

APPENDIX 1

Taxonomic list of aquatic invertebrates found at the 4 sampling sites on Tongariro River in December 1990. Chironomids were separated into taxa at sites TI, TP and TT.

+ = present, - = not recorded, * = not separated.

	TG	TI	TP	TT
Ephemeroptera (mayflies)				
<i>Deleatidium</i> spp.	+	+	+	+
<i>Austroclima jollayae</i>	+	+	+	-
<i>A. sepia</i>	-	+	+	+
<i>Acanthophlebia cruentata</i>	-	+	-	-
<i>Maiulus luma</i>	-	+	+	-
<i>Zephlebia ?spectabilis</i>	-	+	-	-
<i>Zephlebia</i> sp.	-	+	-	-
<i>Nesameletus</i> sp.	+	+	-	-
<i>Coloburiscus humeralis</i>	+	+	+	+
Plecoptera (stoneflies)				
<i>Stenoperla ?maclellani</i>	+	+	-	-
<i>Austroperla cyrene</i>	+	+	+	-
<i>Megaleptoperla grandis</i>	+	+	+	+
<i>Zelandoperla decorata</i>	+	+	+	+
<i>Zelandoperla</i> sp.	+	+	+	-
<i>Zelandobius furcillatus</i>	+	+	+	+
<i>Acroperla trivacuata</i>	+	+	+	+
<i>A. spiniger</i>	-	-	+	-
<i>Halticoperla viridans</i>	+	+	-	-
<i>Spaniocerca zelandica</i>	+	-	-	-
<i>Spaniocerca</i> sp.	-	-	+	-
Trichoptera (caddisflies)				
<i>Aoteapsyche colonica</i>	+	-	-	+
<i>A. ?tepoka</i>	+	+	+	+
<i>A. raruraru</i>	+	+	+	-
<i>Aoteapsyche</i> spp.	+	+	+	+
<i>Orthopsyche fimbriata</i>	-	-	-	+
<i>Oxyethira albiceps</i>	+	+	+	+
<i>Paroxyethira hendersoni</i>	+	-	-	-
<i>Psilochorema</i> sp.	+	+	+	+
<i>Costachorema ?callista</i>	+	+	+	+
<i>C. ?brachyptera</i>	+	+	+	-
<i>C. ?xanthoptera</i>	+	+	+	+
<i>C. ?psaroptera</i>	-	-	+	-
<i>Hydrobiosis parumbripennis</i>	+	+	+	+
<i>H. ?frater</i>	+	+	+	-
<i>H. ?harpidosa</i>	+	+	+	-
<i>H. ?spatulata</i>	+	-	+	-
<i>H. ?charadraea</i>	-	-	-	+
<i>H. ?clavigera</i>	-	-	-	+

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	TG	TI	TP	TT
Trichoptera (caddisflies) (Continued)				
<i>Hydrobiosis</i> sp.A	+	-	-	-
<i>Hydrobiosis</i> sp.B	-	-	+	-
<i>Neurochorema confusum</i>	+	+	+	+
<i>Neurochorema</i> sp.	+	+	+	+
<i>Tiphobiosis</i> sp.	-	+	-	-
Hydrobiosidae	+	+	+	+
<i>Plectrocnemia maclachlani</i>	+	+	-	-
<i>Pseudoconesus</i> sp.	-	+	-	-
Oconesidae sp.	-	+	-	-
<i>Hudsonema aliena</i>	-	+	-	-
<i>Triplectides ?dolichos</i>	+	-	-	-
<i>Zelolessica cheira</i>	-	+	-	+
<i>Pycnocentrella eurensis</i>	-	+	-	-
<i>Pycnocentroides</i> spp.	+	+	+	+
<i>Beraeoptera roria</i>	+	+	+	+
<i>Confluens hamiltoni</i>	-	+	-	-
<i>Olinga feredayi</i>	+	+	+	+
<i>Pycnocentria funerea</i>	+	+	-	+
<i>P. evecta</i>	+	+	-	-
Coleoptera (beetles)				
Elmidae	+	+	+	+
Hydraenidae	-	+	+	+
Hydrophilidae	-	-	-	+
Helodidae	-	+	-	-
? <i>Liodessus plicatus</i>	-	-	+	-
Diptera (two-winged flies)				
<i>Cricotopus</i> spp.	*	+	+	+
<i>Eukiefferiella</i> sp.	*	+	+	+
Orthoclaadiinae sp.a	*	+	+	+
Orthoclaadiinae sp.A	*	+	+	+
Orthoclaadiinae sp.B	*	+	+	+
<i>Tanytarsus vespertinus</i>	*	+	+	+
<i>Polypedilum</i> sp.	*	-	+	+
Macropelopiini sp.	*	+	+	+
<i>Maoridiamesa</i> sp.	*	+	+	+
Diamesinae sp.	*	+	+	+
Chironomidae indet.	+	+	+	+
Ceratopogonidae	-	+	+	+
Stratiomyidae	-	-	+	-
Empididae sp.A	+	+	+	+
Empididae sp.B	-	-	-	+
Muscidae sp.A	+	+	+	+
Muscidae sp.B	-	+	-	-
Psychodidae	+	-	-	-
Tanyderidae	-	-	+	-
<i>Limonia</i> sp.	-	-	+	-

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	TG	TI	TP	TT
Diptera (two-winged flies) (Continued)				
<i>Aphrophila neozelandica</i>	+	+	+	+
<i>Paralimnophora skusei</i>	+	+	+	+
Eriopterini sp.A	+	+	+	+
Eriopterini sp.B	+	+	+	+
<i>Molophilus</i> sp.	-	+	-	-
Culicidae	-	-	+	-
<i>Austrosimulium</i> sp.	-	+	+	+
<i>Ephydrella</i> sp.	-	-	+	-
Megaloptera (dobsonflies)				
<i>Archichaulioides diversus</i>	-	+	-	+
Oligochaeta (worms)	+	+	+	+
Nematoda (nematodes)	+	+	+	+
Gordiidae (horse hair worms)	+	-	-	-
<i>Potamopyrgus antipodarum</i> (snails)	-	-	-	+
Total no. of taxa¹	50	61	52	43
No. of samples	23	26	13	21

¹ does not include separate chironomid taxa.

APPENDIX 2

Densities (no. 0.1m^{-2}) of invertebrate larvae collected in replicate Surber samples from "slow" (mean velocity = 0.23 m.s^{-1}), "medium" (mean velocity = 0.59 m.s^{-1}) and "fast" (mean velocity = 1.15 m.s^{-1}) flowing water at TJ (see Fig. 1) in December 1992.

"Slow" flowing water.	Sample #	1	2	3	4	5
Ephemeroptera (mayflies)						
<i>Deleatidium</i> spp.		4	11	17	3	11
<i>Zephlebia</i> sp.		-	1	2	-	2
<i>Coloburiscus humeralis</i>		-	-	2	-	11
Plecoptera (stoneflies)						
<i>Zelandobius furcillatus</i>		-	-	2	-	1
Trichoptera (caddisflies)						
<i>Aoteapsyche</i> spp.		-	4	6	1	19
<i>Oxyethira albiceps</i>		3	5	-	40	36
<i>Paroxyethira hendersoni</i>		-	1	-	-	-
<i>Psilochorema</i> sp.		-	-	-	-	4
"Other" Hydrobiosidae		9	10	6	-	8
<i>Helicopsyche</i> sp.		-	1	-	-	-
<i>Pycnocentroides</i> spp.		3	11	15	2	3
<i>Olinga feredayi</i>		-	-	1	-	-
<i>P. evecta</i>		-	1	-	-	1
Coleoptera (beetles)						
Elmidae		52	30	29	4	10
Diptera (two-winged flies)						
<i>Cricotopus</i> spp.		100	248	108	352	228
<i>Eukiefferiella</i> sp.		60	86	70	70	78
Orthocladiinae sp.a		264	206	212	436	472
<i>Tanytarsus vespertinus</i>		1016	562	454	126	174
<i>Maoridiamesa</i> sp.		116	324	382	794	703
Chironomidae indet.		60	18	26	32	36
Empididae sp.		-	3	-	12	20
Muscidae sp.		-	2	2	-	1
<i>Aphrophila neozelandica</i>		25	44	47	24	77
Eriopterini sp.		-	-	1	-	-
<i>Ephydrella</i> sp.		-	-	1	-	-
Megaloptera (dobsonflies)						
<i>Archichaulioides diversus</i>		-	-	-	-	8
Oligochaeta (worms)		1276	1539	373	1203	481

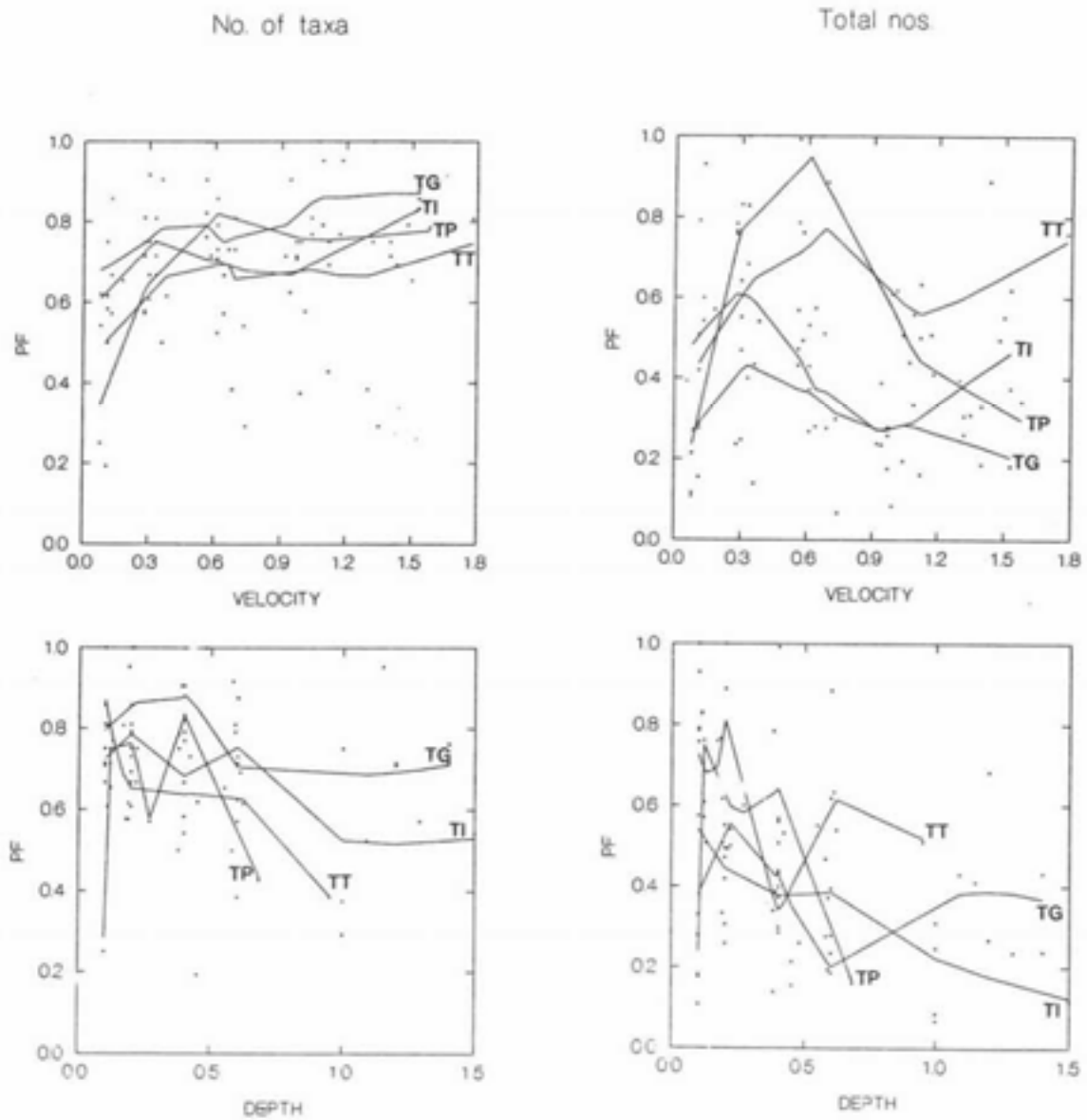
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"Medium" flowing water.	Sample #	1	2	3	4	5
Ephemeroptera (mayflies)						
<i>Deleatidium</i> spp.		12	39	16	9	12
<i>Coloburiscus humeralis</i>		7	1	13	–	3
Plecoptera (stoneflies)						
<i>Zelandobius furcillatus</i>		–	1	1	–	–
<i>Halticoperla viridans</i>		1	–	–	–	–
Trichoptera (caddisflies)						
<i>Aoteapsyche</i> spp.		13	6	60	9	34
<i>Oxyethira albiceps</i>		4	–	4	–	–
"Other" Hydrobiosidae		15	12	6	1	7
<i>Hudsonema aliena</i>		–	–	–	–	1
<i>Helicopsyche</i> sp.		1	–	–	–	–
<i>Pycnocentrodes</i> spp.		10	74	2	–	–
<i>Pycnocentria funerea</i>		–	–	–	–	1
Coleoptera (beetles)						
Elmidae		25	30	5	–	2
Hydrophilidae		1	–	–	–	–
Ptylodactylidae sp.		1	–	–	–	–
Diptera (two-winged flies)						
<i>Cricotopus</i> spp.		102	34	300	110	123
<i>Eukiefferiella</i> sp.		78	22	104	66	104
Orthocladiinae sp.a		104	60	302	126	222
<i>Tanytarsus vespertinus</i>		60	38	212	110	132
<i>Maoridiamesa</i> sp.		990	326	994	758	860
Chironomidae indet.		16	10	38	16	18
Ceratopogonidae		–	–	–	1	–
Empididae sp.		4	–	2	–	2
Muscidae sp.		1	3	6	2	1
<i>Aphrophila neozelandica</i>		84	36	100	50	52
<i>Austrosimulium</i> sp.		–	–	1	–	–
<i>Ephydrella</i> sp.		–	1	–	–	–
Megaloptera (dobsonflies)						
<i>Archichauliodes diversus</i>		–	–	5	1	–
Oligochaeta (worms)		167	217	732	122	268

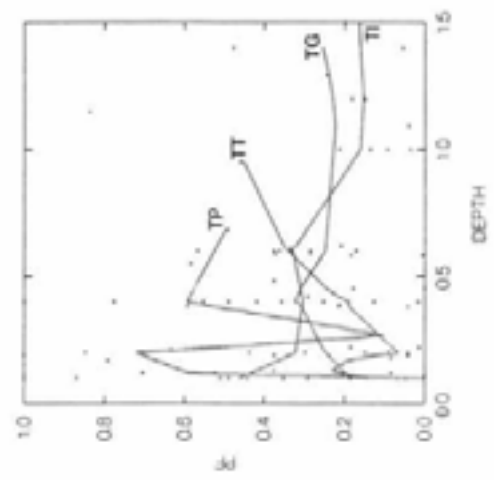
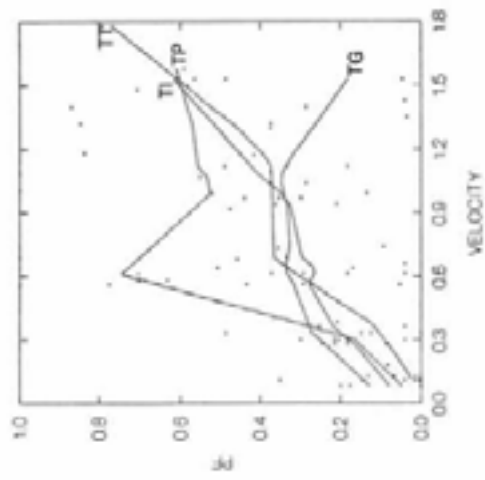
"Fast" flowing water.	Sample #	1	2	3	4	5
Ephemeroptera (mayflies)						
<i>Deleatidium</i> spp.		11	19	11	2	1
<i>Austroclima</i> sp.		-	-	-	1	-
<i>Zephlebia</i> sp.		1	-	-	-	-
<i>Coloburiscus humeralis</i>		10	10	13	9	6
Plecoptera (stoneflies)						
<i>Zelandobius furcillatus</i>		-	1	-	-	-
<i>Acroperla trivacuata</i>		1	-	-	-	-
<i>Spaniocerca</i> sp.		2	-	-	-	-
Trichoptera (caddisflies)						
<i>Aoteapsyche</i> spp.		86	63	132	179	175
<i>Oxyethira albiceps</i>		-	-	4	-	1
"Other" Hydrobiosidae		6	8	4	4	1
<i>Bereoptera roria</i>		-	1	-	-	-
<i>P. evecta</i>		1	-	-	-	-
Coleoptera (beetles)						
Elmidae		2	5	3	2	-
Diptera (two-winged flies)						
<i>Cricotopus</i> spp.		120	126	122	84	53
<i>Eukiefferiella</i> sp.		184	120	180	108	67
Orthoclaadiinae sp.a		116	84	118	142	29
<i>Tanytarsus vespertinus</i>		42	34	78	56	9
<i>Maoridiamesa</i> sp.		860	830	1108	778	430
Chironomidae indet.		44	12	2	20	20
Empididae sp.		-	-	2	1	1
Muscidae sp.		5	1	1	-	1
<i>Aphrophila neozelandica</i>		42	49	69	47	42
<i>Austrosimulium</i> sp.		1	-	-	-	-
Megaloptera (dobsonflies)						
<i>Archichaulioides diversus</i>		-	3	-	-	1
Oligochaeta (worms)		443	159	324	157	117

APPENDIX 3A

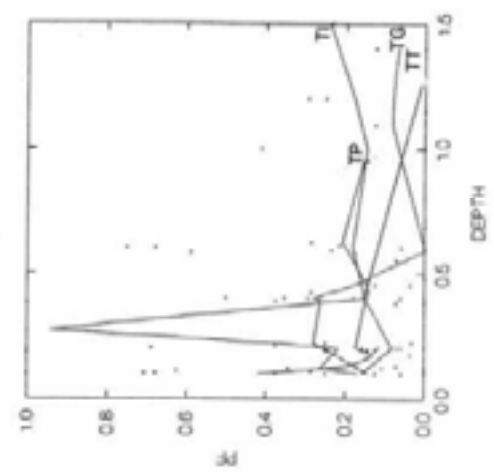
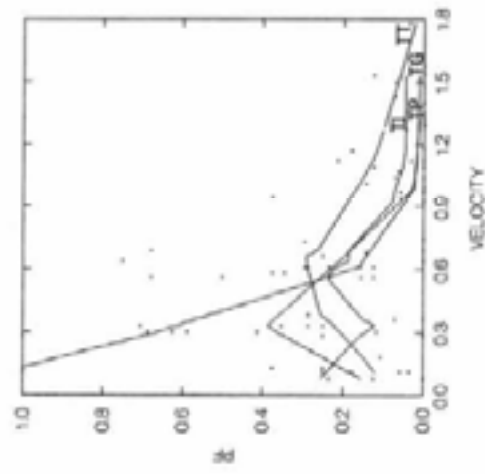
Locally weighted smooth curves plotted through preference factors (PF) (see Section 2.5 for details of calculation) for taxonomic richness (number of taxa), total inverttebrate densities, densities of 7 major taxa and chironomid biomass in relation to water velocity ($m.s^{-1}$) and depth (m) at 3-4 sites on Tongariro River.



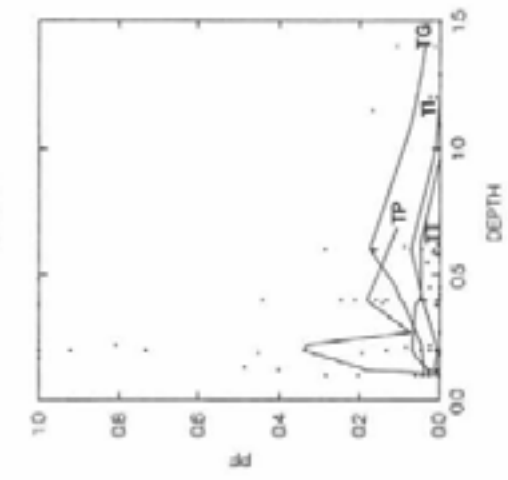
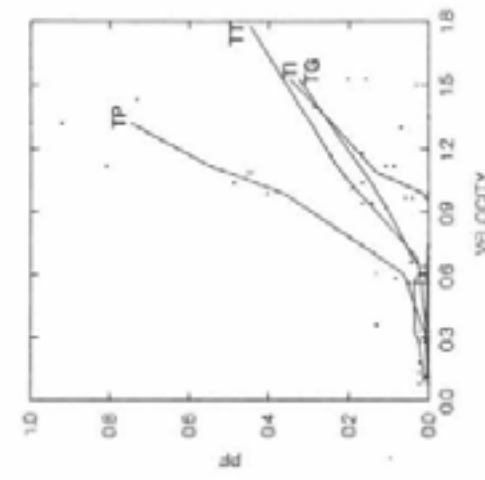
Defleatidium spp.



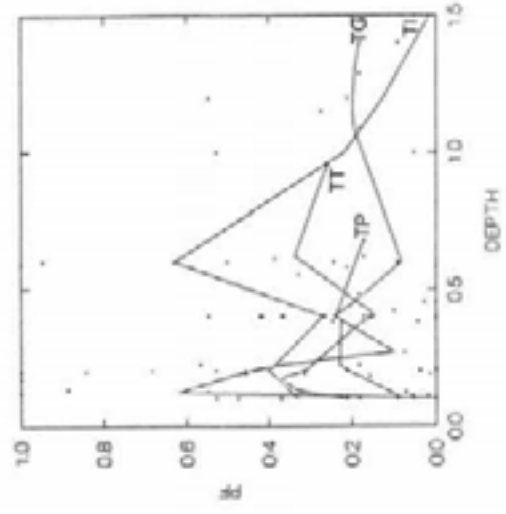
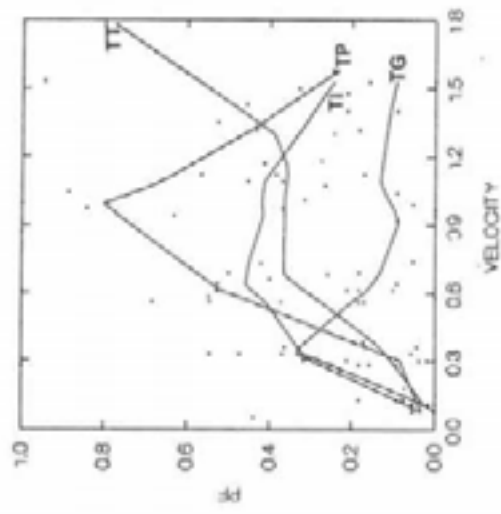
Z. furcillatus



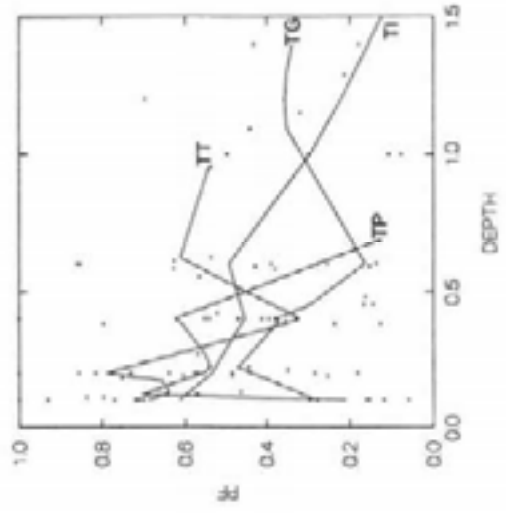
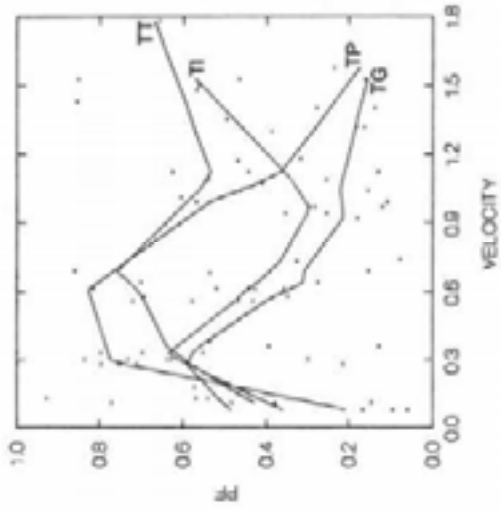
Aoteapsyche spp.



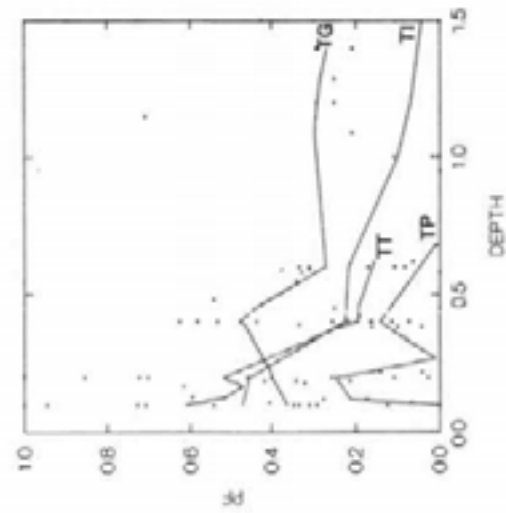
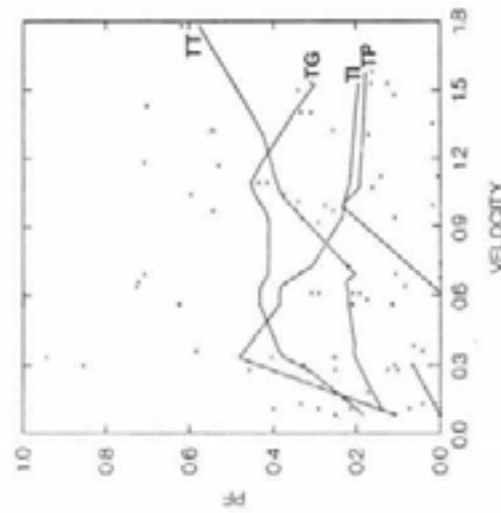
A. neozelandica



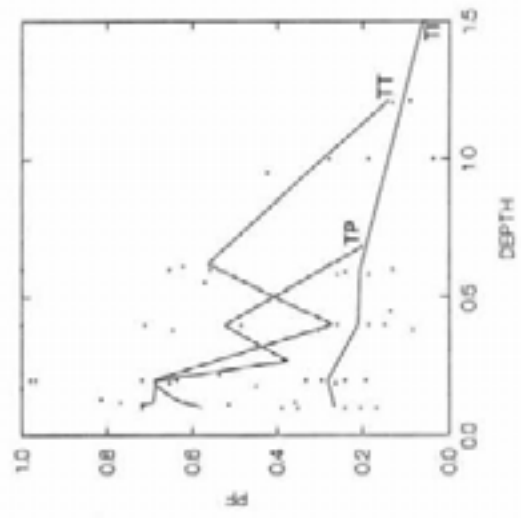
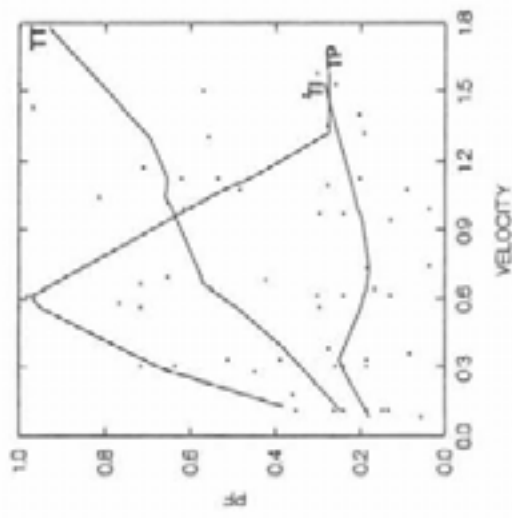
Chironomidae



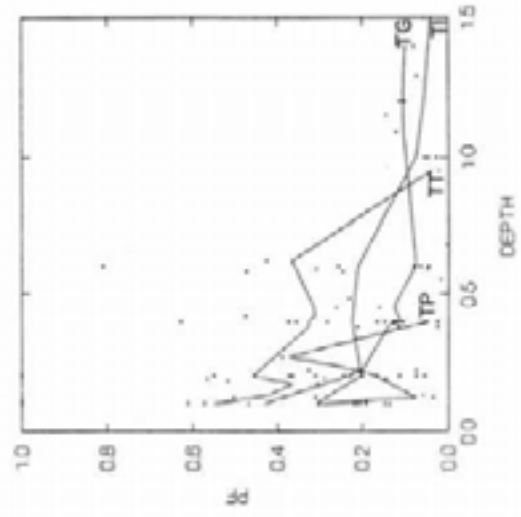
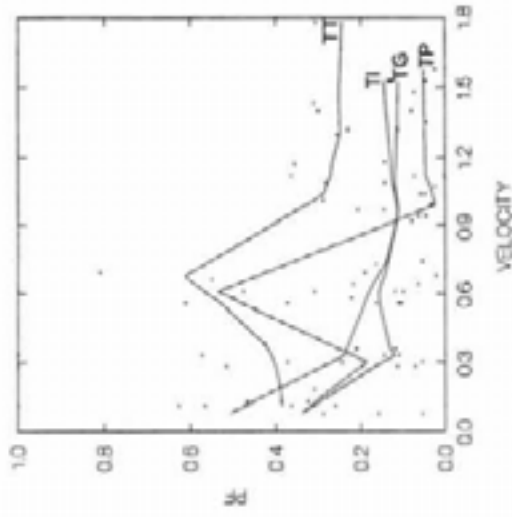
Hydrobiosidae



Chironomidae biomass



Oligochaeta



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