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AQUATIC INVERTEBRATES OF LOWER MANGAHAO AND MANGATAINOKA RIVERS, WAIRARAPA

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ABSTRACT

Benthic invertebrates and sediments were collected from Mangahao River at Marima Domain and from a site on Mangatainoka River to obtain background data on conditions preceding the annual flush of sediment from dams in the upper Mangahao catchment. It was intended to compare pre-flush and post-flush sediment conditions and benthic invertebrate faunas in each river. However, following the first sampling trip it was found that a routine sediment flush would not be carried out in 1992, and so the study was aborted. Results of the first sampling trip are presented in this report. Benthic invertebrate faunas were dominated numerically and gravimetrically by *Deleatidium* spp. Biomass of *Deleatidium* spp. was similar at both sites but densities were higher at the Mangahao River site (mean of five 0.1 m2 Surber samples = 305). Similar numbers of taxa were recorded on average at both sites (16.6-18.0 O.lm-2). Mean weights of coarse sand (1-2 mm) and fine sand (0.25-1 mm) were considerably higher at the Mangatainoka River site (103 and 143 g.0.1m-2), but silt levels were greater at Marima Domain on Mangahao River (32 g.0.1m-2 cf 10 g.0.1m-2).

1 INTRODUCTION

Mangahao River drains the eastern side of Tararua Ranges and supports the largest hydro-electric scheme in the Wellington Conservancy. Large amounts of silt accumulate behind dams on the Mangahao, and this is usually flushed into the lower river each year in March. Concern by the Wellington Conservancy over the effects of this silt on downstream aquatic life led to the submission of research proposals to investigate its impacts on aquatic invertebrates and fish. Following the submission of these proposals, a joint working party comprising DoC, Electricorp, the Regional Council and other interested parties was formed, and it was agreed that Electricorp would fund investigations into the effects of the Mangahao dams and the annual sediment flush on invertebrates and fish.

The resulting research brief involved sampling sites above the dams and on the lower river at Kakariki and Scout Camp. DoC's scientific involvement was limited to assessing the impacts of the sediment flush on benthic invertebrates at Marima Domain. Sampling at Marima Domain and a nearby site on Mangatainoka River was started in November 1991 to collect background data on pre-flush conditions. It was intended to carry out three before flush sampling trips to calibrate differences between the two sites, and then to compare changes at the sites at intervals following the sediment flush down

Table 1. **Results of the preliminary visit (30 October 1991) to potential sampling sites on the two rivers. Invertebrates were subsequently collected from the upper Marima Domain site on Mangahao River and from Site 1 on Mangatainoka River. Totals for substrate percentages may be more or less than 100 because of rounding off errors.**

	Mangahao River		**Mangatainoka River**		
	Upper Domain	**Lower Domain**	**Site 1**	**Site 2**	**Site 3**
Grid reference (NZMS 260)	T24 396744	T24 397746	T25 325628	T25 396676	T24 471774
Temperature (°C)	13	13	14	15	17
Conductivity ($ms.m^{-1}$ @ 18°C)	60	60	40	42	49
Width (m)	30-35	15-20	35-40	30-35	25
Elevation (m a.s.l.)	120	120	240	190	120
Stability rating					
upper banks	27	34	32	25	26
lower banks	34	37	36	28	28
bottom	36	48	43	39	39
total	97	119	111	92	93
Substrate (%)					
bedrock	3	3	0	0	0
boulder	20	5	0	5	8
large cobble	33	15	28	25	23
small cobble	18	45	60	43	43
gravel	15	18	13	23	25
sand	13	13	0	5	3

Table 2. **Water depths (m) and velocities (m.s-1) at sites where samples of benthic invertebrates and sediments were collected at the two sites on 8 November 1991.**

	Mangahao River		**Mangatainoka River**	
Surber sample	**Depth**	**Velocity**	**Depth**	**Velocity**
1	0.36	0.661	0.34	0.814
2	0.36	0.814	0.31	0.814
3	0.35	0.737	0.34	0.763
4	0.40	0.788	0.31	0.763
5	0.33	0.712	0.30	0.814

Mangahao River. Following the first sampling trip, it was revealed that Electricorp would no longer be carrying out a routine sediment flush in March 1992, and the study was therefore aborted. This report presents the results of the initial sampling trip, approximately 10 months after the 1991 flush.

2 METHODS

2.1 Selection of sampling sites

An initial visit to Mangahao and Mangatainoka Rivers was carried out on 30 October 1991 to select physically comparable sampling sites on each river. Assessments were carried out at two sites at Marima Domain on Mangahao River and at three sites on Mangatainoka River (see Table 1 for grid references). Variables measured were water temperature and conductivity (YSI Model 33 S-C-T meter), elevation (1:50,000 maps), Pfankuch (1975) stability ratings (mean of two individual assessments), and channel width and substrate composition (mean of two individual visual estimates). Substrate categories used were bedrock, boulders (>26 cm diameter), large cobbles (13-26 cm), small cobbles (6-12 cm), gravel (0.2-6 cm) and sand (<0.2 cm). Based on these data (Table 1), it was decided to sample aquatic invertebrates at the upper Marima Domain site and the uppermost Mangatainoka site. Important factors in this decision were the water temperature and stability ratings. These sites also had similar channel gradients (4-5 $m.km^{-1}$) and were similar distances below the onset of pastoral development in their respective catchments.

2.2 Collection of invertebrates and substrate analyses

A second trip to the rivers was made on 8 November 1991 to collect benthic invertebrates and to carry out more intensive analyses of the substrate. On this trip, water temperature was 14 °C at both sites, and conductivity was 40 and 60 $mS.m^{-1}$ at Mangatainoka and Mangahao Rivers, respectively. Analyses of substrate composition were carried out at each site by walking in a random manner through the sampling reach and recording the substrate size class present at the left big toe every third step until 100 data points had been collected.

At each site, five points were selected (Table 2) that had depths in the range 0.30-0.40 m and velocities between 0.661 and 0.814 $m.s^{-1}$ (measured with a OSS PCI miniature meter). A Surber sampler (0.1 m^2) was placed at each point and held in place while a piece of PVC tubing (0.3 m diameter; 0.5 m high) was manoeuvered into the Surber quadrat. The substrate in the PVC tubing was agitated to a depth of 10 cm vigorously for one minute to stir up the fine sediment, and a 0.65 l sample of the suspension was collected. The PVC tubing was then removed so that the suspension drifted back into the Surber net (0.25 mm mesh). The substrate in the quadrat was then agitated again and large rocks were scrubbed with a stiff nylon brush to collect benthic invertebrates. The benthos was stirred until all sand to a depth of 10 cm appeared to have been washed into the net.

Table 3. Mean number (ranges in parentheses) of invertebrates in different taxa collected in Surber samples (n = 5) from the two sites on 8 November 1991.

	Mangahao	Mangatainoka
	Ephemeroptera	
Deleatidium spp.	305.0 (197-463)	223.0 (135-304)
Coloburiscus humeralis	0.4 (0-1)	-
	Plecoptera	
Megaleptoperla ?diminuta	0.6 (0-1)	0.2 (0-1)
Stenoperla prasina	0.4 (0-0)	-
Acroperla trivacuata	-	0.2 (0-1)
	Trichoptera	
Oxyethira albiceps	-	0.4 (0-2)
Helicopsyche sp.	-	0.2 (0-1)
Pycnocentrodes sp.	1.2 (0-3)	0.4 (0-1)
Olinga feredayi	0.2 (1-0)	0.2 (0-1)
Aoteapsyche spp.	1.6 (0-4)	0.2 (0-1)
Plectrocnemia maclachlani	1.8 (0-4)	-
?Polyplectropus sp.	2.8 (0-7)	0.2 (0-1)
Psilochorema sp.A	1.2 (0-3)	0.8 (0-1)
Psilochorema sp.B	0.6 (0-1)	-
Hydrobiosis parumbripennis	0.6 (0-1)	0.2 (0-1)
H. ?charadraea	2.4 (0-5)	-
Neurochorema sp.	0.4 (0.1)	-
Hydrobiosidae indet.	0.2 (0-1)	0.6 (0-1)
	Coleoptera	
Elmidae (larvae)	18.6 (8-40)	79.0 (73-96)
Elmidae (adults)	0.6 (0-2)	-
Podaena sp.	-	0.2 (0-1)
	Diptera	
Austrosimulium sp.	0.2 (0-1)	1.4 (0-3)
Aphrophila neozelandica	1.2 (0-2)	-
Empididae	-	0.2 (0-1)
Molophilus sp.	0.2 (0-1)	-
Eriopterini sp.A	-	1.2 (0-4)
Eriopterini sp.B	0.4 (0-1)	2.6 (2-5)
Muscidae (Limnophora)	-	0.2 (0-1)
Chironomidae sp.A	-	1.0 (0-2)
Chironomidae sp.B	37.8 (23-61)	9.4 (7-17)
Chironomidae sp.C	3.8 (1-7)	1.8 (0-3)
Chironomidae sp.D	0.2 (0-1)	0.4 (0-1)
Chironomidae sp.E	4.4 (0-10)	0.6 (0-2)
Chironomidae sp.F	-	0.6 (0-1)
Chironomidae sp.G	2.4 (0-5)	2.6 (2-4)
Chironomidae sp.H	0.4 (0-1)	0.6 (0-2)
Chironomidae sp.I	-	0.2 (0-1)
Chironomidae sp.J	14.2 (10-19)	0.8 (0-1)
Chironomidae sp.K	0.2 (0-1)	0.2 (0-1)
Chironomidae sp.L	0.2 (0-1)	-
Chironomidae sp.M	0.2 (0-1)	-
Chironomidae indet.	0.4 (0-2)	0.6 (0-3)
	Megaloptera	
Archichauliodes diversus	0.8 (0-3)	0.6 (0-2)
	Oligochaeta	
Naididae	35.0 (22-69)	45.0 (19-107)
Other spp.	0.2 (0-1)	0.2 (0-1)
TOTAL INVERTEBRATES	**440.4 (282-690)**	**376.0 (253-467)**
TOTAL TAXA	**18.0 (13-28)**	**16.6 (13-19)**

2.3 Laboratory analyses

Surber samples were washed through 2, 1 and 0.25 mm mesh nested sieves. Invertebrates were picked from material retained on the coarse mesh sieves (2 and 1 mm mesh) by eye, and from the 0.25 mm mesh sieve at 10x magnification. Invertebrates were identified to the lowest practicable taxonomic unit using the keys of Winterbourn & Gregson (1989) and McFarlane (1951). After identification, they were sorted into *Deleatidium* spp. (the dominant taxon; see Table 3) and "Others" (all other taxa combined), and dried at 60°C overnight, after which they were weighed to the nearest mg.

Sand retained by the 1 and 0.25 mm mesh sieves was also dried and weighed. Suspension samples containing fine sediments < 0.25 mm in size (referred to hereafter as silt) were passed through pre-weighed Whatman GF/C filters (15 cm diameter). Trapped silt and filters were dried overnight at 60°C, weighed, and then ashed overnight in a muffle furnace at 500°C before being re-wetted, dried and weighed to give ash-free dry weight of silt. Weights of silt were adjusted for the volume of water in the PVC tubing at the time of sampling and for the surface area sampled, so that results could be expressed as grams of silt per 0.1 m2 of riverbed.

3 RESULTS AND DISCUSSION

3.1 Invertebrate faunas

Deleatidium spp. was the most abundant taxon at both sites followed by Naididae worms, elmid beetles, and Chironomidae sp.B (Table 3). Mean densities of *Deleatidium* spp. and Chironomidae sp.B were higher in Mangahao River whereas more Elmidae larvae and Naididae were found in Mangantainoka River. On average, similar numbers of taxa were found in Surber samples in both rivers (Table 3). Mean biomass of *Deleatidium* spp. larvae was similar at both sites (0.062-0.068 g.0.lm-2) (Fig. 1). The biomass of all other invertebrate taxa combined was greater in Mangahao River.

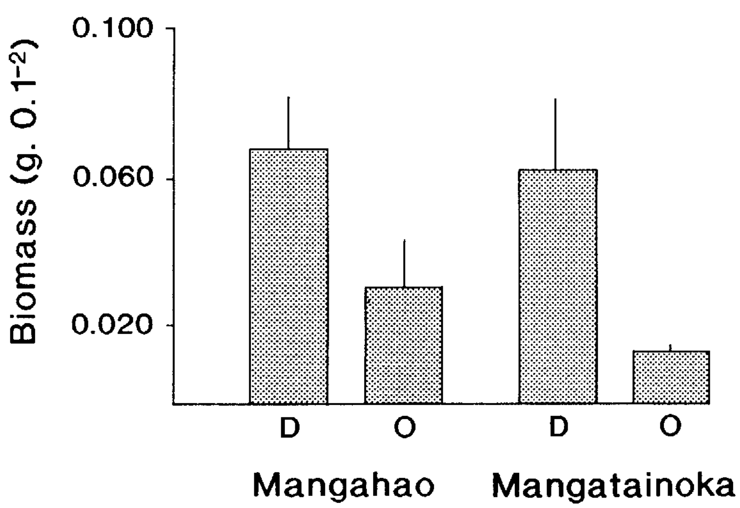

Figure 1. Mean (+2SE) biomass of *Deleaddium* spp. (D) and all other taxa (O) collected in Surber samples at the two sites (n = 5).

Statistical comparisons of the density and biomass of invertebrates between sites are not presented because this was outside the original objective of the study. Rather than comparing sites, I was interested in characterising the sediment conditions and benthic faunas at each site before the flush down Mangahao River, and in comparing post-flush changes to that river and to the control site on Mangatainoka River, which does not receive an artificially-induced sediment flush.

3.2 Sediment analyses

Estimates of substrate composition obtained by random observation indicated that the sampling reach in Mangahao River had more large cobbles but less gravel than the reach in Mangatainoka River (Table 4). Weights of coarse sand (1-2 mm) and fine sand (0.25-1 mm) in Surber quadrats were almost an order of magnitude higher at the sampling site on Mangatainoka River (104 and 143 g.0.1 m-2, respectively) than on Mangahao River (Fig. 2). However, mean weights of silt in the benthos were three times higher at the Marima Domain site on Mangahao River (32 g.0.1m-2 cf 10 g.0.lm-2 at the Mangatainoka site). Statistical comparisons between sites were not made for the reason outlined above.

Table 4. Substrate composition (%) recorded in sampling reaches at the two sites on 8 November 1991.

	Mangahao	Mangatainoka
Large cobbles	28	11
Small cobbles	41	33
Gravel	23	54
Sand	8	2

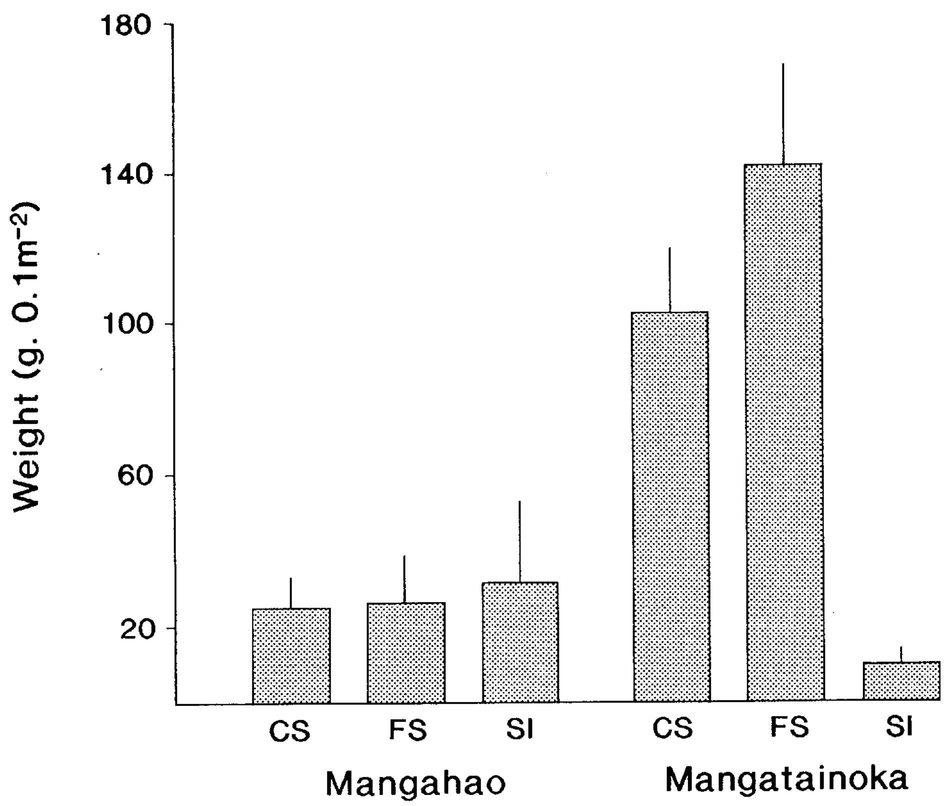

Figure 2. Mean (+2SE) weights of coarse sand (CS; 1-2 mm), fine sand (FS; 0.25-1 mm) and silt (SI; < 0.25 mm) collected in Surber net quadrats at the two sites (n = 5 except for FS at Mangahao where n = 4).

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