Macroinvertebrate Density in Riffles Before and After Treatment

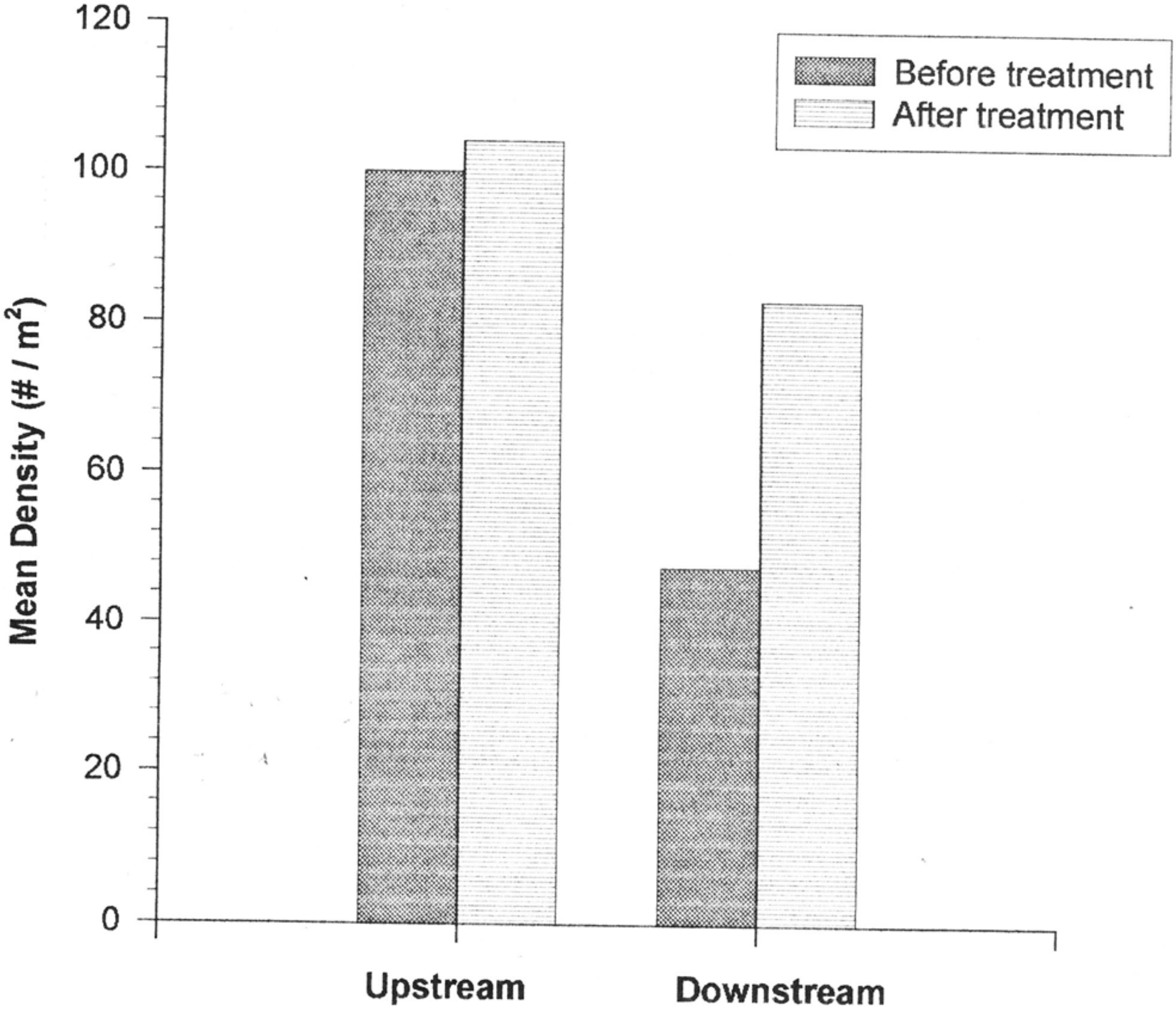
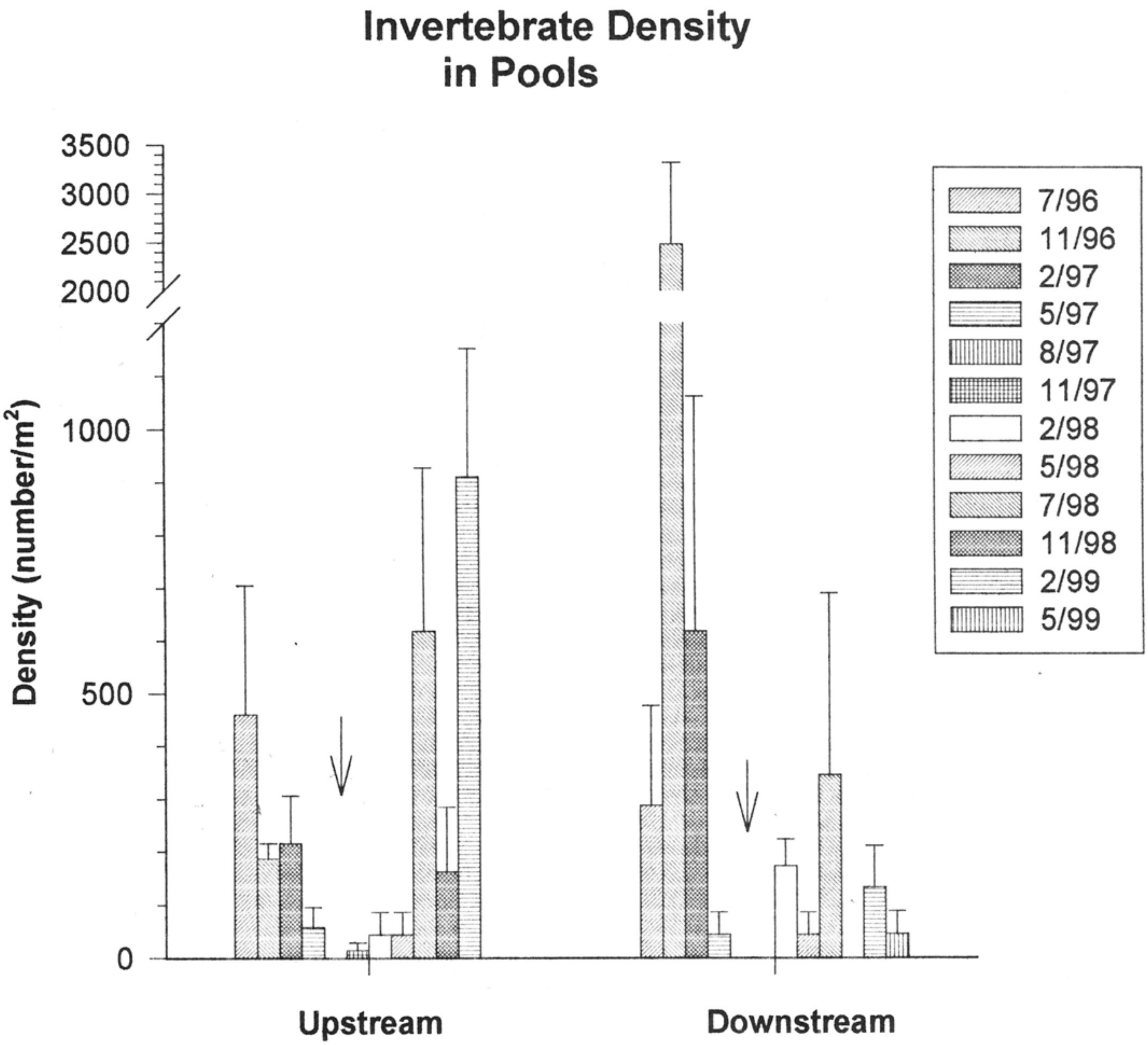
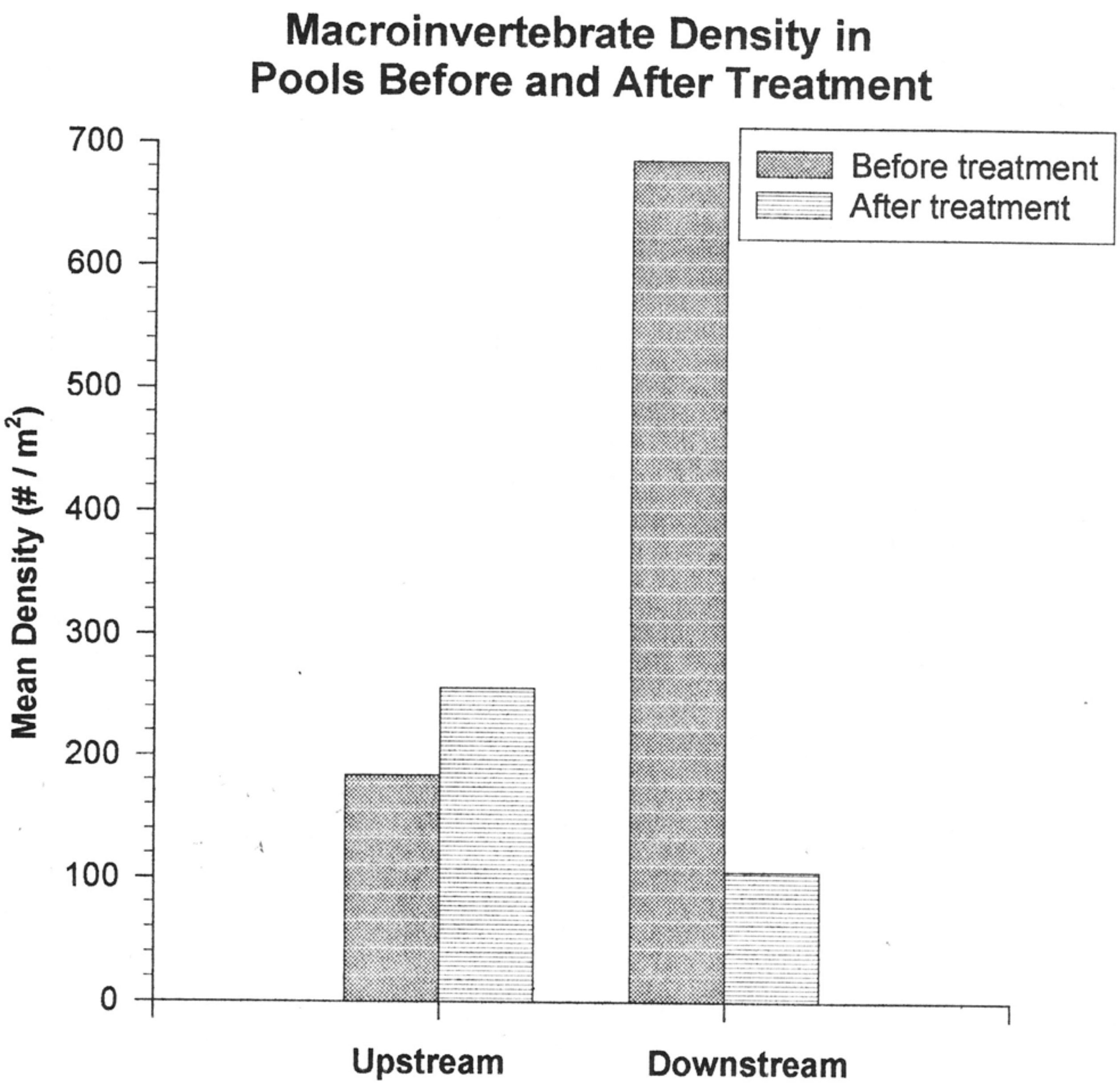


Figure 22



Invertebrate Density
in Pools
Density (number/m²)
3500
3000
2500
2000
1000
500
0
Upstream
Downstream
7/96
11/96
2/97
5/97
8/97
11/97
2/98
5/98
7/98
11/98
2/99
5/99

Figure 23



Macroinvertebrate Density in
Pools Before and After Treatment
Mean Density (# / m2)
700
600
500
400
300
200
100
0
Before treatment
After treatment
Upstream
Downstream

Figure 24

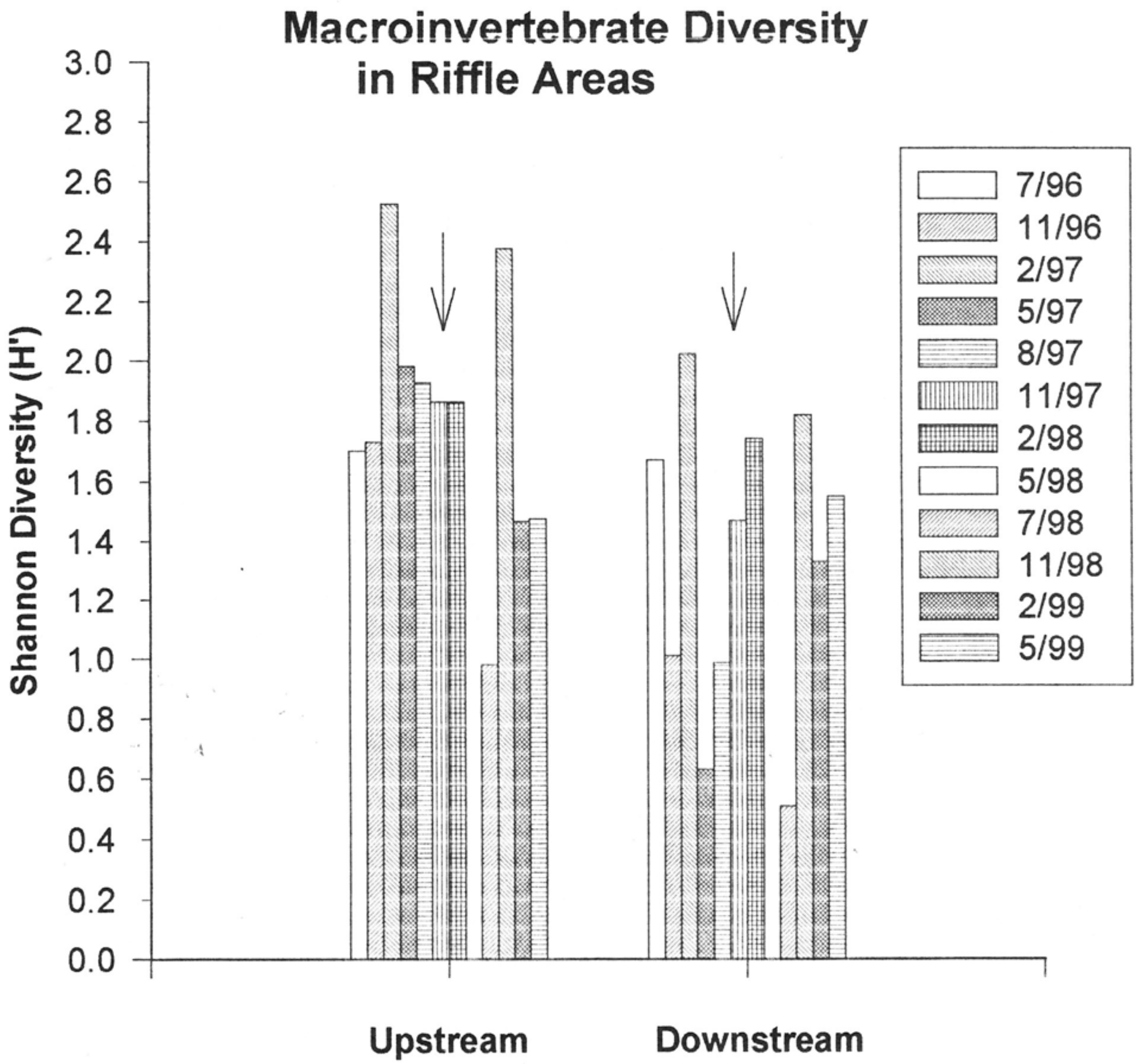

Macroinvertebrate Diversity
in Riffle Areas
Shannon Diversity (H')
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Upstream
Downstream
7/96
11/96
2/97
5/97
8/97
11/97
2/98
5/98
7/98
11/98
2/99
5/99

Figure 25

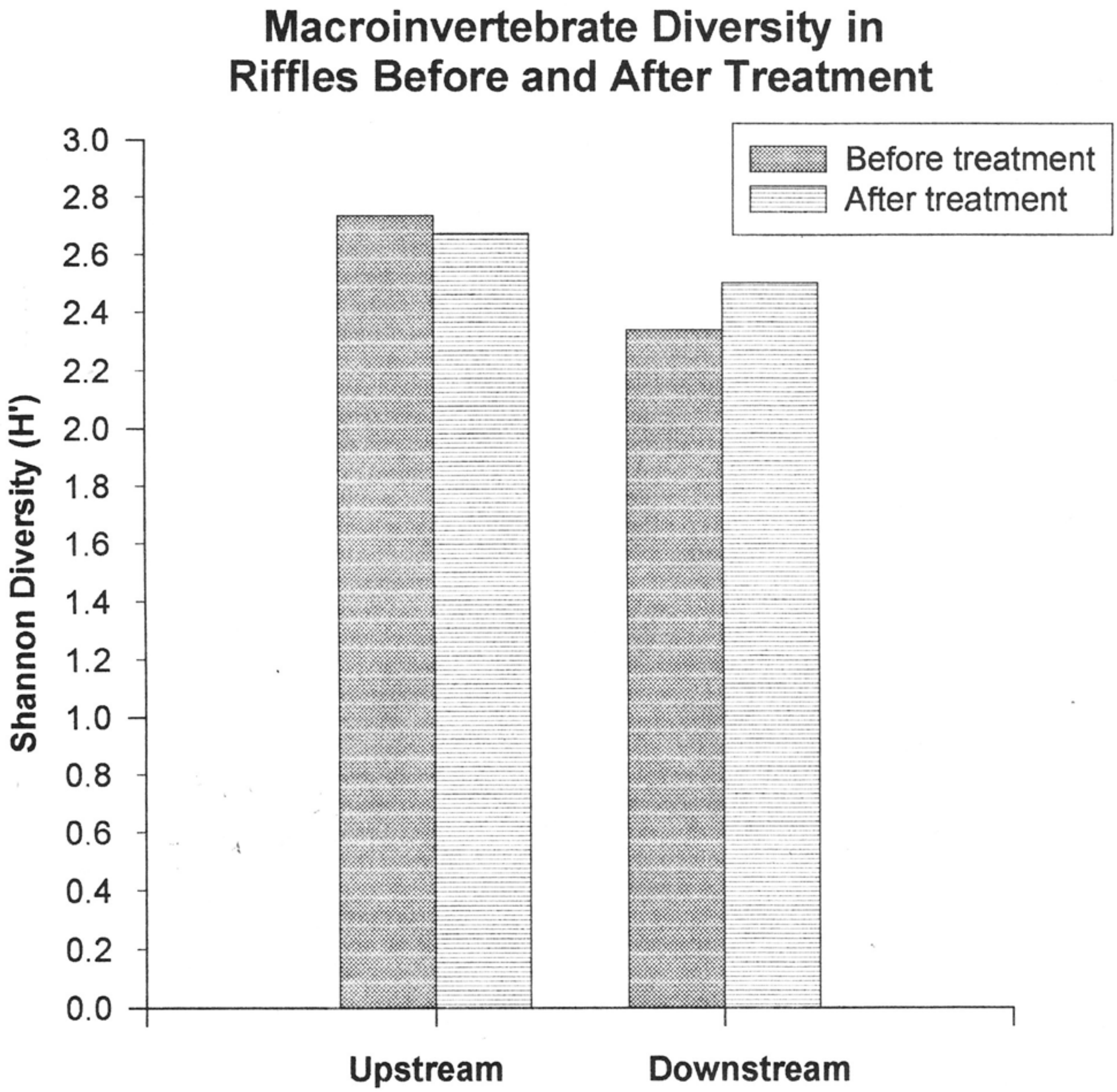

Macroinvertebrate Diversity in
Riffles Before and After Treatment
Shannon Diversity (H')
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Before treatment
After treatment
Upstream
Downstream

Figure 26

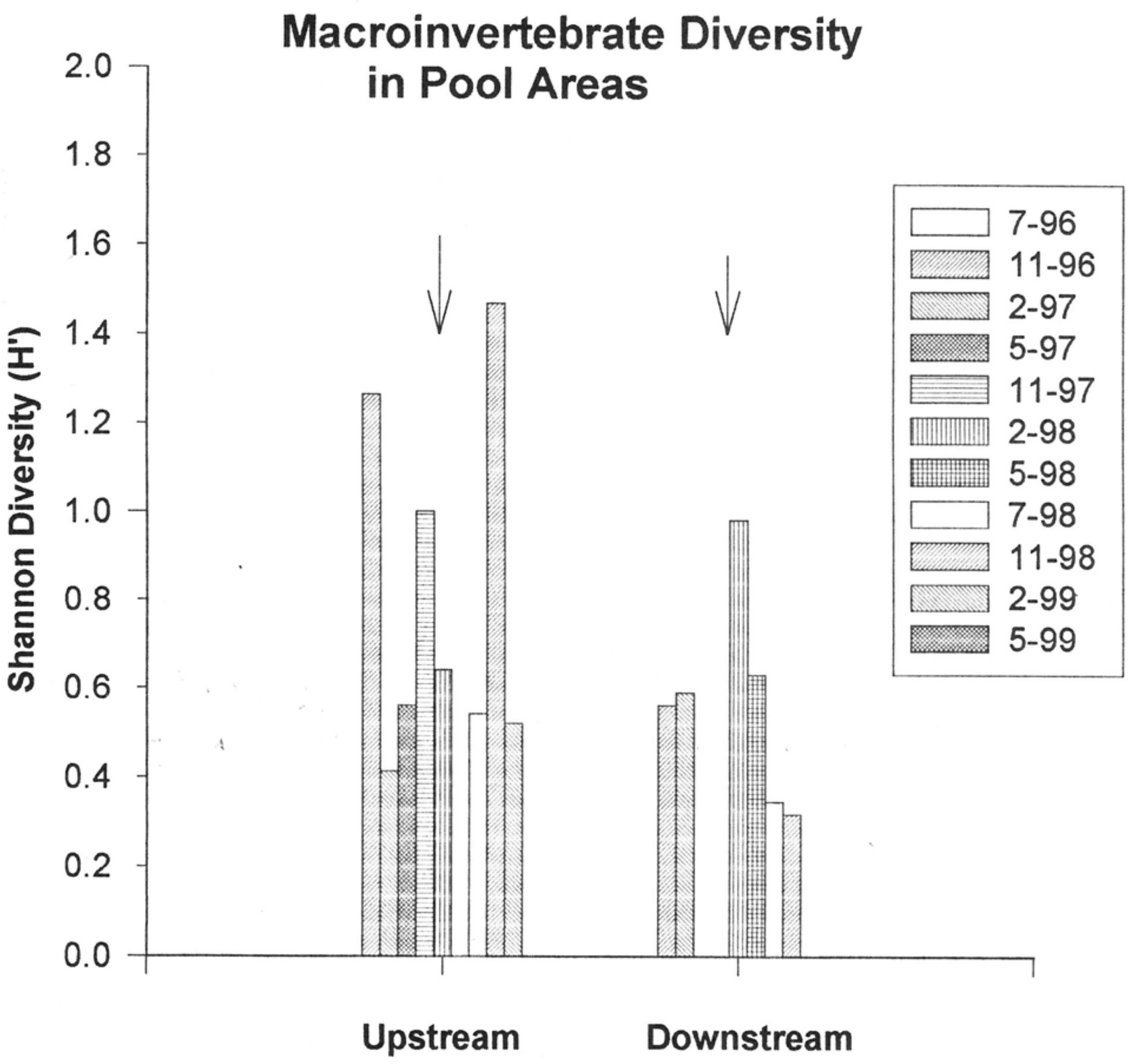

Macroinvertebrate Diversity
in Pool Areas
Shannon Diversity (H')
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Upstream
Downstream
7-96
11-96
2-97
5-97
11-97
2-98
5-98
7-98
11-98
2-99
5-99

Figure 27

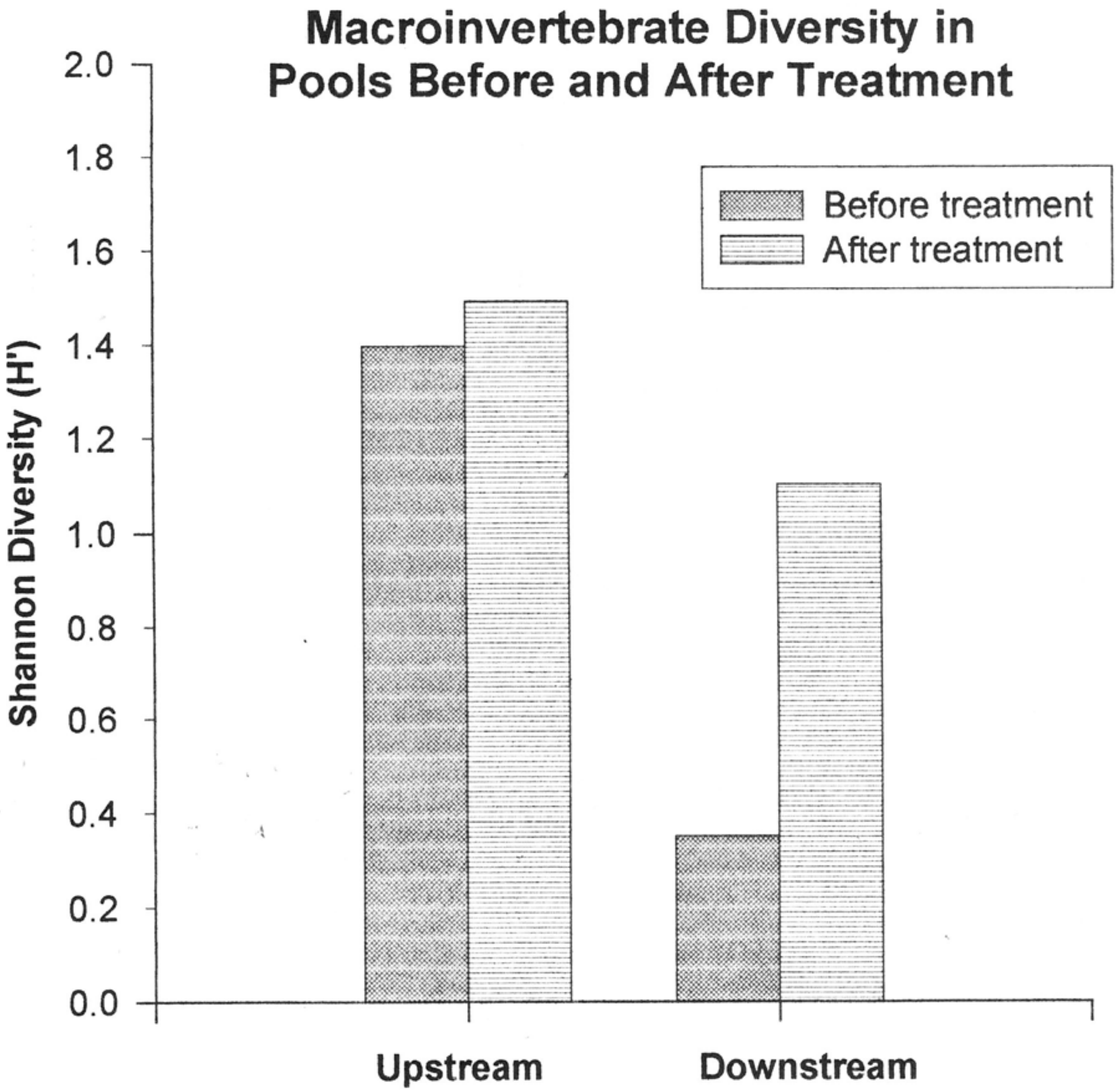

Macroinvertebrate Diversity in
Pools Before and After Treatment
Shannon Diversity (H')
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Before treatment
After treatment
Upstream
Downstream

Figure 28

Ordination of Surber Samples

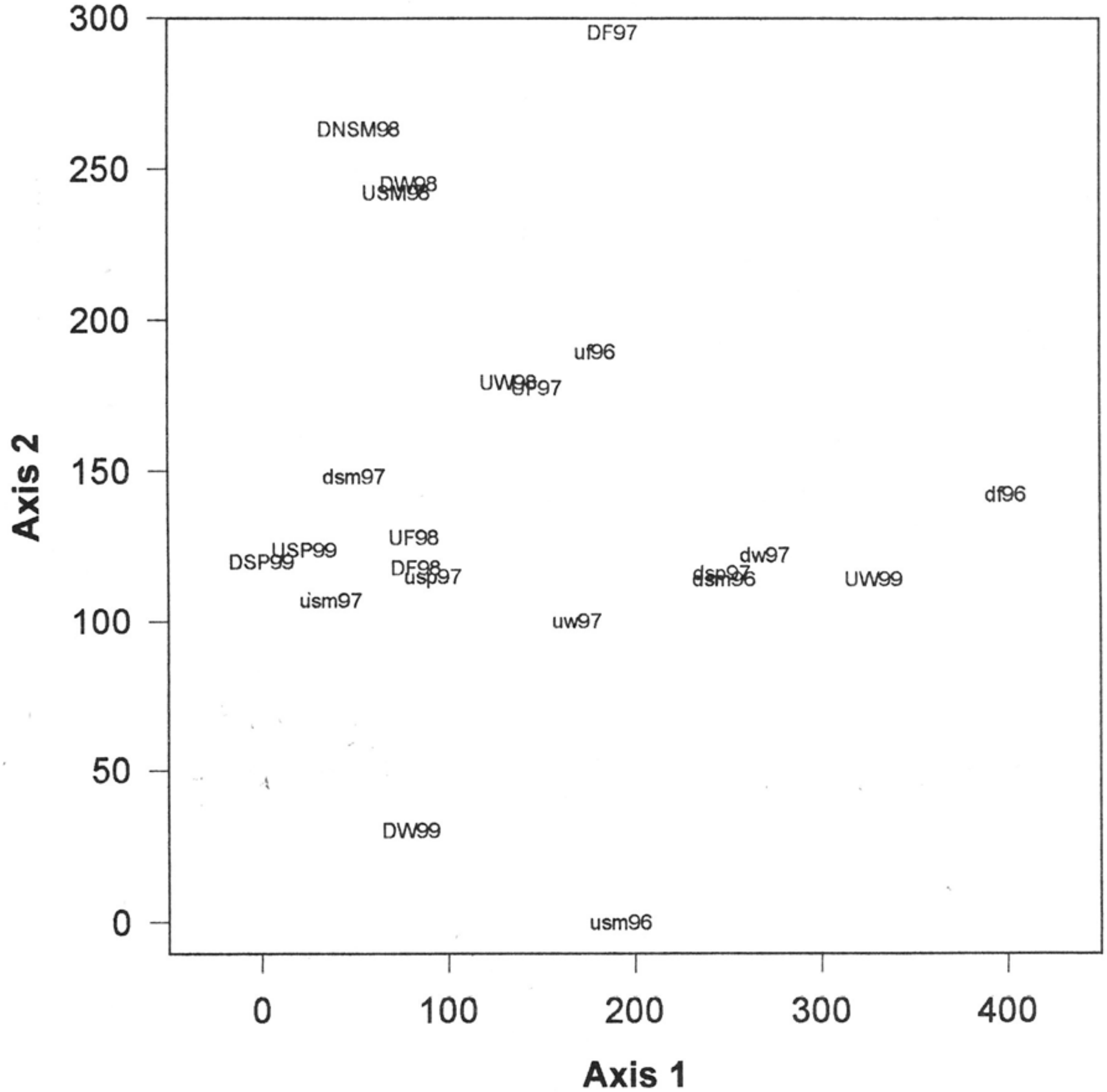


Figure 29

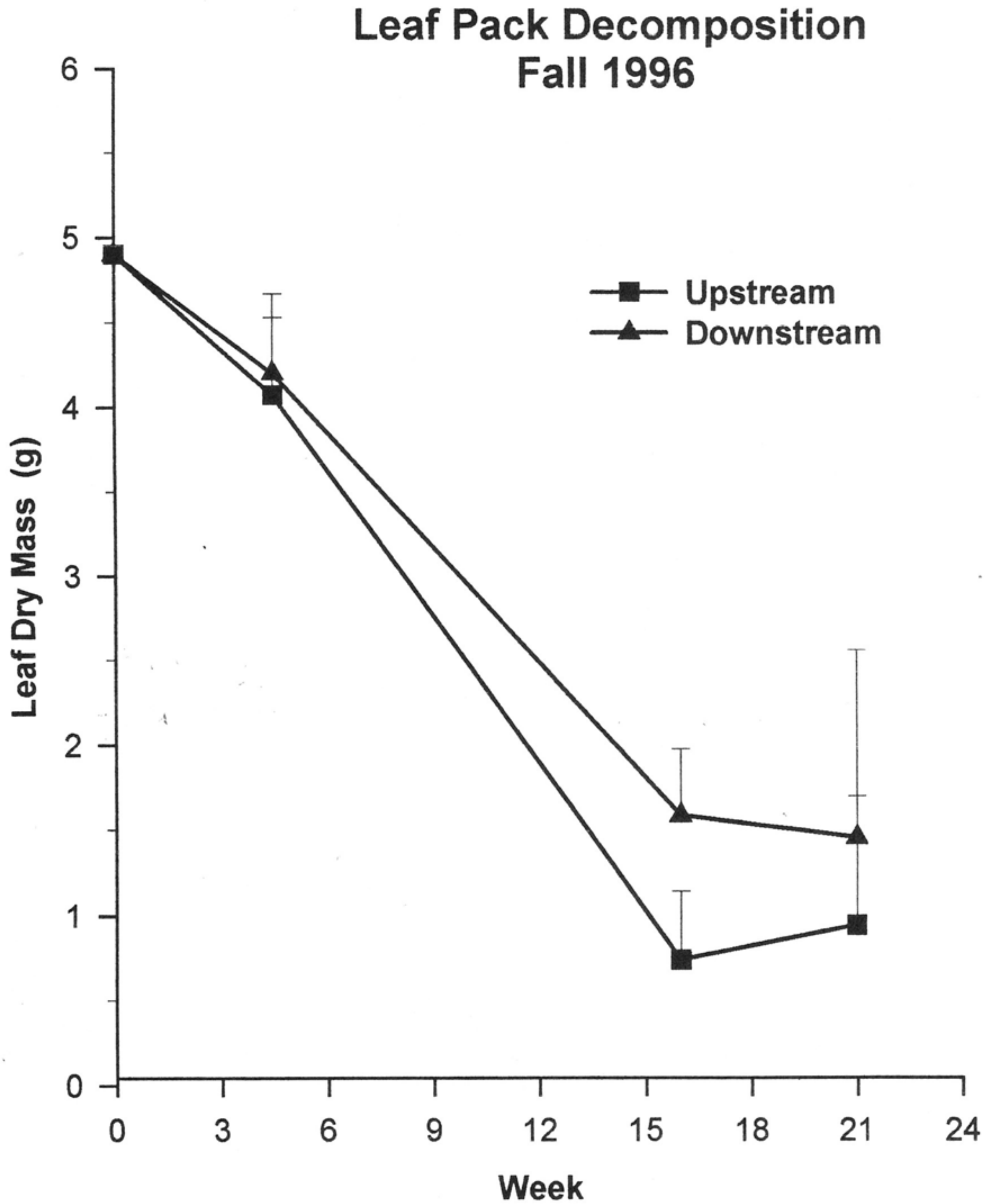

Leaf Pack Decomposition
Fall 1996
Upstream
Downstream
Leaf Dry Mass (g)
Week
0
1
2
3
4
5
6
0
3
6
9
12
15
18
21
24

Figure 30

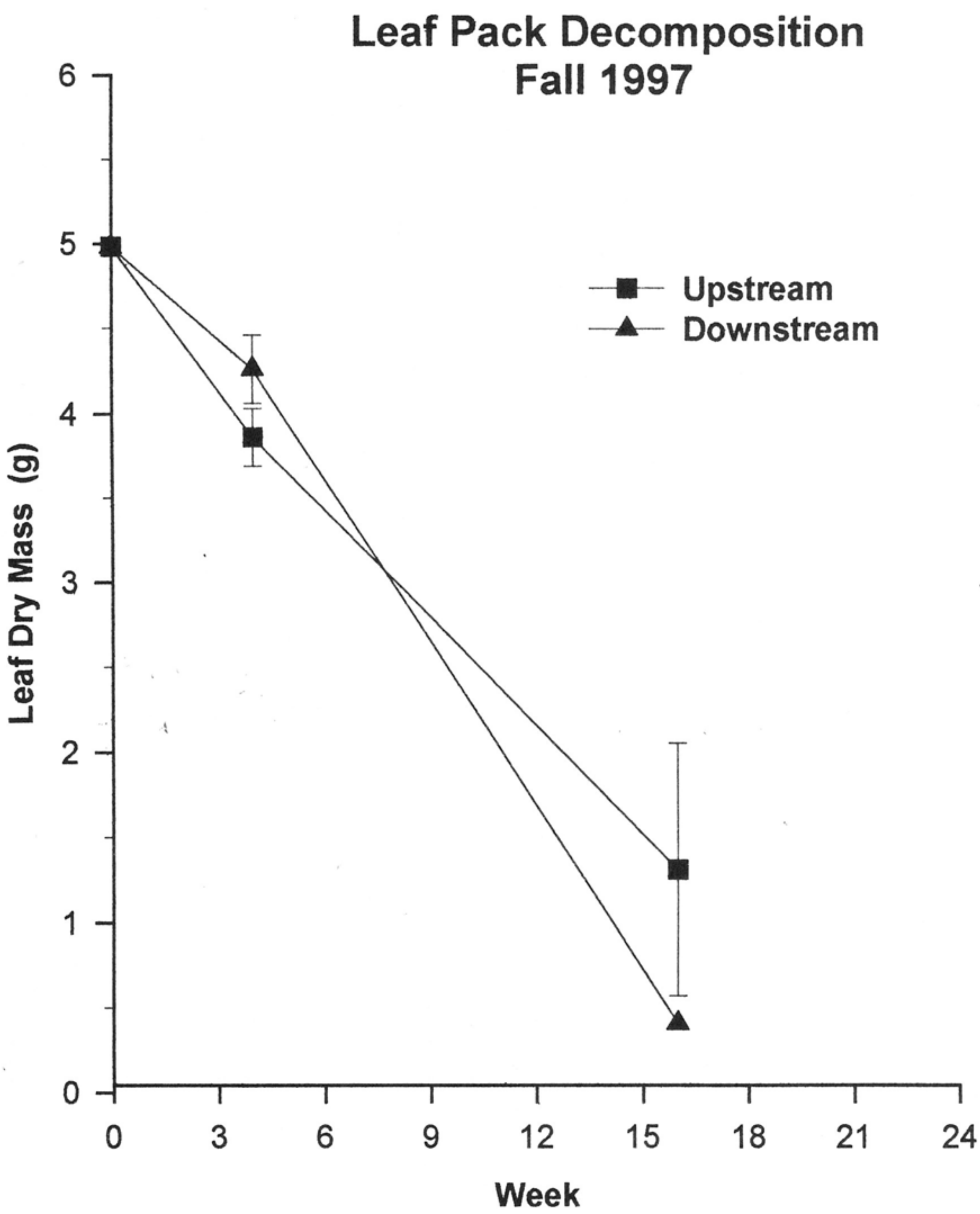
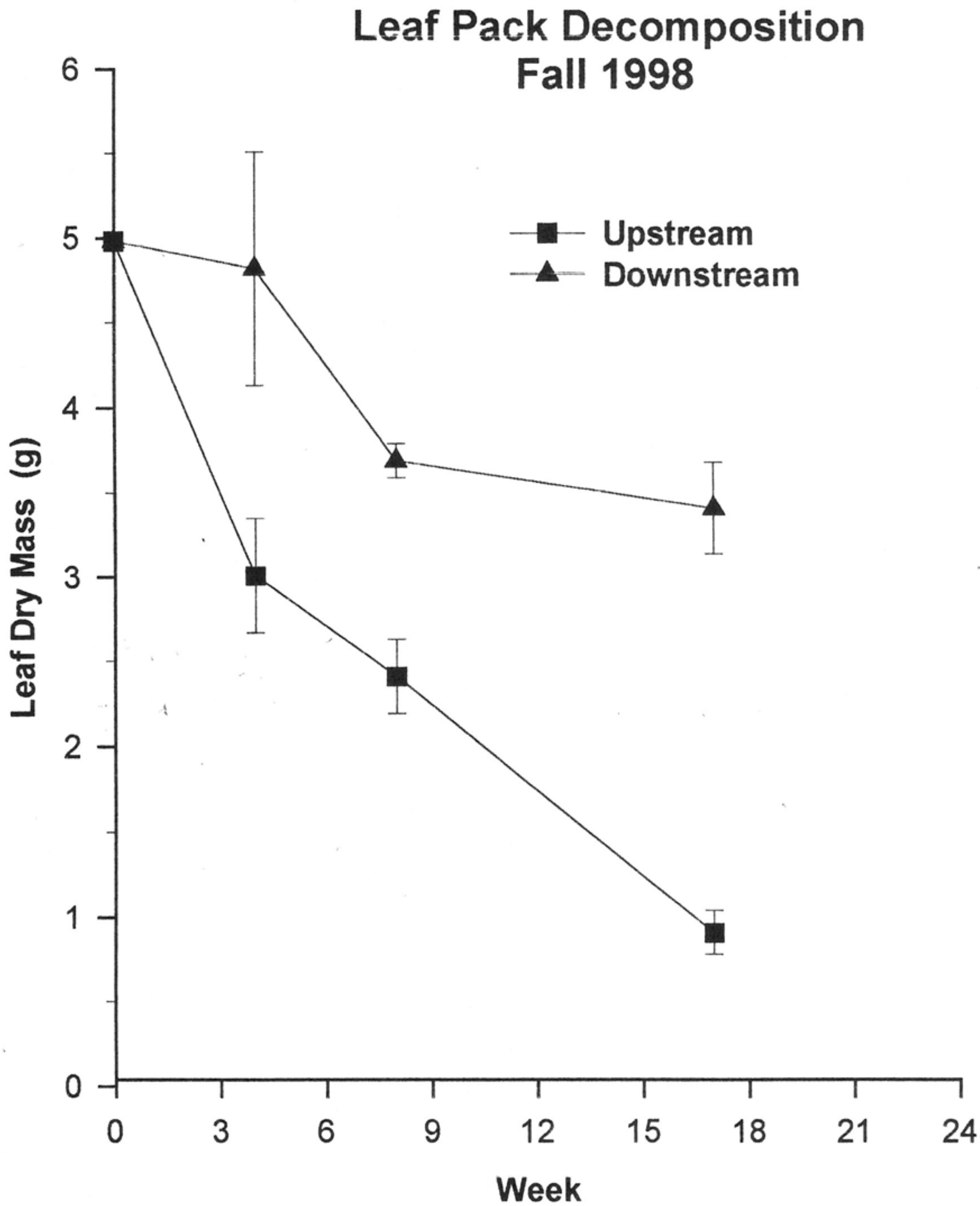
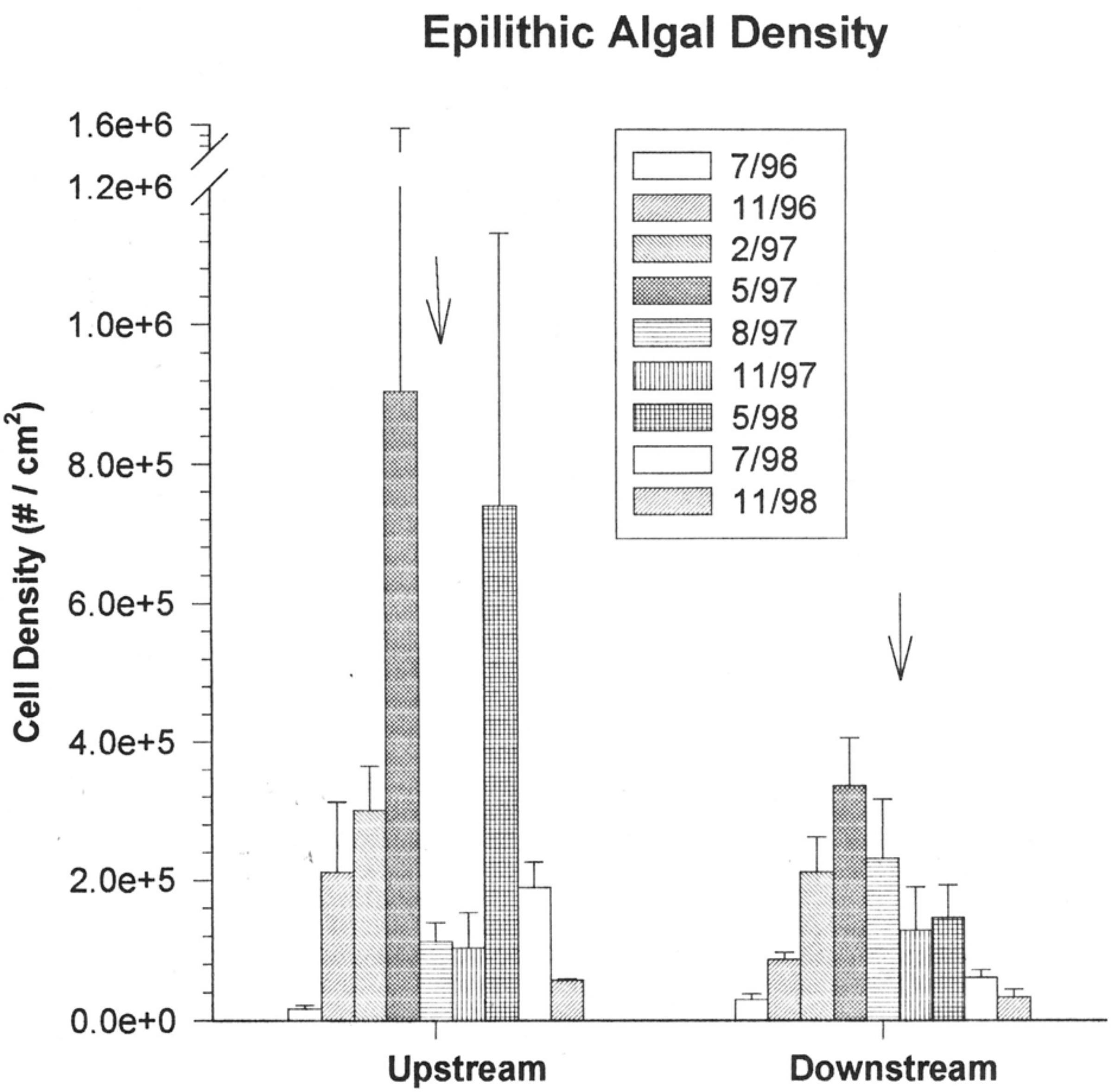

Leaf Pack Decomposition
Fall 1997
Upstream
Downstream
Leaf Dry Mass (g)
Week
0
1
2
3
4
5
6
0
3
6
9
12
15
18
21
24

Figure 31



Leaf Pack Decomposition
Fall 1998
Upstream
Downstream
Leaf Dry Mass (g)
Week
0
1
2
3
4
5
6
0
3
6
9
12
15
18
21
24

Figure 32



Epilithic Algal Density
1.6e+6
1.2e+6
1.0e+6
8.0e+5
6.0e+5
4.0e+5
2.0e+5
0.0e+0
Cell Density (# / cm2)
7/96
11/96
2/97
5/97
8/97
11/97
5/98
7/98
11/98
Upstream
Downstream

Figure 33

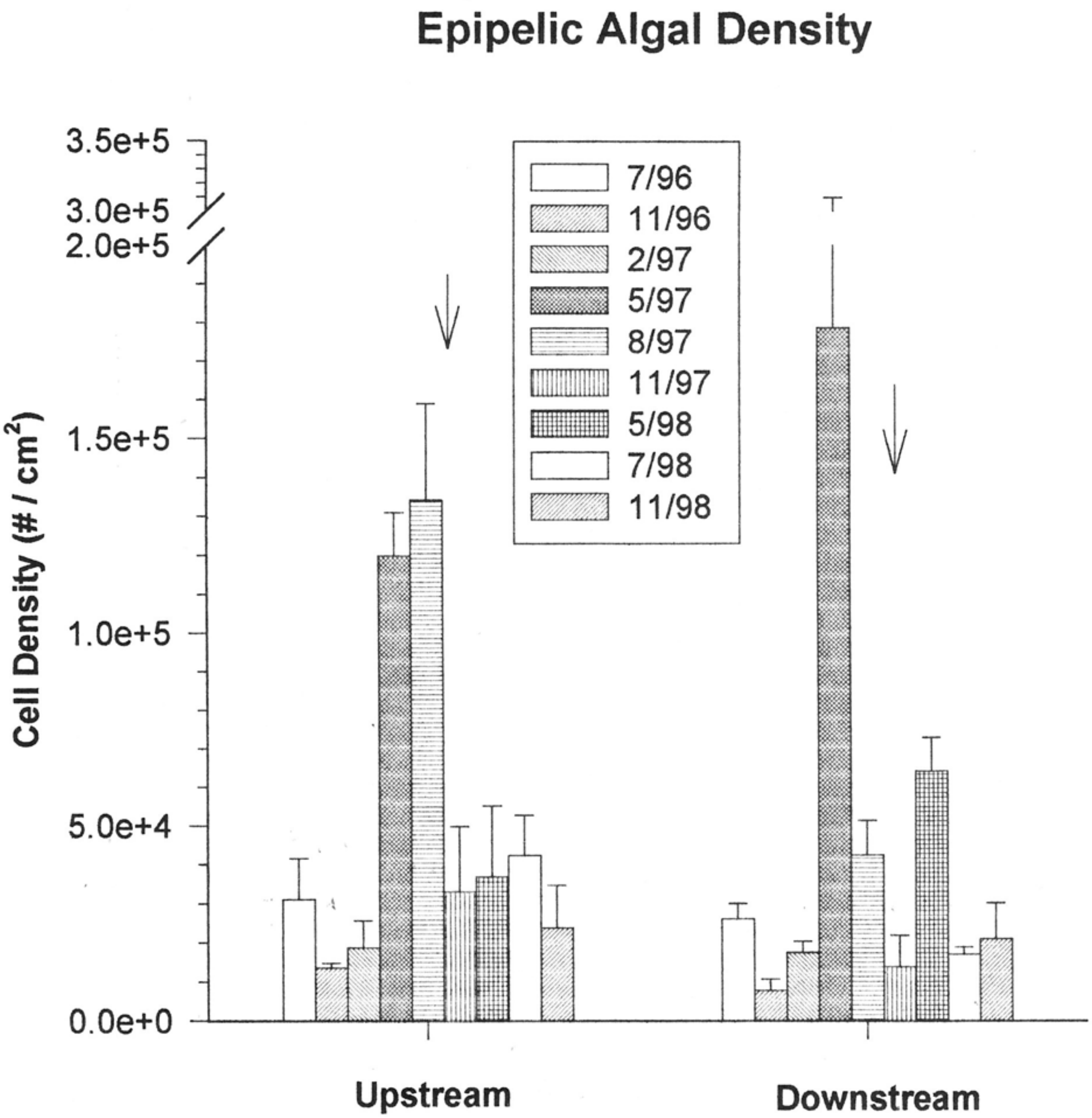

Epipelic Algal Density
3.5e+5
3.0e+5
2.0e+5
1.5e+5
1.0e+5
5.0e+4
0.0e+0
Cell Density (# / cm2)
7/96
11/96
2/97
5/97
8/97
11/97
5/98
7/98
11/98
Upstream
Downstream

Figure 34

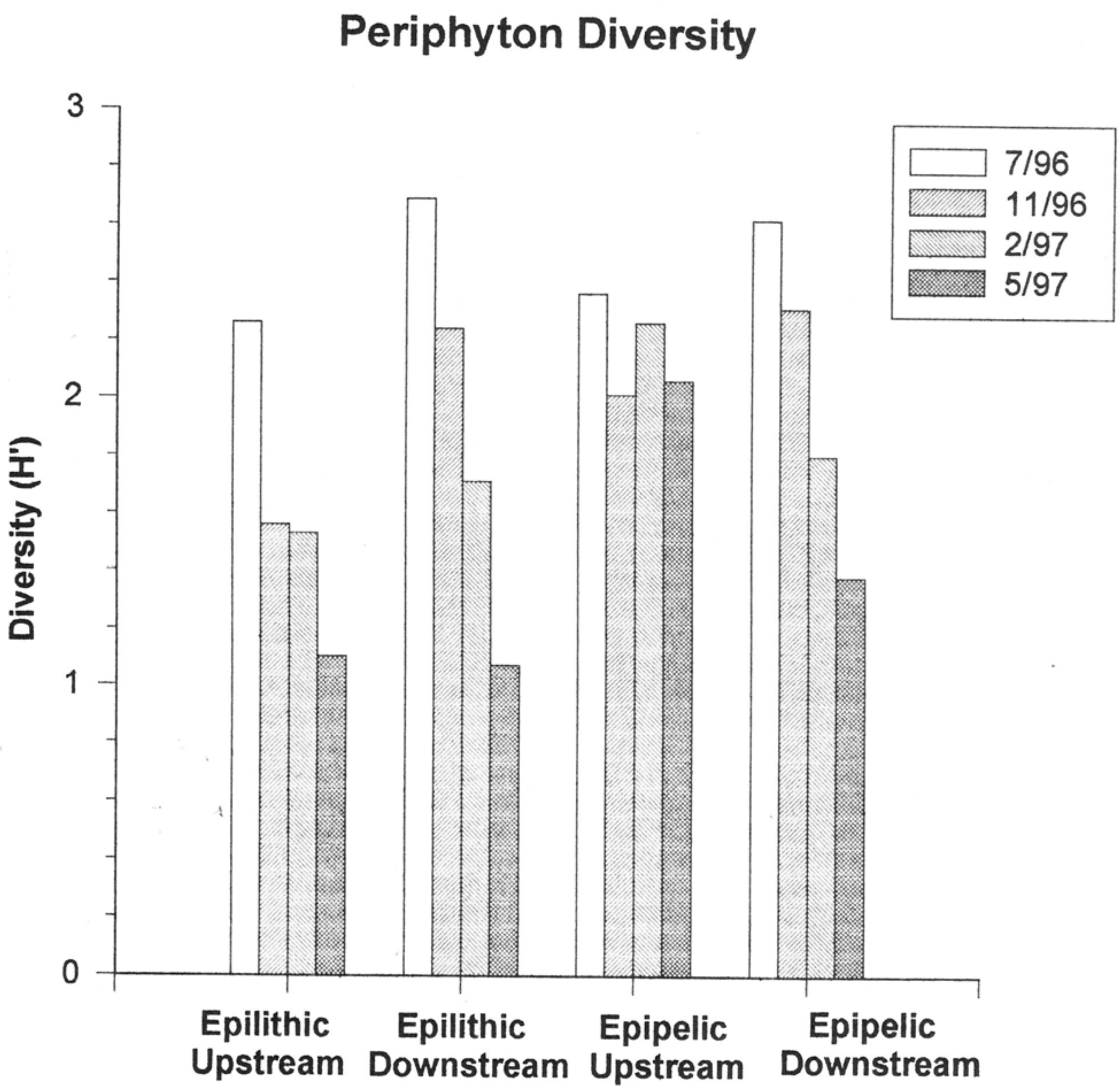

Periphyton Diversity
3
2
1
0
Diversity (H')
7/96
11/96
2/97
5/97
Epilithic Upstream
Epilithic Downstream
Epipelic Upstream
Epipelic Downstream

Figure 35

Table 1. Mean macroinvertebrate species composition in riffle areas (3reps pooled). 1.0 = 100%
up=upstream, dn=downstream samples.

Label	up0796	dn0796	up1196	dn1196	up0297	dn0297	up0597	dn0597	up0897	dn0897
Taxon										
Tipulidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0215	0.0000
Antocha	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hexatoma	0.0000	0.0000	0.0210	0.1000	0.0000	0.1000	0.1481	0.6670	0.1083	0.0000
Tipula	0.0000	0.1818	0.0210	0.0000	0.0642	0.0000	0.0741	0.0000	0.0000	0.0190
Limnophila	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hemerodroma	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Chrionomidae	0.1000	0.0909	0.0430	0.0500	0.1615	0.2000	0.0370	0.0000	0.0215	0.0390
Simulidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Simulium	0.0000	0.0000	0.0000	0.0500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Primocera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Atherix	0.3000	0.2727	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Certatogonidae	0.0000	0.0000	0.0000	0.0000	0.0973	0.0000	0.0000	0.0000	0.0000	0.0000
Shaeromias	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Dicranota	0.0000	0.0000	0.0000	0.0000	0.0321	0.0000	0.0000	0.0000	0.0000	0.0000
Chironom. pup.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Rhyacophila	0.0000	0.0000	0.0430	0.0000	0.0321	0.0000	0.0000	0.0000	0.0000	0.0000
Hydropsyche	0.0000	0.0000	0.4260	0.0000	0.0642	0.1000	0.1481	0.0000	0.2400	0.5000
Cheumatopsyche	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0370	0.0000	0.0000	0.0190
Diplectrona	0.2000	0.0000	0.0850	0.0000	0.1946	0.0000	0.3704	0.0000	0.2819	0.4230
Macrostemum	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ceralcula	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Potamyia	0.0000	0.0000	0.0210	0.0000	0.0321	0.1000	0.0000	0.0000	0.0000	0.0000
Dolophilodes	0.0000	0.0909	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pschomia	0.0000	0.0000	0.0210	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Limnephilidae	0.0000	0.0000	0.0210	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pycnopsyche	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Chyranda	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0370	0.0000	0.0000	0.0000
Apatania	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Elimidae	0.0000	0.0000	0.0000	0.0000	0.0321	0.0000	0.0000	0.0000	0.0439	0.0000
Stenelmis	0.0000	0.0909	0.0000	0.0000	0.0000	0.0000	0.0370	0.0000	0.0000	0.0000
Dubiraphia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0439	0.0000
Optioservus	0.0000	0.0000	0.0000	0.0000	0.0321	0.0000	0.0000	0.0000	0.0000	0.0000
Nigronia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sialis	0.0000	0.0000	0.0000	0.0000	0.0321	0.0000	0.0000	0.0000	0.0000	0.0000
Neohermus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0215	0.0000
Hetageniidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0654	0.0000
Stenonema	0.0000	0.0000	0.0430	0.0000	0.0000	0.0000	0.0370	0.0000	0.0000	0.0000
Stenacron	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Leptophlediidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Plecoptera	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Isoperla	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Peltoperla	0.0000	0,0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Utaperla	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0370	0.0000	0.1522	0.0000
Leuctra	0.2000	0.2727	0.0000	0.0000	0.0321	0.2000	0.0000	0.3330	0.0000	0.0000
Capnidae	0.0000	0.0000	0.2550	0.7000	0.0321	0.1000	0.0000	0.0000	0.0000	0.0000
Goera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Leptophlebia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Dasyhelia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
New Tipulid sp	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Calopteryx	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Boyeria	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Amphipoda	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0370	0.0000	0.0000	0.0000
Pisidium	0.0000	0.0000	0.0000	0.0000	0.0000	0.1000	0.0000	0.0000	0.0000	0.0000
Oligochaeta	0.0000	0.0000	0.0000	0.1000	0.0973	0.1000	0.0000	0.0000	0.0000	0.0000

Table 1

Table 1. Continued.

Label	up1197	dn1197	up0298	dn0298	up0598	dn0598	up0798	dn0798	up1198	dn1198
Taxon										
Tipulidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Antocha	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hexatoma	0.1670	0.0000	0.0616	0.1000	0.0000	0.0000	0.0416	0.0000	0.0505	0.0000
Tipula	0.0830	0.3636	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0247	0.0139
Limnophila	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hemerodroma	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0124	0.0000
Chrionomidae	0.1670	0.0000	0.1867	0.0000	0.0000	0.0000	0.0416	0.0000	0.0124	0.1353
Simulidae	0.0000	0.2727	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Simulium	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Primocera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0371	0.0000
Atherix	0.1670	0.0909	0.1867	0.0000	0.0000	0.0000	0.0132	0.0000	0.0000	0.0000
Certatogonidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Shaeromias	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0139
Dicranota	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Chironom. pup.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0629	0.0000
Rhyacophila	0.0000	0.0000	0.0000	0.1000	0.0000	0.0000	0.0132	0.0230	0.0000	0.0000
Hydropsyche	0.2500	0.1818	0.1867	0.4000	0.0000	0.0000	0.7675	0.8849	0.2763	0.2826
Cheumatopsyche	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1258	0.3234
Diplectrona	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1371	0.0000
Macrostemum	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0139
Ceralcula	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Potamyia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1075
Dolophilodes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pschomia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Limnephilidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pycnopsyche	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0132	0.0000	0.0000	0.0000
Chyranda	0.0830	0.0000	0.1291	0.1000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000
Apatania	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0876	0.0000
Elimidae	0.0000	0.0000	0.0000	0.1000	0.0000	0.0000	0.0000	0.0230	0.0000	0.0000
Stenelmis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Dubiraphia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Optioservus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0132	0.0000	0.0000	0.0139
Nigronia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0230	0.0000	0.0000
Sialis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0274	0.0000	0.0124	0.0000
Neohermus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hetageniidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stenonema	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stenacron	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0247	0.0000
Leptophlediidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0371	0.0000
Plecoptera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Isoperla	0.0830	0.0000	0.1867	0.1000	0.0000	0.0000	0.0690	0.0460	0.0000	0.0000
Peltoperla	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Utaperla	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0371	0.0000
Leuctra	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0247	0.0000
Capnidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Goera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0247	0.0269
Leptophlebia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0139
Dasyhelia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0408
New Tipulidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Calopteryx	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Boyeria	0.0000	0.0000	0.0626	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Amphipoda	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pisidium	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Oligochaeta	0.0000	0.0909	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0124	0.0000

Table 1 (cont.)

Table 1. Continued

Label	up0299	dn0299	up0599	dn0599
Taxon				
Tipulidae	0.0000	0.0000	0.0000	0.0000
Antocha	0.0000	0.0000	0.0000	0.2861
Hexatoma	0.0000	0.0000	0.0000	0.1426
Tipula	0.0906	0.0000	0.1427	0.0000
Limnophila	0.0906	0.0000	0.0000	0.0000
Hemerodroma	0.0000	0.0000	0.0000	0.0000
Chrionomidae	0.0000	0.0000	0.0000	0.0000
Simulidae	0.0000	0.0000	0.0000	0.0000
Simulium	0.0000	0.0000	0.0000	0.0000
Primocera	0.0000	0.0000	0.0000	0.0000
Atherix	0.0000	0.0000	0.0000	0.0000
Certatogonidae	0.0000	0.0000	0.0000	0.0000
Shaeromias	0.0000	0.0000	0.0000	0.0000
Dicranota	0.0000	0.0000	0.0000	0.0000
Chironom. pup.	0.2739	0.0628	0.0000	0.0000
Rhyacophila	0.0000	0.0628	0.0000	0.0000
Hydropsyche	0.0000	0.0000	0.1427	0.1426
Cheumatopsyche	0.0000	0.1874	0.0000	0.0000
Diplectrona	0.0000	0.5613	0.4291	0.2861
Macrostemum	0.0000	0.0000	0.0000	0.0000
Ceralcula	0.0000	0.0000	0.0000	0.0000
Potamyia	0.0000	0.0000	0.0000	0.0000
Dolophilodes	0.0000	0.0000	0.0000	0.0000
Pachomia	0.0000	0.0000	0.0000	0.0000
Limnephilidae	0.0000	0.0000	0.0000	0.0000
Pycnopsyche	0.0000	0.0000	0.0000	0.0000
Chyranda	0.0000	0.0000	0.0000	0.0000
Apatania	0.0000	0.0000	0.0000	0.0000
Elimidae	0.0000	0.0000	0.0000	0.0000
Stenelmis	0.0000	0.0000	0.0000	0.0000
Dubiraphia	0.0000	0.0000	0.0000	0.0000
Optioservus	0.0000	0.0000	0.0000	0.0000
Nigronia	0.0000	0.0000	0.0000	0.0000
Sialis	0.0000	0.0000	0.0000	0.0000
Neohermus	0.0000	0.0000	0.0000	0.0000
Hetageniidae	0.0000	0.0000	0.0000	0.0000
Stenonema	0.0000	0.0000	0.0000	0.0000
Stenacron	0.0000	0.0000	0.0000	0.0000
Leptophlediidae	0.0000	0.0000	0.0000	0.0000
Plecoptera	0.0000	0.0628	0.0000	0.0000
Isoperla	0.0000	0.0000	0.0000	0.0000
Peltoperla	0.0000	0.0000	0.1427	0.1426
Utaperla	0.0000	0.0000	0.0000	0.0000
Leuctra	0.3635	0.0000	0.0000	0.0000
Capnidae	0.0000	0.0000	0.0000	0.0000
Goera	0.0000	0.0000	0.0000	0.0000
Leptophlebia	0.0000	0.0000	0.0000	0.0000
Dasyhelia	0.0000	0.0000	0.0000	0.0000
New Tipulidae	0.0000	0.0000	0.1427	0.0000
Calopteryx	0.0000	0.0000	0.0000	0.0000
Boyeria	0.0000	0.0000	0.0000	0.0000
Amphipoda	0.0000	0.0000	0.0000	0.0000
Pisidium	0.0000	0.0000	0.0000	0.0000
Oligochaeta	0.1813	0.0628	0.0000	0.0000

Table 2. Macroinvertebrate species composition in pools of Big Run Creek. 1.0 = 100%
Up=upstream sample, dn=downstream sample.

Label	up0796	dn0796	up1196	dn1196	up0297	dn0297	up0597	dn0597	up1197	up0298
Species										
Hexatoma	0.0000	0.0000	0.0771	0.0000	0.1333	0.0000	0.2504	0.0000	0.0000	0.6659
Tipula	0.0000	0.0000	0.0771	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Diptera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Chironomidae	1.0000	1.0000	0.5380	0.8843	0.0000	0.8603	0.7496	1.0000	1.0000	0.0000
Tabanus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Atherix	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ceratopogonidae	0.0000	0.0000	0.0000	0.0231	0.1333	0.0465	0.0000	0.0000	0.0000	0.0000
Dicranota	0.0000	0.0000	0.0000	0.0000	0.6001	0.0233	0.0000	0.0000	0.0000	0.0000
Chironom. pup.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3341
Pychoptera	0.0000	0.0000	0.0000	0.0058	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Trichoptera	0.0000	0.0000	0.0000	0.0058	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Limnephilidae	0.0000	0.0000	0.0771	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Elmidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0233	0.0000	0.0000	0.0000	0.0000
Sialis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Utaperla	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Leuctra	0.0000	0.0000	0.2307	0.0174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Leptophlebia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cordulegaster	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Isopoda	0.0000	0.0000	0.0000	0.0058	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Oligochaeta	0.0000	0.0000	0.0000	0.0462	0.1333	0.0465	0.0000	0.0000	0.0000	0.0000

Label	dn0298	up0598	dn0598	up0798	dn0798	up1198	up0299	dn0299	dn0599
Species									
Hexatoma	0.1666	0.0000	0.6659	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tipula	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Diptera	0.0000	0.0000	0.3341	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Chironomidae	0.6663	1.0000	0.0000	0.0000	0.9164	0.1819	0.9033	0.7776	1.0000
Tabanus	0.0000	0.0000	0.0000	0.0000	0.0000	0.2729	0.0967	0.0000	0.0000
Atherix	0.0836	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ceratopogonidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Dicranota	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Chironom. pup.	0.0000	0.0000	0.0000	0.7675	0.0418	0.0000	0.0000	0.0000	0.0000
Pychoptera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Trichoptera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Limnephilidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Elmidae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sialis	0.0836	0.0000	0.0000	0.2325	0.0000	0.0000	0.0000	0.0000	0.0000
Utaperla	0.0000	0.0000	0.0000	0.0000	0.0000	0.0910	0.0000	0.0000	0.0000
Leuctra	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Leptophlebia	0.0000	0.0000	0.0000	0.0000	0.0000	0.3632	0.0000	0.0000	0.0000
Cordulegaster	0.0000	0.0000	0.0000	0.0000	0.0418	0.0000	0.0000	0.0000	0.0000
Isopoda	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Oligochaeta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2224	0.0000

Table 2

Table 3. Taxonomic composition of epilithic periphyton (3 reps pooled). 1=100%
Codes for species ID are in Table 5.

Label	UP 7/96	DN 7/96	UP11/96	DN 11/96	UP 2/97	DN 2/97	UP 5/97	DN 5/97
Class size	3	3	3	3	3	3	3	3
Species ID								
100	0.0077	0.0013	0.0000	0.0062	0.0000	0.0002	0.0014	0.0000
102	0.2491	0.1436	0.4375	0.3036	0.2112	0.1071	0.1256	0.0670
105	0.0000	0.0000	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000
109	0.0000	0.0010	0.0000	0.0020	0.0000	0.0007	0.0000	0.0000
111	0.0000	0.0010	0.0000	0.0018	0.0003	0.0000	0.0000	0.0000
113	0.0015	0.0000	0.0000	0.0020	0.0000	0.0000	0.0000	0.0000
114	0.0000	0.0000	0.0000	0.0000	0.0005	0.0002	0.0000	0.0000
115	0.0177	0.0237	0.0000	0.0000	0.0048	0.0057	0.0056	0.0088
116	0.0000	0.0000	0.0000	0.0020	0.0000	0.0005	0.0000	0.0000
117	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
118	0.0012	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
119	0.0000	0.0000	0.0000	0.0063	0.0000	0.0003	0.0003	0.0000
121	0.0084	0.0085	0.0010	0.0112	0.0007	0.0007	0.0033	0.0006
122	0.0000	0.0019	0.0000	0.0000	0.0000	0.0000	0.0008	0.0004
125	0.0000	0.0000	0.0000	0.0037	0.0008	0.0000	0.0005	0.0000
128	0.0000	0.0034	0.0005	0.0018	0.0011	0.0011	0.0032	0.0000
135	0.0000	0.0022	0.0005	0.0054	0.0000	0.0030	0.0007	0.0002
137	0.0009	0.0038	0.0000	0.0005	0.0000	0.0002	0.0005	0.0000
139	0.0000	0.0000	0.0000	0.0028	0.0000	0.0000	0.0000	0.0000
140	0.0368	0.0193	0.0010	0.0084	0.0013	0.0003	0.0000	0.0007
141	0.0000	0.0036	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000
142	0.0089	0.0036	0.0124	0.0137	0.0017	0.0042	0.0000	0.0000
147	0.0387	0.0144	0.0907	0.1212	0.0457	0.0617	0.0120	0.0133
148	0.2748	0.0956	0.3205	0.2830	0.4907	0.4216	0.7320	0.7388
149	0.0000	0.0000	0.0000	0.0000	0.0000	0.0019	0.0000	0.0000
160	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
162	0.1869	0.2648	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
163	0.0000	0.0051	0.0010	0.0021	0.0000	0.0020	0.0000	0.0010
164	0.0000	0.0000	0.0000	0.0000	0.0023	0.0033	0.0000	0.0000
167	0.0000	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
171	0.0134	0.0132	0.0044	0.0031	0.0020	0.0000	0.0059	0.0009
174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
176	0.0150	0.0090	0.0038	0.0305	0.0113	0.0035	0.0023	0.0004
177	0.0000	0.0000	0.0000	0.0010	0.0004	0.0000	0.0000	0.0000
178	0.0000	0.0000	0.0000	0.0025	0.0000	0.0000	0.0000	0.0000
179	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000
182	0.0045	0.0049	0.0007	0.0084	0.0004	0.0113	0.0032	0.0000
183	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000
184	0.0025	0.0065	0.0000	0.0000	0.0003	0.0050	0.0000	0.0000
185	0.0046	0.0033	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002
189	0.0000	0.0000	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000
192	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
194	0.0007	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
198	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000
200	0.0009	0.0019	0.0005	0.0000	0.0000	0.0004	0.0000	0.0000
201	0.0029	0.0017	0.0010	0.0055	0.0011	0.0002	0.0020	0.0000
205	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000
206	0.0022	0.0051	0.0035	0.0000	0.0000	0.0000	0.0000	0.0000
207	0.0000	0.0075	0.0000	0.0000	0.0005	0.0002	0.0002	0.0000
208	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000
224	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000
228	0.0000	0.0000	0.0014	0.0020	0.0000	0.0000	0.0000	0.0000
230	0.0000	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
235	0.0000	0.0000	0.0015	0.0005	0.0000	0.0000	0.0003	0.0002
236	0.0000	0.0000	0.0000	0.0077	0.0002	0.0010	0.0019	0.0025
238	0.0117	0.0302	0.0010	0.0100	0.0009	0.0013	0.0135	0.0044
239	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000
240	0.0096	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
242	0.0000	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
244	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000
245	0.0000	0.0000	0.0010	0.0000	0.0000	0.0002	0.0025	0.0000
247	0.0000	0.0000	0.0024	0.0013	0.0011	0.0003	0.0011	0.0000
248	0.0035	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
249	0.0015	0.0017	0.0000	0.0018	0.0000	0.0000	0.0000	0.0000
250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0034	0.0002
251	0.0000	0.0000	0.0000	0.0019	0.0000	0.0000	0.0000	0.0000
253	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000
255	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004
259	0.0000	0.0026	0.0000	0.0005	0.0000	0.0006	0.0000	0.0009
260	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0005	0.0000
263	0.0000	0.0000	0.0000	0.0000	0.0003	0.0006	0.0000	0.0000
264	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
265	0.0024	0.0010	0.0000	0.0000	0.0000	0.0021	0.0000	0.0000
267	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000

Table 3

268	0.0000	0.0000	0.0089	0.0106	0.0000	0.0000	0.0000	0.0000
269	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000
277	0.0015	0.0039	0.0000	0.0000	0.0000	0.0000	0.0003	0.0001
278	0.0207	0.0177	0.0024	0.0029	0.0000	0.0000	0.0022	0.0000
283	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002
289	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
292	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
293	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000
295	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000
297	0.0015	0.0036	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
298	0.0000	0.0054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
299	0.0000	0.0055	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000
301	0.0047	0.0000	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000
302	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000
304	0.0015	0.0070	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
305	0.0072	0.0017	0.0060	0.0152	0.0013	0.0017	0.0053	0.0004
308	0.0000	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
311	0.0247	0.1166	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
312	0.0000	0.0007	0.0737	0.0722	0.0504	0.1233	0.0000	0.0510
313	0.0091	0.0968	0.0073	0.0116	0.0046	0.0017	0.0000	0.0000
314	0.0000	0.0101	0.0055	0.0120	0.1532	0.2260	0.0624	0.0042
315	0.0015	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
316	0.0116	0.0009	0.0014	0.0013	0.0000	0.0000	0.0000	0.0000
317	0.0007	0.0047	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
318	0.0007	0.0046	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
319	0.0007	0.0086	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
320	0.0000	0.0000	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000
321	0.0000	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
322	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
323	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
324	0.0000	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
325	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
326	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000
327	0.0000	0.0000	0.0000	0.0023	0.0000	0.0000	0.0000	0.0780
328	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000
329	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000
330	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000
331	0.0000	0.0000	0.0000	0.0005	0.0007	0.0000	0.0000	0.0000
332	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000
333	0.0000	0.0000	0.0000	0.0000	0.0085	0.0037	0.0000	0.0000
334	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000
335	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	0.0000	0.0000
336	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
337	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000
338	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000
339	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000
340	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0087
341	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0163
342	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000
359	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
373	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000
379	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
380	0.0000	0.0000	0.0000	0.0019	0.0000	0.0000	0.0000	0.0000
382	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000
383	0.0000	0.0000	0.0000	0.0052	0.0000	0.0000	0.0000	0.0000
384	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000
385	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000

Table 3 (cont.)

Table 4. Taxonomic composition of epipelic periphyton (3 reps pooled). 1=100%
Codes for species ID are in Table 5.

Label	UP 7/96	DN 7/96	UP11/96	DN 11/96	UP 2/97	DN 2/97	UP 5/97	DN 5/97
Class size	3	3	3	3	3	3	3	2
Species ID								
100	0.0061	0.0007	0.0065	0.0096	0.0132	0.0057	0.0081	0.0008
102	0.4482	0.3441	0.1898	0.1625	0.1992	0.0897	0.2041	0.0732
104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
105	0.0000	0.0000	0.0000	0.0010	0.0017	0.0000	0.0000	0.0000
107	0.0000	0.0000	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000
109	0.0000	0.0000	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000
114	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	0.0000	0.0000
115	0.0000	0.0056	0.0092	0.0184	0.0115	0.0129	0.0079	0.0031
116	0.0018	0.0000	0.0019	0.0052	0.0012	0.0000	0.0050	0.0000
119	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0100	0.0000
121	0.0160	0.0268	0.0295	0.0278	0.0447	0.0338	0.0367	0.0106
122	0.0000	0.0000	0.0009	0.0000	0.0033	0.0022	0.0024	0.0027
125	0.0000	0.0024	0.0005	0.0013	0.0000	0.0011	0.0000	0.0000
126	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
128	0.0027	0.0000	0.0000	0.0026	0.0038	0.0039	0.0017	0.0031
131	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0000
132	0.0000	0.0000	0.0000	0.0019	0.0000	0.0004	0.0000	0.0000
135	0.0053	0.0054	0.0271	0.0033	0.0039	0.0017	0.0048	0.0010
137	0.0009	0.0016	0.0000	0.0000	0.0000	0.0000	0.0050	0.0000
139	0.0016	0.0016	0.0015	0.0026	0.0006	0.0000	0.0000	0.0000
140	0.0392	0.0233	0.0131	0.0038	0.0222	0.0058	0.0105	0.0054
141	0.0000	0.0000	0.0013	0.0000	0.0000	0.0000	0.0053	0.0000
142	0.0162	0.0101	0.0137	0.0177	0.0065	0.0087	0.0081	0.0029
147	0.0226	0.0135	0.0000	0.0000	0.0000	0.0068	0.0000	0.0069
148	0.1300	0.0805	0.5101	0.4234	0.4442	0.6350	0.4696	0.6939
149	0.0000	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
154	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0918
160	0.0000	0.0000	0.0004	0.0005	0.0000	0.0003	0.0000	0.0000
162	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	0.0000	0.0000
163	0.0043	0.0049	0.0013	0.0013	0.0129	0.0078	0.0251	0.0000
164	0.0000	0.0000	0.0000	0.0000	0.0013	0.0017	0.0000	0.0000
167	0.0000	0.0016	0.0000	0.0038	0.0000	0.0003	0.0010	0.0000
169	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000
171	0.0328	0.0305	0.0292	0.0193	0.0309	0.0110	0.0457	0.0110
173	0.0018	0.0000	0.0000	0.0010	0.0000	0.0010	0.0000	0.0000
174	0.0000	0.0000	0.0005	0.0000	0.0010	0.0000	0.0000	0.0000
176	0.0268	0.0297	0.0247	0.0148	0.0194	0.0065	0.0316	0.0087
177	0.0000	0.0008	0.0000	0.0007	0.0000	0.0007	0.0000	0.0000
179	0.0000	0.0000	0.0019	0.0000	0.0022	0.0021	0.0000	0.0000
181	0.0000	0.0000	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000
182	0.0132	0.0127	0.0041	0.0057	0.0180	0.0071	0.0005	0.0000
184	0.0000	0.0000	0.0019	0.0091	0.0032	0.0010	0.0000	0.0000
185	0.0000	0.0000	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000
189	0.0037	0.0074	0.0063	0.0024	0.0000	0.0007	0.0041	0.0014
190	0.0018	0.0022	0.0000	0.0013	0.0006	0.0000	0.0000	0.0000
195	0.0000	0.0000	0.0022	0.0005	0.0000	0.0007	0.0000	0.0000
198	0.0000	0.0000	0.0013	0.0000	0.0011	0.0000	0.0000	0.0000
200	0.0000	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
201	0.0280	0.0291	0.0016	0.0086	0.0037	0.0035	0.0131	0.0017
206	0.0000	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
207	0.0000	0.0042	0.0000	0.0046	0.0023	0.0015	0.0000	0.0000
209	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003	0.0000	0.0000
210	0.0000	0.0000	0.0000	0.0038	0.0000	0.0000	0.0000	0.0000
215	0.0028	0.0016	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000
222	0.0000	0.0000	0.0054	0.0000	0.0000	0.0000	0.0000	0.0000
224	0.0000	0.0000	0.0000	0.0000	0.0012	0.0000	0.0022	0.0000
228	0.0000	0.0033	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000
235	0.0141	0.0048	0.0035	0.0075	0.0105	0.0027	0.0050	0.0021
236	0.0018	0.0000	0.0023	0.0000	0.0012	0.0015	0.0010	0.0017
238	0.0174	0.0577	0.0189	0.1038	0.0187	0.0100	0.0268	0.0182
239	0.0009	0.0009	0.0024	0.0005	0.0017	0.0058	0.0000	0.0004
240	0.0000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
243	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0067	0.0000
244	0.0041	0.0000	0.0000	0.0000	0.0005	0.0010	0.0004	0.0000
245	0.0000	0.0016	0.0000	0.0000	0.0012	0.0020	0.0000	0.0017
247	0.0000	0.0000	0.0065	0.0361	0.0066	0.0046	0.0011	0.0040
248	0.0009	0.0016	0.0000	0.0020	0.0011	0.0000	0.0000	0.0000
249	0.0081	0.0039	0.0017	0.0022	0.0000	0.0017	0.0000	0.0019
250	0.0051	0.0048	0.0000	0.0000	0.0000	0.0000	0.0004	0.0025
251	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0008
253	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0018	0.0000
255	0.0000	0.0000	0.0004	0.0000	0.0006	0.0003	0.0000	0.0000
256	0.0000	0.0000	0.0030	0.0010	0.0012	0.0000	0.0004	0.0004
258	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	0.0000	0.0000
259	0.0000	0.0000	0.0013	0.0018	0.0034	0.0041	0.0004	0.0022
260	0.0000	0.0000	0.0000	0.0000	0.0032	0.0040	0.0005	0.0017
262	0.0000	0.0000	0.0004	0.0000	0.0027	0.0036	0.0007	0.0000
263	0.0000	0.0000	0.0000	0.0000	0.0043	0.0044	0.0032	0.0017

265	0.0035	0.0008	0.0036	0.0109	0.0017	0.0000	0.0023	0.0010
266	0.0000	0.0000	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000
267	0.0000	0.0007	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000
269	0.0000	0.0009	0.0000	0.0019	0.0000	0.0027	0.0000	0.0000
270	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
275	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000	0.0004	0.0008
276	0.0026	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008
277	0.0027	0.0008	0.0011	0.0010	0.0055	0.0033	0.0036	0.0066
278	0.0159	0.0294	0.0067	0.0100	0.0027	0.0026	0.0087	0.0058
279	0.0055	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000
281	0.0000	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000
282	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000
283	0.0027	0.0008	0.0008	0.0013	0.0006	0.0007	0.0043	0.0000
286	0.0008	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
287	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0000
289	0.0000	0.0000	0.0013	0.0000	0.0011	0.0007	0.0000	0.0000
290	0.0000	0.0008	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000
291	0.0046	0.0048	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000
293	0.0000	0.0000	0.0016	0.0000	0.0016	0.0000	0.0010	0.0000
295	0.0000	0.0000	0.0000	0.0000	0.0069	0.0052	0.0000	0.0000
297	0.0000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
299	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000
301	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
304	0.0000	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
305	0.0063	0.0043	0.0222	0.0157	0.0098	0.0199	0.0155	0.0155
312	0.0027	0.0000	0.0000	0.0000	0.0131	0.0139	0.0000	0.0020
313	0.0583	0.1394	0.0064	0.0066	0.0064	0.0061	0.0000	0.0000
314	0.0027	0.0000	0.0041	0.0023	0.0017	0.0000	0.0044	0.0000
316	0.0000	0.0009	0.0022	0.0038	0.0000	0.0000	0.0000	0.0000
317	0.0000	0.0029	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
327	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0042
328	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	0.0000
330	0.0000	0.0029	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
332	0.0000	0.0000	0.0000	0.0020	0.0000	0.0000	0.0000	0.0000
333	0.0000	0.0000	0.0101	0.0073	0.0250	0.0343	0.0000	0.0000
342	0.0108	0.0057	0.0000	0.0007	0.0000	0.0000	0.0000	0.0000
343	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
344	0.0018	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
345	0.0009	0.0017	0.0004	0.0000	0.0005	0.0020	0.0000	0.0000
346	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
347	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
348	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
349	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
350	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
351	0.0000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
352	0.0000	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
353	0.0000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
354	0.0000	0.0016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
356	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
357	0.0000	0.0549	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
358	0.0000	0.0034	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000
359	0.0000	0.0034	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
360	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
361	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
362	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000
363	0.0000	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000
364	0.0000	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000
365	0.0000	0.0000	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000
367	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000
368	0.0000	0.0000	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000
369	0.0000	0.0000	0.0000	0.0090	0.0000	0.0000	0.0000	0.0000
371	0.0000	0.0000	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000
372	0.0000	0.0000	0.0000	0.0086	0.0000	0.0000	0.0000	0.0000
373	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000
374	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000
375	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
376	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000
377	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000
378	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0055
380	0.0092	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
386	0.0000	0.0000	0.0025	0.0000	0.0000	0.0000	0.0000	0.0000
387	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000
388	0.0000	0.0000	0.0000	0.0000	0.0012	0.0004	0.0000	0.0000
389	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000	0.0007	0.0000
390	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000
391	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000
392	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
393	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000
394	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000
395	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004

Table 4 (cont.)

Table 5. Numeric codes for algal species listed in Tables 3 and 4.

Taxon	Code
Ach childanos	235
Ach cleavii	160
Ach deflexa	161
Ach exigua v. constricta	214
Ach exigua	104
Ach hauckinana rost	261
Ach hustedii	218
Ach lanceolata v. dubia	105
Ach lanceolata	100
Ach lapponica v ninkei	213
Ach linearis	162
Ach marginulata	317
Ach minutissima macro	250
Ach minutissima	102
Ach peragalli	287
Ach saccula	281
Ach. caspierra	338
Ach. helvetica	355
Ach. laveis	354
Ach. minutis. gracillima	306
Ach. pseudoblitera	343
Ach. sp	328
Ach. stewartii	307
Amphora ovalis	107
Amphora sp	332
Amphora sp.	370
Amphora venter	108
Amphoroa perpusilla	109
Anabaena	163
Ankistridesmus	110
Anom serians brach	237
Anom vitrea	236
Astereocystis	337
Audouinella	314
Bacillaria paradoxa	303
Caloneis bacillium	260
Calonies hylina	163
Cladophora	311
Closterium	222
Clostridium	164
Coc. plac. v. euglypta	111
Cosmarium	165
Croococcus	112
Crucigina	166
Cyclotella	167
Cymatopluera solera	168
Cymb amphicephala	224
Cymb angusta	251
Cymb cessatii	280
Cymb cistula	169
Cymb cuspidata	319
Cymb hebreda	252
Cymb laveis	284
Cymb lunata	292
Cymb mexicana	170
Cymb microcephala	285
Cymb minuta	171
Cymb naviculaformis	215
Cymb prostrata	172
Cymb sinuata	113
Cymb tumida	173
Cymb. turgidula	375
Denticula elegans	114

Denticula sp.	365
Diatoma vulg hiemalie	174
Diploneis sp	216
Euglena	349
Eun bilunaris	269
Eun curvata	240
Eun curvata v. capitata	319
Eun elegans	241
Eun exigua	238
Eun implicata	268
Eun intermedia	267
Eun musicola triden	270
Eun negelii	239
Eun sp.	318
Eun tenella	243
Eun vanherk	242
Eun. bilunaris v. microceph	348
Eun. GV	361
Eun. musicola	374
Eun. pectinalis NV	346
Eunotia minor	115
Frag brevistrata v. inflata	118
Frag capucina	217
Frag constr v venter	119
Frag lepto	117
Frag pinata NV	229
Frag pinnata v. lancetula	175
Frag sp	116
Frag vaucheriae	176
Frag virescens	262
Frust rhomb viridula	274
Frust rhomb. v. amphi	316
Frust rhomboides	177
Frust vulg crass	263
Frust weinholdii	302
Gomp acuminatum	120
Gomp afine	227
Gomp angustatum	122
Gomp constriuctum v capitata 123	
Gomp gracile	228
Gomp olivacium	230
Gomp parvulum	121
Gomp sp.	178
Gomp subclavicum	179
Gomp. GV	352
Gongostonium	350
Gryosigma spencerii	180
Gyro modiferum	282
Hantz. amphioxys	359
Kirchneriella?	124
Klebsormidium	312
Melosira distans	258
Melosira islandica	220
Melosira varians	125
Meridon circulare	259
Merismopedia	335
Microspora	327
Mougeotia	339
Nav ?schoreder	323
Nav accomoda	211
Nav agphuphala??	317
Nav arvensis	133
Nav capitata	181
Nav celmintis	131
Nav cryptocephala NV	135
Nav cryptocephala venter	134
Nav crytotenella	265

Table 5 (cont.)

Nav exigua capitata	295
Nav gottlandica	297
Nav gregarica/ secura	182
Nav gynginsingensis	219
Nav indent	183
Nav lanceolata	184
Nav menisculus v. upsalensis or Nav menisculus	186
Nav minima	137
Nav miniscula	185
Nav minnewaukonesis	272
Nav muralis	136
Nav mutica	289
Nav notha	275
Nav odiosa	264
Nav pelliculosa	187
Nav placentula	126
Nav pupula v. minuta	231
Nav pupula	132
Nav pupula v. ellipica	188
Nav radiosa v tenella	130
Nav radiosa NV	127
Nav rhynocephala	189
Nav seminulum	255
Nav simula	273
Nav sp	128
Nav subtillisima	129
Nav symetrica	296
Nav symetrica	190
Nav tripunctata NV	192
Nav viridula v. rostellata	210
Nav. bicephala	308
Nav. cuspidata	336
Nav. secura	368
Nav. viridula	369
Ned. affine v. humurus	334
Nedium affine	286
Nedium bisculatum	256
Nedium iridis	362
Nedium productum	271
Nedium sp	257
Nits communis/Kutz	193
Nitz acicularis	194
Nitz amphibia	195
Nitz apiculata	196
Nitz communis	212
Nitz commutata	276
Nitz dissipata	142
Nitz filiformis	279
Nitz flexoides	320
Nitz fonticula	199
Nitz frust v. perp	200
Nitz frust NV	139
Nitz ganderschmidtensis	197
Nitz gracilis	138
Nitz holstatica	144
Nitz hungarica	209
Nitz linearis	293
Nitz littoralis	198
Nitz nana	245
Nitz palea	140
Nitz paleacea	141
Nitz pellucida	294
Nitz perminuta	315
Nitz recta	208
Nitz romana	143
Nitz sigma	266
Nitz sociablis	322

Table 5 (cont.)

Nitz sp.	201
Nitz sublinearis	298
Nitz. accuminata	347
Nitz. clausii	373
Nitz. dubia	301
Nitz. intermedia	360
Nitz. lencensis?	367
Nitz. obstusa	371
Nitz. perminuta	353
Nodularia	357
Odeogonium	316
Oocystis	333
Opephora martyi	146
Orthoseria roeseana	288
Oscillatoria	147
Pediastrum	201
PGV	305
Phormidium	148
Pinn abaujensis	318
Pinn braunii	321
Pinn caudata	225
Pinn dactylus	246
Pinn divergentissima	291
Pinn mesopleta	254
Pinn microstauron	248
Pinn obscura	249
Pinn sp	253
Pinn subcapitata	247
Pinn. divergens	309
Pinn. GV	358
Pinn. pseudomicrostauron	325
Pinn. subcapitata v. subog	344
Plectorina??	372
Rhoc cruvata	149
Scen bijuga	202
Scen incrasulatus	203
Scen obliquis	150
Scen quadicaudata	204
Scendesmus sp.	378
Sprulina	340
Staur phonecentron	282
Staur smithii	283
Stauroneis anceps	290
Stauroneis kregerii	281
Stig basal cells	152
Stig filament	153
Sur. patella	330
Suri angust	278
Suri linearis	223
Suri minuta	277
Suri ovallis	299
Suri ovata	205
Suriella amphioxys	304
Suriella brebisooni v. kut	342
Suriella sp	329
Symploca	363
Syn radians	351
Syn. puchella lanceolata	310
Synd acus	226
Synd rumpens or rumpens v. familaris	206
Synd tenera	221
Synd ulna	207
Tab flocculosa	244
Tribonema	341
Unknown green	154
Wollea	313

Table 5 (cont.)

Table 6. Percent similarity among epilithic periphyton samples. 100% = all species in common at the same abundance between two samples. 0% = no species in common.

Labels /	UP 7/96	DN 7/96	UP11/96	DN11/96	UP 2/97	DN 2/97	UP 5/97	DN 5/97
UP 7/96	100.0							
DN 7/96	60.9	100.0						
UP11/96	60.5	29.7	100.0					
DN11/96	65.4	34.3	81.1	100.0				
UP 2/97	55.5	29.4	65.2	63.2	100.0			
DN 2/97	45.0	26.5	58.5	56.8	80.2	100.0		
UP 5/97	45.6	29.0	48.5	47.2	70.7	62.3	100.0	
DN 5/97	37.2	20.0	46.1	43.3	63.5	56.9	83.1	100.0

Table 7. Percent similarity among epipelic samples. 100% = all species in common at the same abundance between two samples. 0% = no species in common.

Labels /	UP 7/96	DN 7/96	UP11/96	DN11/96	UP 2/97	DN 2/97	UP 5/97	DN 5/97
UP 7/96	100.0							
DN 7/96	73.3	100.0						
UP11/96	49.6	44.8	100.0					
DN11/96	45.8	44.8	78.0	100.0				
UP 2/97	51.8	46.6	83.8	77.3	100.0			
DN 2/97	34.1	29.9	75.7	66.8	75.0	100.0		
UP 5/97	51.5	47.4	84.9	76.5	84.5	69.9	100.0	
DN 5/97	30.1	24.6	68.4	59.7	62.2	81.4	64.6	100.0

Table 8. Metal concentrations in hydropsychid caddisfly tissue collected 24 July 1996, upstream and downstream in Big Run Creek. Concentrations in caddisflies collected in unimpacted Wolf Creek on 30 July 1997 are given for comparison.

Sample Site	Aluminum (mg/kg)	Iron (mg/kg)	Zinc (mg/kg)
Upstream	892.3	769.2	256.4
Downstream	878.6	357.1	357.1
Wolf Creek	455.4	1024.0	60.2

Jennings Vertical Flow System
Environmental Education & Interpretation Effort

Contributed by: Will Taylor
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Introduction

Awareness, concern and action are a direct result of quality environmental education. This creates a future generation of environmentally educated and concerned citizenry prepared to address complex environmental issues and is the key to gaining support for future watershed improvement projects. The educational opportunities related to this project are both innovative and unique. To our knowledge no other watershed improvement effort has such a strong educational component. These opportunities will continue long after project completion. This will encourage continued research by students and professionals wishing to monitor the effectiveness of the Jennings vertical flow system.

Students, teachers and volunteers played an integral role throughout each stage of this project. Often these individuals could be found working side by side with professionals in the fields of engineering, mining, ecology and system design, providing valuable, real life, hands-on experience that can not be duplicated in the classroom. The participation of these individuals during the development, construction and evaluation of the vertical flow system encouraged an atmosphere conducive to learning and sharing of ideas. The end result is a site accessible to educational institutions and the public which demonstrates the impact of acid mine drainage and the successful treatment of mine drainage with passive technology.

Jennings Environmental Education Center

The catalyst for this project's strong educational component was its location within a state park with a long history of quality environmental education and interpretation. As an environmental education center, the Jennings Center takes on the role of increasing the community's awareness of environmental issues and providing educational opportunities regarding these issues so that the citizenry of the Commonwealth can make informed decisions regarding the environment. Each year Jennings serves the community by providing environmental education opportunities to over 167,000 visitors, 280 schools, 11 colleges and universities and a number of civic organizations.

Jennings saw promise, not disaster, when an abandoned mine began releasing severely polluted acid mine drainage into the park's main tributary in 1984. Rather than ignore the situation, the Jennings Center took a chance and seized the opportunity to make a difference by teaching about a current and significant environmental issue. Dedicated to finding a new and innovative way of correcting the problem, Jennings became the site of one of the first constructed wetlands designed to treat acid mine drainage in 1989. This wetland was quickly incorporated into the educational program allowing thousands of highschool and college students to be introduced to passive treatment as it was being developed. As passive technology adapted to incorporate new ideas and discoveries so to did the educational program. The addition of an anoxic limestone drain in 1992 provided yet another working example of science and technology. That same year the Jennings Water Quality Improvement Coalition was formed, organizing a corps of educators and scientists eager to share ideas and test new theories. The result of these individuals working together was the development and construction of the vertical flow system.

Through the dedication and hard work of countless individuals, agencies and businesses, Jennings is now one of the most unique sites in the world. The site provides fascinating history of a past era of coal mining, demonstrates the impact acid mine drainage can have upon the land and water and showcases three working, passive techniques for treating acid mine drainage. All treatment systems and information are accessible to educational institutions and professionals. Currently thousands of students and educators visit Jennings each year via field trips, workshops and special events to learn about stream ecology, coal, acid mine drainage and passive technology. In 1998 the Jennings Environmental Education Center received the Three Rivers Environmental Award for its innovative educational program that developed as result of a diverse group of dedicated individuals working toward the common goal of improving the watershed.

Colleges and Universities

Grove City College and Slippery Rock University immediately recognized the significance of the project at Jennings. Dr. Dean DeNicola, Dr. Mike Stapleton and Dr. Fred Brenner developed progressive ways to incorporate the vertical flow project into their curriculum.

Slippery Rock students working with Dr. DeNicola began monitoring Big Run, the tributary receiving the destructive drainage. Their research focused on how the addition of the vertical flow system would affect the biological diversity of the stream. Data was collected on Big Run prior to the construction of the system and is continuing to be collected now that the system is in place. Macroinvertebrates and aquatic vegetation are monitored for changes in density and metal uptake.

Also with Slippery Rock University, Dr. Stapleton's students are concentrating on studying the water chemistry of acid mine drainage and how that chemistry is affected by passive treatment. Samples of water are taken to the University's laboratory where they are analyzed. Columns modeling the vertical flow system are constructed so every step of the treatment process can be evaluated and recorded. Students are encouraged to construct their own columns to model any treatment ideas they may have. Throughout the semester students monitor these columns to research the effectiveness of different treatment options.

Dr. Brenner encourages his Grove City College students to study different passive technologies, such as the vertical flow system, and to develop their own methods of treating mine drainage. The students then use the Jennings site as an outdoor laboratory to construct working models of their ideas. Currently a small scale model of a cattail wetland is in place. Chemical composition of influent and effluent is analyzed and monitored to identify any changes.

All students are invited to present their findings to professionals in the fields of mining and reclamation at an annual symposium hosted by the Slippery Rock Watershed Coalition at the Jennings Environmental Education Center.

In addition to exciting research projects many of these students were involved in the actual construction of the vertical flow system. They eagerly installed piping, constructed the overdrain and underdrain system, checked elevations, and shoveled stone and compost. The ability to apply what they were researching and to see the results of their efforts work, was truly a unique and valuable experience.

The Jennings site will continue to act as a site for colleges and universities to try new ideas that, if successful, may be applied to the watershed in the future.

Girl Scouts and Homeschool Students

Charles Cooper, of CDS Associates Inc,. has taken it upon himself to provide several homeschool students and Girl Scouts with an opportunity to gain valuable hands-on experience that could not be gained in a classroom. Mr. Cooper included these students in virtually every aspect of the design and construction of the system. These students assisted with site surveys, mapping, plan development, water testing, revegetation, building improvements and as built surveys. Several students have presented their work at symposiums, workshops and other events.

Mr. Cooper is currently setting up a temporary laboratory at Jennings where he can train students how to use water analysis equipment. This equipment will be used to analyze water samples taken in the watershed.

Many of these students plan to continue studying environmental science and engineering in college.

Annual Symposium

Every spring the Slippery Rock Watershed Coalition hosts a symposium at the Jennings Environmental Education Center. This symposium affords the opportunity for professionals to mingle with students, government to share with industry and the community to become actively involved in their watershed.

The symposium is meant as a forum for sharing ideas, successes and failures and enjoys participants from all over the world. Highschool and college students are actively involved in the symposium. Highschool students participate in activities designed to introduce water quality and passive technologies. College students are invited to present information they have collected during their research within the watershed. Participating students benefit greatly by meeting professionals and making connections with people in their field of interest.

Wayside Exhibits

There is a need to interpret the events that have taken place at Jennings to the casual park visitor with little or no background concerning the abatement of acid mine drainage. This can be accomplished through a series of nonpersonal services such as brochures and wayside exhibits that the park visitor can read at their leisure if interested. Wayside exhibits were developed to interpret the history of coal mining at Jennings, the formation and impact of acid mine drainage and the development of the constructed wetland treatment ponds. These exhibits are located in the kiosk by the lower wetland ponds. Future plans include wayside exhibits interpreting the vertical flow system, anoxic limestone drain and abandoned Brydon mine.

...cy of the Land

...t history past ...s have relied on the ...vive—leaving us a ...and use and abuse. ..., logging, and coal ...affected the area you see before you. This wetland is an attempt to learn from that past and leave a new legacy for the future.

Fuel for Thought

Surrounding you is a network of coal seams mined from 1920 through 1942. The Foltz Hill mine fueled the local economy by providing jobs and a primary source of energy. Coal still provides much of our energy needs. Ninety percent of all coal mined today is used to generate electricity.

A Price to Pay

We pay a price for coal that is not reflected in our electric bill. Although inactive, the Foltz Hill mine continues to impact the land you see. Certain minerals exposed to air and water during mining create a powerful acid capable of dissolving metals from surrounding rock. Known as acid mine drainage, this damaging combination finds its way into streams and can be lethal to plants and animals. This deadly drainage is the most severe polluter of Pennsylvania's waterways, affecting over 2,400 stream miles.

Lessons from the Land

A new generation is also relying on the land to improve our lives. Wetlands, such as these, were the first type of natural system used to treat acid mine drainage.

Coal Calamity

The Foltz Hill mine operated during a time when there were no environmental mining regulations. As a result poisonous drainage and a damaged landscape were left behind, challenging a new generation to solve these problems. Of the many attempts to find a solution, even those that failed taught valuable lessons.

The Dirty Work

Wetlands have always filtered and stored our precious supply of water. But an amazing discovery in the 1970s revealed that wetlands also improved the quality of mine water. Our new understanding of nature's filtering ability lead to the construction of these wetlands in 1988 as a passive method of treating water. Constructed wetlands offer an inexpensive alternative to continuous and costly chemical treatment and help offset the loss of natural wetlands.

Wetlands at Work

1 Silt Removal Pond

This pond collects and slows the mine water, allowing silt to settle out.

2 Wetlands

Layers of compost and limestone nourish plants and host bacteria that lower the acidity and remove metals from mine drainage.

3 More Wetlands

Cattails, once thought to absorb acids and metals from water, provide oxygen and habitat for the helpful bacteria.

4 Finishing Pond

The pond slows the flow of the improved water and provides a new habitat between the wetlands and the stream.