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AQUATIC INVERTEBRATES OF LOWER MOHAKA RIVER, HAWKE' S BAY

by

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CONTENTS

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ABSTRACT

Aquatic invertebrates were collected from four habitat types (slow/deep, slow/shallow, fast/deep and fast/shallow water) at seven sites on lower Mohaka River, Hawke's Bay, to provide information on the habitat preferences of dominant taxa and to see if any species of conservation interest were present. Sixty-five invertebrate taxa were recognised in the samples and most of these (45-49) occurred at the two uppermost sites on the mainstem of the river. Most of the invertebrate species collected have widespread distributions, and many of the taxa encountered infrequently (i.e., found at only one site) are common in some other rivers. The most frequently encountered taxa (i.e., those found in >25 of the 27 samples) were larvae of the leptophlebiid mayfly *Deleatidium* spp., Elmidae beetles, the chironomids *Tanytarsus vespertinus* and Orthocladiinae sp.A, and the net-spinning caddisfly *Aoteapsyche* spp. Chironomidae and *Aoteapsyche* spp. were most abundant in fast water whereas Elmidae were more abundant in slow water, and *Deleatidium* spp. were abundant across a range of depths and velocities. Potential effects of dams on the benthic invertebrate fauna of Mohaka River are briefly discussed.

1 INTRODUCTION

Mohaka River flows from the Kaweka Ranges and through northern Hawke's Bay to enter the sea about 50km north of Napier. At present the river flow is not regulated, but Electricorp have plans to construct up to three dams on the river for hydro-electricity generation. In October 1987, the Hawke's Bay Acclimatisation Society and the Council of North Island Acclimatisation Socities applied for a Water Conservation Order for the river, and in March 1990 a draft national order was issued. This covered all the waters of Mohaka River and would have effectively prohibited any major hydro-electric development.

Electricorp have subsequently appealed the draft order to the effect that damming restrictions should be removed altogether or that the section of river of interest to Electricorp should not be protected. The Department of Conservation is supporting the draft order, believing that the intrinsic values of the lower river have not been

adequately addressed. To obtain more information on these values, the Department carried out sampling to investigate the composition of the aquatic invertebrate fauna at several sites that would be affected by the proposed dams. The results of this work are presented here.

2 METHODS

Aquatic invertebrates and physical habitat data were collected on 14 February 1991 from seven sites along the lower section of Mohaka River that would be affected by proposed dams (Table 1). All sites were on the mainstem of Mohaka River except for Site 7 which was on Te Hoe River above the Mohaka confluence. Invertebrates were collected from 4 habitat types at each site (Table 2) by turning over and brushing substrata in front of a 0.25mm mesh triangular kick net for one minute. Samples were preserved in 5% formalin. Before collecting invertebrates, water depth and velocity (at 0.4x depth) were measured with a OSS PCI miniature meter. Where flow did not appear to be laminar, depth and velocity measurements were made at up to five points and were averaged.

At each sampling point, the proportions of boulders (>256mm across), cobbles (64-256mm), gravel (2-63mm) and sand (0.063-2mm) covering the river bed were assessed visually and converted into a substrate index using the equation given in Appendix 1 (after Jowett et al. 1991). Substrate embeddedness and periphyton abundance were also assessed visually using the indices described in Appendix 1. Invertebrate samples were picked through twice on a white tray and identifications were made to the lowest practicable taxonomic level using the keys of McFarlane (1951), Winterbourn (1973), Cowley (1978) and Winterbourn & Gregson (1989). The fast/deep sample from Site 7 was lost.

3 RESULTS AND DISCUSSION

3.1 Composition of the invertebrate fauna

A total of 65 aquatic invertebrate taxa were collected from the 27 sampling locations on Mohaka River (Table 3). When all Chironomidae were considered together, the number of taxa (56) was similar to that recorded from four habitat types at five sites in nearby Ngaruroro River in June 1990 using the same sampling technique (Collier & Henriques, 1991). Most taxa were recorded from the two uppermost sites on the mainstem of Mohaka River (Sites 5 and 6) which yielded at least 11 more taxa than any other site (Table 3). The fewer samples collected at Site 7 may have influenced the total number of taxa recorded there.

The leptophlebiid mayfly *Deleatidium* spp. and Elmidae bettles were recorded at all 27 sampling locations, larvae of the chironomid *Tanytarsus vespertinus* and the net-spinning caddisfly *Aoteapsyche* spp. were recorded at 26 locations, and the chironomid Orthocladiinae sp.A at 25 locations. Overall, *Deleatidium* and *Aoteapsyche* were relatively most abundant at Site 1, Elmidae at Site 7 and Chironomidae at Site 3 (Table 4).

Quinn & Hickey (1990) sampled Mohaka River near the SH5 bridge (above my sampling sites) as part of the "100 Rivers" survey in March-April 1987, and recorded 21 taxa in seven Surber samples, considerably fewer taxa than I recorded at any site in the lower river using the kick sampling technique. They found that the biomass of the invertebrate fauna at that site was dominated by *Deleatidium* and *Aoteapsyche* species, and was typical of other upland sites with steep gradients, cool water, cobble beds and low proportions of developed catchment (TWINSPAN Class 3 of their study).

In the lower river, 13 taxa were recorded infrequently (i.e., in only one sample), but most of those taxa are widespread and common in some rivers. An unidentified Tipulidae (Diptera) larva was recorded at Site 7 and an unidentified *Hydrobiosis* species was found at Sites 3, 5 and 7 (Table 3). These taxa occurred in low numbers and were early instar larvae making identification difficult. One small specimen of what was probably *Gyraulus kahuica* (Mollusca) was collected at Site 6. This species has a distribution restricted to Hawke's Bay, Gisborne and Kaikoura, but the validity of the species is dubious (Winterbourn, 1973).

Based on identifications of larvae, the aquatic invertebrate fauna of the lower section of Mohaka River is unremarkable and contains mostly taxa that are widespread and common elsewhere. Because of the low level of taxonomic resolution achievable using larvae of some groups, I was not able to conclusively say whether any taxa were rare or restricted to the Mohaka River system. The upper two sites on the mainstem (Sites 5 and 6) supported the most number of invertebrate taxa, and the section represented by these sites had the highest value in terms of diversity *(sensu* Collier & Henriques, 1991)

3.2 Habitat preferences of invertebrates

Some work has been carried out on the microhabitat preferences of aquatic invertebrates in Mohaka River (Jowett et al. 1991). This has shown that locations with water depths <0.7m and velocities of about 1.0 $m.s^{-1}$ provided the most suitable habitat for *Deleatidium* spp. larvae. In my study, samples were collected in areas of slower velocity than the apparent optimum for *Deleatidium*, and larvae were relatively most abundant in slow/shallow and fast water (Table 5).

When data for four rivers (including the Mohaka) were combined, Jowett et al. (1991) showed that *Aoteapsyche* larvae occurred in greater proportions (relative to the maximum density at any site) at locations where velocity was above 0.5 $m.s^{-1}$ and depths were <0.7m. This is consistent with my finding that *Aoteapsyche* larvae were relatively more abundant in "fast" water (0.50-0.96 m.s-1) at depths of 0.10-0.45m (Table 5). 1 found Chironomidae larvae to be relatively more abundant in "fast" water (Table 5), but all my sampling locations were within the range of depths (<0.7m) and velocities (<1.0 m.s-1) that Jowett et al. (1991) found Chironomidae to be relatively most abundant. In my study, Elmidae larvae were relatively more abundant in shallow water (Table 5); this taxon was not discussed by Jowett et al. (1991).

Construction of dams can have marked effects on aquatic invertebrate faunas (Winterbourn, 1987). Above dams, running water species will be replaced by species adapted to still water and by facultative species with broad flow requirements. Timms (1982) found that some dammed lakes in the South Island contained almost half as many benthic invertebrate taxa on average (7) as a set of South Island lakes in general. This

number contrasts with the average of 37 invertebrate taxa found at the seven sites that I sampled on Mohaka River. The formation of impoundments can be expected to substantially reduce the number of invertebrate species present, and result in communites dominated by worms, chironomids, gastropods and bivalves (Winterbourn, 1987).

The effects of flow regulation on invertebrate communities below dams depends on the operating conditions of the dam and the resulting discharge regime. Generally, densities of invertebrates increase below dams, but the the number of taxa is reduced and the composition of the community is altered (Winterbourn, 1987). Large populations of *Aoteapsyche* are often found below dams where they feed on planktonic organisms and other small food items released from dams upstream (Winterbourn, 1987). This dominance tends to change with distance downstream, however.

Work carried out on Mohaka River indicates that many of the dominant taxa are relatively most abundant in "shallow" or "fast" water, habitats that would be reduced by the formation of impoundments. This can be expected to lead to reductions in the number of taxa and, above dams, a shift in dominance away from taxa that prefer fast running water (e.g., *Aoteapsyche). Aoteapsyche* larvae are widespread in Mohaka River, and may become the dominant taxon below dams. The effects on other invertebrate species below dams would depend largely on the operating conditions adopted.

4. ACKNOWLEDGEMENTS

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Table 1 Location, elevation and water temperature of the seven sites sampled on Mohaka River. -, no data.

Site	Grid ref. (NZMS 260)	Elevation (m asl)	Temperature (°C)
1	W19 665307	40	22
2	W19 624324	60	22
3	W19 618353	60	22
4	V19 478361	120	19
5	V19 451353	140	19
6	V19 407337	180	18
7	V19 407353	180	-

Table 2 Range of depths and velocities of the four habitat types sampled at each site.

Habitat type	Code	Depth (m)	Velocity ($m.s^{-1}$)
Slow/deep	SD	0.40–0.45	0.16–0.46
Slow/shallow	SS	0.10–0.15	0.14–0.28
Fast/deep	FD	0.40–0.45	0.71–0.96
Fast/shallow	FS	0.10–0.15	0.50–0.79

Table 3 List of invertebrate taxa found in Mohaka River. +=present, -=not recorded.

	Site 1			Site 2			Site 3			Site 4			Site 5			Site 6			Site 7			No. of records
	S D	S	F D	F S	S D	F D	F S	S D	F S	S D	F S	F D	S D	S	F D	F S	S D	F S	S D	S	F S	
Order Ephemeroptera																						
Deleatidium spp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	27
Austroclima sepia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	2
Austroclima jollyae	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	+	+	-	-	+	6
Austroclima spp.	-	-	-	+	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	-	-	5
Mauiulus luma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	1
Leptophlebiidae indet.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	2
Nesameletus sp.	-	-	-	-	-	+	-	-	-	-	+	+	+	-	-	+	+	+	+	+	+	14
Coloburiscus humeralis	-	+	-	+	-	-	-	-	-	-	-	+	-	+	+	-	-	+	-	+	+	11
Order Plecoptera																						
Zelandobius furcillatus	+	-	-	+	-	-	-	-	-	-	-	-	+	-	-	+	+	+	-	-	-	11
Z. confusus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	1
Zelandoperla decorata	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	+	-	-	-	4
Zelandoperla sp.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	1
Austroperla cyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	1
Order Trichoptera																						
Olinga feredayi	-	+	+	+	+	+	-	-	-	-	+	-	+	+	+	+	-	+	+	+	+	20
Beraeoptera roria	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	+	+	+	-	+	+	10
Pycnocentria evecta	+	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	4
Pycnocentria sp.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	4
Pycnocentrodes aureola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	2
P. aff. aeris	-	+	-	-	-	+	-	-	-	-	-	+	-	-	-	+	-	+	+	-	+	8
Pycnocentrodes spp.	+	+	+	+	+	+	+	-	+	+	-	-	+	+	+	-	+	+	+	+	+	23
Conoesucidae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	2
Hudsonema amabilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	2
Oxyethira albiceps	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Polyplectropus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	1
Aoteapsyche colonica	-	-	+	-	-	-	-	-	-	-	-	+	-	+	+	-	-	+	+	-	-	8
A. rarureru	-	+	-	-	-	-	+	+	-	-	-	+	+	-	+	+	-	-	+	+	-	12
A. aff. tepoka	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	3
Aoteapsyche spp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	26
Hydrobiosis aff. *parumbripennis*	-	+	+	+	+	+	+	-	+	+	+	-	+	-	+	+	+	+	+	+	+	21
H. aff. frater	+	+	+	+	+	+	+	+	-	+	-	+	+	+	+	-	-	+	-	+	+	19
H. aff. charadraea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	3
Hydrobiosis sp.	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	5
Costachorema sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	1
Neurochorema confusum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	2
Psilochorema aff. *mimicum*	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	+	-	-	-	6
P. aff. nemorale	-	+	+	+	+	-	+	-	-	+	-	+	-	+	-	-	-	-	-	+	-	9
Psilochorema sp.	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	+	-	+	-	-	-	8
Hydrobiosidae indet.	-	+	+	-	-	+	-	+	-	-	+	+	+	+	-	+	+	+	-	+	-	16
Order Coleoptera																						
Elmidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	27
Hydrophilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	1
Order Diptera																						
Eriopterini sp. A	+	-	+	-	+	+	+	-	+	-	+	-	-	+	-	-	+	+	-	+	+	16
Eriopterini sp. B	-	-	-	-	+	+	-	-	+	-	+	-	+	+	-	-	-	+	-	-	+	8
Molophilus sp.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	3
Empididae spp.	-	+	+	+	+	+	+	-	+	-	-	-	-	-	-	-	+	+	-	-	-	10
Aphrophila neozelandica	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	+	-	-	-	5
Austrosimulium sp.	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	3
Paralimnophora skusei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	1
Muscidae sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	1
Ceratopogonidae sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	2
Tipulidae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Orthocladiinae sp. A	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	25
Orthocladiinae sp. B	-	-	-	+	-	-	+	+	+	+	+	+	+	+	-	+	+	+	-	+	-	16
Orthocladiinae sp. C	-	+	-	+	-	-	+	+	+	+	+	+	+	+	-	+	+	+	-	+	-	17
Orthocladiinae sp. D	-	+	+	+	-	+	-	+	+	+	+	+	+	+	-	+	+	+	+	+	-	21
Orthocladiinae sp. E	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	2
Pentaneurini sp.	+	+	+	+	+	-	+	-	+	-	+	-	-	-	-	+	-	-	-	+	+	13
Tanypodini sp.	+	+	+	+	+	+	-	+	+	+	+	-	+	+	-	-	+	-	-	+	+	16
Maoridiamesa sp.	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	-	-	+	-	-	-	5
Tanytarsus vespertinus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	26
aff. *Paucispinigera* sp.	-	+	-	-	+	+	-	-	-	+	-	-	+	+	-	-	+	-	-	+	+	11
Order Megaloptera																						
Archichauliodes diversus	+	+	+	+	-	-	+	-	+	-	-	+	+	-	-	-	-	+	+	+	-	14
PHYLUM MOLLUSCA																						
Potamopyrgus antipodarum	-	-	-	+	-	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	5
aff. *Gyraulus kahuica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	1
Amphipoda sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Oligochaeta spp.	-	+	+	+	+	+	+	-	-	-	+	-	-	+	-	-	-	-	+	-	+	14
No. of taxa per site	31			32			32			34			49			45			33			

Table 4 Means (and ranges) of percent abundance of total invertebrate numbers in each sample for the four most common invertebrate taxa at seven sites in Mohaka River (n-4 except for Site 7 where n=3). See Table 1 for site locations.

Site	*Deleatidium*	*Aoteapsyche**	Elmidae	Chironomidae*
1	36 (19-43)	11 (2-24)	22 (8-44)	24 (9-55)
2	18 (15-24)	2 (0.3-5)	28 (3-49)	42 (13-72)
3	15 (6-28)	4 (0.7-9)	7 (1-10)	73 (47-83)
4	15 (6-25)	5 (0.1-10)	9 (1-25)	48 (9-83)
5	12 (4-22)	3 (0.3-6)	15 (4-24)	53 (20-85)
6	32 (14-62)	4 (1-10)	31 (18-48)	18 (2-43)
7	19 (14-28)	8 (0-18)	45 (23-64)	2 (1-2)

*, all taxa combined

Table 5 Means (and ranges) of percent abundance of maximum number of taxa recorded at any site for the four most common invertebrate taxa in four habitat types in Mohaka River (n=7 except for FD where n=6). See Table 2 for description of habitat codes.

Habitat	*Deleatidium*	*Aoteapsyche**	Elmidae	Chironomidae*
SD	7 (0.6-14)	1 (0-5)	12 (3-19)	11 (<0.1-30)
SS	13 (4-26)	1 (0.1-3)	16 (3-49)	19 (<0.1-60)
FD	13 (4-22)	5 (0.7-12)	7 (0.8-21)	36 (4-85)
FS	13 (6-28)	8 (2-18)	8 (1-23)	46 (2-83)

*, all taxa combined

Appendix 1 Physcial characteristics of the locations sampled for aquatic invertebrates in Mohaka River. See Table 2 for habitat codes.

Site/ habitat	Depth (m)	Velocity ($m.s^{-1}$)	Substrate index[1]	Embedded-ness index[2]	Periphyton index[3]
Site 1:					
SD	0.40	0.20	4.8	2	3
SS	0.13	0.28	5.0	2	4
FD	0.40	0.84	4.8	1	4
FS	0.15	0.71	5.1	2	4
Site 2:					
SD	0.45	0.26	4.2	2	2
SS	0.15	0.24	4.2	1	2
FD	0.45	0.79	5.0	3	4
FS	0.15	0.73	5.3	2	5
Site 3:					
SD	0.45	0.31	4.9	3	3
SS	0.15	0.22	5.4	3	5
FD	0.45	0.71	5.4	3	4
FS	0.15	0.78	5.3	3	5
Site 4:					
SD	0.45	0.16	5.6	3	3
SS	0.15	0.25	5.3	2	3
FD	0.45	0.96	6.2	4	4
FS	0.15	0.79	5.9	3	4
Site 5:					
SD	0.40	0.25	4.2	2	2
SS	0.10	0.14	4.9	3	3
FD	0.45	0.76	6.2	4	3
FS	0.15	0.50	6.2	4	3
Site 6:					
SD	0.40	0.20	4.9	2	2
SS	0.10	0.20	4.6	3	3
FD	0.40	0.79	6.0	3	3
FS	0.10	0.66	6.3	3	3
Site 7:					
SD	0.40	0.46	3.8	2	1
SS	0.10	0.27	4.5	2	2
FS	0.15	0.79	4.7	1	2

[1], calculated from the formula 0.07 boulder% + 0.06 cobble% + 0.45 gravel% + 0.03 sand%

[2], 1=no packing evident; 2-mostly a loose assortment with little overlap; 3=moderately packed with some overlap; 4=tightly packed and/or overlapping

[3], 1=clean substrate; 2=slippery but little periphyton growth; 3=growth visible with green/brown colour; 4=filamentous algae obvious; 5=filamentous algae covering >80% of upper surface and sides