPT, were sampled at nine urban sites.

The aims of this study were to (1) document the adult aquatic insect fauna (EPT) of small streams and seepages in the city, (2) provide an indication of their likely larval habitats, and (3) report on species of taxonomic or conservation significance with a view to determining the value of seepage habitats.

2. Methods

2.1 Sampling sites

Adult aquatic insects were collected at nine small stream and seepage sites (Fig. 1) using ultraviolet (UV) light traps from 17 November 2006 to 27 January 2007. Sites were grouped according to the main tributary of the Waikato River into which they drained i.e., Sites 1–3 = Kirikiriroa Stream; Sites 4–6 = Waitawhiriwhiri Stream; Sites 7–9 = Mangakotukutuku Stream. Sampling locations and characteristics can be seen in Figure 1, and Tables 1 and 2.

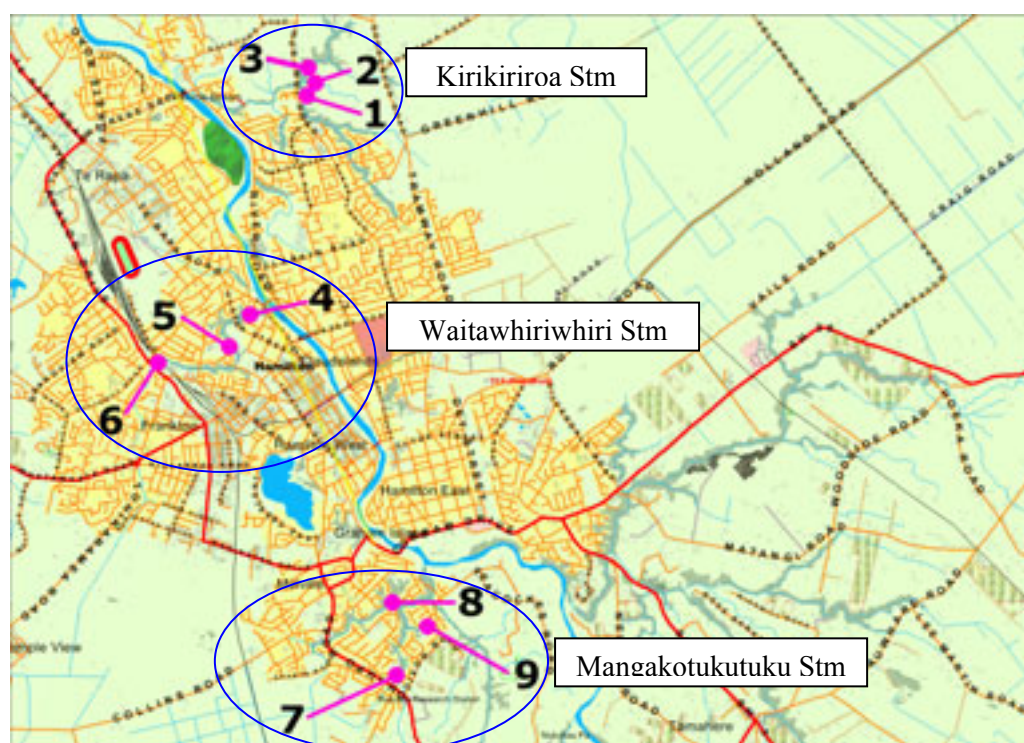


Figure 1: Location of the nine sites sampled in Hamilton City.

Table 1: Sampling sites.

Site number	Stream	Location	Grid reference
1	Kirikiroa	Mangaiti Reserve (top of park)	2710666E, 6382008N
2	Kirikiroa	Mangaiti Reserve (under willows)	2710781E, 6382111N
3	Kirikiroa	Mangaiti Reserve (parallel to Hukanui Road)	2710730E, 6382208N
4	Waitawhiriwhiri	Edgecumbe Park	2709955E, 6378520N
5	Waitawhiriwhiri	Beetham Park	2709616E, 6378115N
6	Waitawhiriwhiri	Caltex truck stop, Avalon Drive	2708445E, 6377795N
7	Mangakotukutuku	Te Anau Park	2712195E, 6372955N
8	Mangakotukutuku	Sandford Park	2712000E, 6374070N
9	Mangakotukutuku	Fitzroy Park	2712575E, 6373665N

Table 2: Site characteristics.

Site characteristics	Kirikiroa Stream			Waitawhiriwhiri Stream			Mangakotukutuku Stream		
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Habitat	seep/ small stream	small stream	seep	small stream	seep	seep	seep	seep/ small stream	seep/ small stream
Dominant substrate	mud	mud, sand	mud, organics	mud, organics	mud	sand, small gravels	mud, organics	mud	mud, organics
Water colour	brown	clear	murky	clear	damp soil	iron floc	clear	clear	clear
Woody debris (%cover)	70	60	70	50	0	70	90	100	80
Surface scum present	yes	no	yes	no	na	no	no	na	no
Smell when disturbed	sulphide	no	no	no	no	hydrocarbon	sulphide	no	no
Iron floc present nearby	yes	yes	yes	no	yes	yes	no	no	yes
Rubbish present	no	no	no	no	no	yes	yes	no	no
Amount of shade overhead (%)	0	95	45	10	100	60	35	50	100

2.2 Light traps

UV Light traps were deployed for one night each month (17 November 2006, 15 December 2006 and 27 January 2007). Each light trap consisted of a low power (6 W) model F6T5 blacklight fluorescent tube laid over a white dish (38 X 27 X 6 cm). The dish was half-filled with water into which a few drops of detergent had been mixed to break the water surface tension. The lights were powered by 12 V batteries run from timing units which enabled all lights to be turned on and off simultaneously. Light traps were placed within 1 m of the stream edge or seepage and set to run from 21:00-23:00 hrs and 02:00-03:00 hrs.

3. Results and discussion

3.1 Abundance and composition

Results are summarised in Appendix 1. A total of 1713 adult mayflies and caddisflies representing 8 families, 16 genera, and 26 species were collected. No stoneflies were caught during this study, though *Zelandobius furcillatus* has been reported from the Waikato River (NIWA, unpublished data). The absence of stoneflies in this survey may have been a consequence of the sampling methodology as few New Zealand Plecoptera species are attracted to UV light.

Caddisflies were by far the most abundant order of aquatic insect caught in terms of numbers (1710) and diversity (7 families, 14 genera, 23 species). This included a species new to science from the microcaddisfly genus *Oxyethira* (*Oxyethira* n. sp.). Mayflies were poorly represented in our study with only three species (sole specimens from two genera) of the Leptophlebiidae family captured (Appendix 1). Kirikiriroa Stream samples (Sites 1–3) collected the greatest number of caddisflies and mayflies (1211) with Site 3 recording the greatest diversity of all sites (18). The Waitawhiriwhiri (Sites 4–6) and Mangakotukutuku Streams (Sites 7–9) recorded fewer species, but a similar number of insects (242 and 260, respectively). Overall mean diversity was greatest at the Mangakotukutuku Stream with 13 species, followed by Kirikiriroa with 11 species, and lowest at Waitawhiriwhiri with a mean of 6 species.

The adults of net spinning caddisfly larva Hydropsychidae were the most commonly caught insect, comprising 66% of total numbers (2 genera, 4 species). A well known, but undescribed species of hydropsychid, *Aoteapsyche* sp. X, was the most abundant adult insect caught during the study period and contributed 98% of individuals from this family. This species is one of the most commonly caught species around Hamilton, and the Waikato Region in general. The predatory caddisfly family Hydrobiosidae (3 genera, 6 species) and the Leptophlebiidae mayflies (2 genera, 3 species) were the least represented families, contributing to less than 1% of total numbers. Over half the taxa (14 species) caught were represented by 5 or fewer individuals.

3.2 Spatial patterns

Only *Oxyethira albiceps* and *Pseudoeconesus bistirpis* were recorded at all nine sites. *Aoteapsyche* sp. X and *Paroxyethira hendersoni* were recorded at 8 sites. Eight species were collected from all three streams, but were not present at all sites. Six species were only ever caught from the Kirikiriroa Stream sites (*A. colonica*, *Hydrobiosis budgei*, *H. umbripennis*, *Oxyethira* n. sp., *Pycnocentria funerea*, and the mayfly *Zephlebia dentata*). *Hydrobiosis umbripennis*, *P. funerea*, *Oxyethira* n. sp. and *Z. dentata* were only caught at Site 3. *Pycnocentrodes aeris* was only caught from the Waitawhiriwhiri Stream (Beetham Park, Site 5).

Orthopsyche thomasi and the mayflies *Neozephlebia scita* and *Zephlebia tuberculata* were only recorded from the Mangakotukutuku Stream (Te Anau Park, Site 7).

The caddisflies *Edpercivalia thomasoni*, *Orthopsyche fimbriata*, *O. thomasi*, *Triplectidina moselyi* *P. bistirpis* and the mayfly *Z. tuberculata* are generally considered obligate forest species, and were mostly restricted to sites with substantial riparian vegetation present e.g., Mangakotukutuku Stream.

The importance of seepage habitats within the city was emphasised when an extra eight species (*E. thomasoni*, *O. thomasi*, *P. bistirpis*, *T. moselyi*, *Polyplectropus altera*, *P. aurifusca*, *Oxyethira* n. sp. and *Z. tuberculata*) generally indicative of seepage or small (zero-order) stream habitats were recorded. The presence of seepages in the Hamilton city-scape increased the known biodiversity by over 30%, and more importantly included a new species of caddisfly, highlighting the role these often overlooked habitats play in maintaining and contributing to biodiversity values. A combination of soft benthic sediments, shade offered by low growing riparian grasses, and ample food resources (leaves and small sticks) may have enabled *P. bistirpis* to colonise a variety of seepage habitats in the vicinity of the nine sites sampled. All other species caught were generally associated with either larger streams and rivers or open landscapes within the central North Island. The preservation of vegetated gully systems throughout Hamilton City have protected seepage habitats as part of the riparian complex, and therefore the biodiversity of these urban streams is potentially greater than is commonly found in cities.

3.3 Biodiversity and conservation significance

Data obtained from the New Zealand Trichoptera Database (Ward & Henderson, 1993) in June 2007 indicated only 10 species of adult caddisflies had been recorded within Hamilton City. This study adds another 17 species. A previous study (unpublished data) of urban Trichoptera in the Mangakotukutuku Stream recorded five species (*Helicopsyche* sp., *Hudsonema* sp., *H. parumbripennis*, *Polyplectropus impluvii*, and *Triplectides cephalotes*) that were not collected in this study or listed in the Trichoptera Database. *Polyplectropus impluvii* is also considered an obligatory seepage species.

The adult trichopteran fauna known from Hamilton therefore currently stands at 31 species. In addition, the three mayfly species also appear to be new records for Hamilton (pers. comm., Terry Hitching, Canterbury Museum). In comparison, data extracted from the New Zealand Trichoptera Database (June 2007) revealed only 16–18 species are known within a similar 8 km sampling radius (i.e., the approximate spread of sampling sites in Hamilton) from central Auckland and Christchurch.

The new species of *Oxyethira* is only known from two male specimens collected from Mangaiti Reserve in the suburb of Chartwell. This may be New Zealand's smallest and rarest caddisfly.

Although very similar to two of the three known species in this genus (*O. ahipara* and *O. waipoua*), there are sufficient morphological differences for designation of a new species. *Oxyethira ahipara* has been recorded from the Kiripaka Stream, Whatawhata, south-west of Hamilton, and *O. waipoua* is only known from single localities in Northland and the Ruahine Ranges. Females and larvae of *Oxyethira* n. sp. are currently unknown. The larval habitat may well be the seepage in the immediate vicinity of where the light trap was placed.

The name *O. kirikiroa* has been proposed to honour the stream location of where this species was found; it is also the original Maori name for the area now known as Hamilton. This is Hamilton's only endemic species of caddisfly known to date, and is currently being described.

No other species of special conservation significance, as listed by the Department of Conservation's 'New Zealand Threat Classification System lists – 2005 - Freshwater invertebrates' (Hitchmough et al. 2007) were collected during the sampling period.

4. Summary

A total of 1713 adult mayflies and caddisflies representing 8 families, 16 genera, and 26 species was collected. Caddisflies were by far the most abundant order of aquatic insect caught in numbers and diversity. A caddisfly species new to science was collected from a seepage of the Kirikiriroa Stream in Mangaiti Reserve. Mayflies were poorly represented in the samples with only three specimens caught.

No other species of special conservation significance were collected, but an additional 17 adult species of Trichoptera were recorded from Hamilton City for the first time, as were three species of adult mayfly.

The biodiversity of Hamilton urban streams is potentially greater than in other larger cities. This may be attributable to the large number of vegetated gully systems present around the city. Species generally associated with native forest were mostly restricted to sites with substantial riparian vegetation present, such as along the Mangakotukutuku Stream. In this study, remnant riparian vegetation and bank-side seepages within Hamilton City appear to provide refugia and suitable habitats for specialist species normally associated with small native forest streams and/or seepages. Maintenance of riparian cover over seepages may provide a continuous supply of organic input and shade, and lead to increased habitat complexity. Though seepages and small streams within a city are less likely to be influenced by factors such as stormwater run-off due to increases in urbanisation, it is nonetheless important that these gully systems, and subsequently the functions of seepages and small streams, and their biodiversity values are protected and incorporated into local conservation efforts and city biodiversity planning.

5. References

Collier, K.J.; Smith, B.J. (2006). Distinctive aquatic invertebrate assemblages colonise rockface seepages in northern New Zealand. *Biodiversity and Conservation 15*: 3591-3616.

Hitchmough, R.; Bull, L.; Cromarty, P. (compilers). (2007). New Zealand threat classification system lists – 2005. Science and Technical Publication. Department of Conservation, Wellington, 194 p.

Ward, J.B.; Henderson, I.M. (1993). The New Zealand Trichoptera Database. *The Weta 16*: 10-11.

6. Appendix

Appendix 1: Total counts for Adult Trichoptera (caddisflies) and Ephemeroptera (mayflies) from nine sites sampled in Hamilton City (Nov 2006–Jan 2007). 1 new record for city, 2 larval habitat = seepage, 3 larval habitat = stream.

Taxa	Kirikiriroa			Waitawhiriwhiri			Mangakotukutuku			totals
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	
TRICHOPTERA										
Conoesucidae										
<i>Pycnocentria funerea</i> ^{1,3}			1							1
<i>Pycnocentrodes aeris</i> ^{1,3}					2					2
<i>P. aureolus</i> ³	39		12	15	3		4		2	75
Hydrobiosidae										
<i>Edpercivalia thomasoni</i> ^{1,2}								1	1	2
<i>Hydrobiosis centralis</i> ^{1,3}						1	1			2
<i>H. budgei</i> ^{1,3}	1		1							2
<i>H. copis</i> ^{1,3}			1						1	2
<i>H. umbripennis</i> ^{1,3}			1							1
<i>Psilochorema mimicum</i> ^{1,3}		2	3						4	9
Hydroptilidae										
<i>Oxyethira albiceps</i> ³	5	3	111	10	3	1	4	11	1	149
<i>Oxyethira n.sp.</i> ^{1,2}			2							2
<i>Paroxyethira hendersoni</i> ³	12	1	6		1	1	5	6	12	44
Hydropsychidae										
<i>Aoteapsyche colonica</i> ^{1,3}	1		1							2
<i>Aoteapsyche sp. X</i> ³	678		211	153	21	2	17	18	16	1116
<i>Orthopsyche fimbriata</i> ^{1,3}			3				2	4		9
<i>O. thomasi</i> ^{1,2}							1	6		7
Leptoceridae										
<i>Oecetis unicolor</i> ^{1,3}							1		1	2
<i>Triplectides dolichos</i> ^{1,3}			1	1				8	1	11
<i>T. obsoletus</i> ³	1	26	33				22	1	3	86
<i>Triplectidina moselyi</i> ^{1,2}						1	3		1	5
Oeconesidae										
<i>Pseudoeconesus bistirpis</i> ^{1,2}	1	3	14	30	1	2	12	10	10	83
Polycentropodidae										
<i>Polyplectropus altera</i> ^{2,3}	4	14	9			3	1	19	13	63
<i>P. aurifusca</i> ^{1,2,3}		1	8	9			8	8	1	35
EPHEMEROPTERA										
Leptophlebiidae										
<i>Neozephlebia scita</i> ^{1,3}							1			1
<i>Zephlebia dentata</i> ^{1,3}			1							1
<i>Z. tuberculata</i> ^{1,2,3}							1			1
Taxa richness	9	7	18	6	6	7	15	11	14	26
Total number	742	50	419	218	31	11	83	92	67	1713