2000-2004 BENTHIC BIOLOGICAL ASSESSMENT OF THE LOWER MILL RIVER, HAMDEN / NEW HAVEN (CT)

prepared for :

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INTRODUCTION

The purpose of this study is to provide baseline information for future management decisions in conjunction with possible alterations to present stream flows. The study provides quantitative and qualitative information about general habitat characteristics and benthic macroinvertebrate community structure at five locations along the lower Mill River in Hamden and New Haven, CT. This study summarizes survey results from 2000 through 2004 (ENSR 2000, 2001, 2002, 2003). It is intended that a review of all data will be conducted before and after the new Whitney water treatment facility comes on line to evaluate any potential impact thresholds. This investigation facilitates that analysis.

METHODS

General methods were consistent among all years of study, beginning in 2000. Samples were collected in June and August of each year, at the peak of the tidal outflow (low tide). In 2004, samples were collected in June, September and October for all stations, and in November for station 1 only. Sampling locations (Figure 1) were the same in each year. Sampling stations were longitudinal stretches, ranging from 85 to 300 ft in length (~25-90 m). Each sampling station was characterized for general habitat and instream water quality at representative sites. A single sample per site was used to determine water quality parameters.

Aquatic habitat was evaluated in a qualitative to semi-quantitative way. This involves a modified version of the USEPA Rapid Bioassessment Protocol (Physical Characterization / Water Quality Assessment) (Barbour et al. 1999). Aquatic habitat characterization included features such as surrounding land use, canopy cover, flow, and substrate composition for each sampling station. Water quality was assessed in a quantitative way with in situ determinations of water temperature, dissolved oxygen content, conductivity, turbidity, and pH at each sampling station.

Timed (two minutes) D-frame dip-net sampling was used to collect macroinvertebrates. This method is commonly used as a multi-habitat rapid bioassessment technique (Barbour et al. 1999). Riffle habitats were sampled, although at higher flows some of these areas could be characterized as run habitats. Macroinvertebrates were captured in the net by dislodging the substrate up to 1 ft (0.3 m) upstream of the dip-net. Two subsamples per sampling station were collected. Each subsample consisted of a two-minute collection, itself comprised of four 30-second collection efforts at four nearby locations within the site. Subsamples were preserved in 70% ethanol for laboratory analysis. Macroinvertebrates were sorted, identified to the lowest practical taxonomic level, and counted. Samples were collected during the period of low tide on both sampling dates each year.

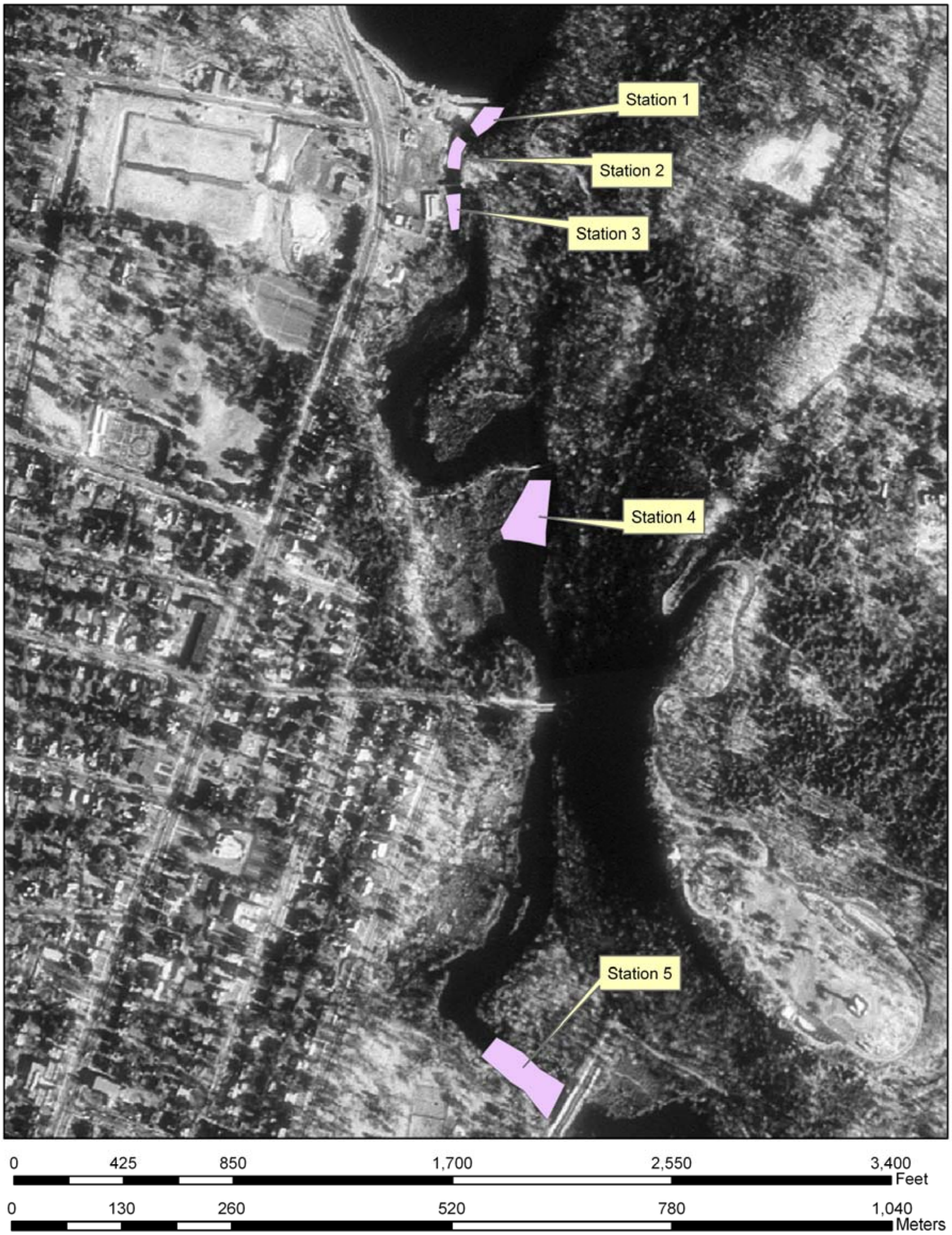

Figure 1. Locations of the five sampling stations along the Lower Mill River in Hamden (stations 1-4) and New Haven (station 5).

The two macroinvertebrate subsamples were analyzed separately, but combined into a single sample per station for data analysis. Variability among subsamples was evident in virtually all surveys, as is expected for such samples, but was not striking in most cases. Numerical analysis included relative abundance and dominance patterns based on taxonomic and feeding groups, species richness, diversity and evenness. Species richness was expressed as number of taxa (S). Species diversity quantifies the degree of dominance (or lack thereof) of taxa within a community; it measures the distribution of individuals among taxa present. When one taxon or a few taxa dominate a community, diversity is low. Species diversity was calculated as the Shannon-Weaver index (H'), but this measure is affected by the number of taxa present. Evenness (Pielou's index J') normalizes H' in relation to number of taxa, and therefore provides the basis for a quantitative diversity comparison between communities with different S values (the scale is always 0 to 1, with 1 indicating the highest normalized diversity). Mathematical descriptions of the indices can be found in Zar (1984).

RESULTS

Habitat Characterization

Predominant land use (forest and residential) and sources of pollution (storm pipes discharging at several locations between stations 2 and 5) were the same in all surveys (Table 1). Sources of pollution to the lower Mill River include combined sewer overflows (CSOs), one of which is located in the study area (East Rock Road). CSOs can have strong but intermittent water quality impacts below station 2. Canopy cover reached a maximum at station 3 and a minimum at station 1. Major shore or bank erosion was not observed.

Flow was estimated or calculated at the spillway of Lake Whitney. Flows on the day of the survey are not necessarily an indication of antecedent conditions, however, and SCCRWA flow records were consulted to categorize the hydrological conditions for two and a half months before each sampling. The spring flows were generally larger than the summer flows (Table 2), as expected, but with considerable variability. Based on factors such as tidal influence and watershed hydrologic characteristics, a wide range of flow conditions might be anticipated at any given time within the study area. Tidal influences are apparent at stations 3, 4 and 5, while variation in flow from Lake Whitney is the more dominant current influence at stations 1 and 2, and often at station 3 as well. While water level changes with tide are evident at station 3, saltwater does not intrude this far upstream. Habitat assessment sheets for all sampling events are included in Appendix A.

Observed instream features changed slightly among years, mainly as a function of altered flows. Spring flows in some years were apparently substantial with pronounced peaks, resulting in apparent wash-out of fine materials and even some gravel at upstream stations, with deposition

Table 1. - Lower Mill River habitat characterization. Ranges are for all samplings in each of June and August. The September 2004 sampling is included with the August data.

	Stn 1		Stn 2		Stn 3		Stn 4		Stn 5	
Parameters	**Jun**	**Aug**	**Jun**	**Aug**	**Jun**	**Aug**	**Jun**	**Aug**	**Jun**	**Aug**
Length of Segment	85 ft (26 m)		150 ft (46 m)		300 ft (91 m)		300 ft (91 m)		300 ft (91 m)	
Watershed/Bank Features										
predominant surrounding land use	forest/residential		forest/residential		forest/residential		forest/residential		forest/residential	
canopy cover	open		some shade (<40%)		mod. Shade (30-80%)		some shade (<40%)		some shade (<40%)	
dominant riparian vegetation	shrubs		shrubs		trees		trees/shrubs		trees	
bank stability [1]	stable		stable		stable		stable		stable	
other notable features	near dam		near dam		downstream of dam		tidal influence		tidal influence	
In-stream Features										
general habitat type (%)										
riffle	100	100	90-100	90-100	0-80	5-95	-	-	-	-
run	-	-	0-10	5-10	20-100	5-95	50-80	20-40	80-95	0-70
pool	-	-	-		-	-	20-50	60-80	5-20	30-100
estimated stream width (ft):	25-100	10-70	25-55	20-65	70-104	80-100	100-130	80-100	100-120	70-100
estimated stream depth (ft):										
riffle	0.5-2.0	0.5-1.0	0.5-2.0	0.2-1.5	0-1.0	0.3-1.0	-	-	-	-
run	-	-	0-1.2	0-1.5	1.0-2.0	0.5-1.5	3.0-3.3	2.0-3.0	2.5-4.0	0-2.5
pool	-	-	-	-	-	-	3.0-4.0	2-4	1.5-4.0	2.5-4.5
inorganic substrate composition[2]										
bedrock	-	-	-	-	-	-	-	-	-	-
boulder (>256 mm)	10	0-10	10	5-10	0-5	5	5	5	1-5	0-5
cobble (64-256 mm)	75-90	70-95	70-90	60-90	10-40	10-45	5-20	10-20	2-15	0-20
gravel (2-64 mm)	10-15	5-20	10-20	10-20	40-80	40-75	5-40	5	20-40	25-60
sand (0.06-2 mm)	-	-	-	0-10	10-15	10-25	45-60	55-60	40-60	30-60
silt (0.004-0.006 mm)	-	-	-	-	-	-	5-20	15-20	7-20	0-15
clay (<0.004 mm)	-	-	-	-	-	-	-	-	-	-
organic substrate composition[2]										
detritus[3]	0-5	5-10	0-5	5-10	5	5-10	5-20	5-10	5-15	5-10
aquatic macrophytes (total)	40-50	30-100	30-50	25-100	10-100	5-80	10-30	15-70	10-60	40-100
filamentous algae	50	20-100	25-50	10-25	10-95	5-20	5-30	10-25	5-60	0-30
water lilies (*Nymphaea, Nuphar*)	-	-	-	-	-	0-20	0-10	0-50	-	-
pondweeds (*Potamogeton spp*) [4]	-	-	0-40	0-80	0-5	0-80	0-20	0-30	0-10	0-100
moss	-	-	0-5	0-15	0-5	-	0-5	-	0-2	0-5
waterweed (*Elodea canadensis*)	-	-	0-25	0-5	0-25	<5-5	0-25	<5-10	0-25	0-20
tidal influence	No	No	No	No	No	No	Yes	Yes	Yes	Yes

(1) stable = minimal evidence of erosion or bank failure

(2) percent coverage

(3) logs, wood, coarse particulate organic matter

(4) *Potamogeton richardsonii* at stn 5 and narrow-leaved species at the other stations.

Table 2. - Average flows at the Lake Whitney dam in spring (April 1-June 15) and summer (June 16-August 30) of 2000 through 2004. Data are not included for summer 2004, however, due to inaccuracy of measurements during the drawdown and construction.

Season/Year	Flow (mgd)
Spring 2000	116
Summer 2000	53
Spring 2001	122
Summer 2001	57
Spring 2002	88
Summer 2002	42
Spring 2003	140
Summer 2003	97
Spring 2004	93

at downstream stations. Flows then subsided for the summer in most cases, resulting in less active stream area, lower water velocity, and greater plant build-up.

Filamentous algal growth and coverage by rooted aquatic plants varied detectably among seasons and years, at least partly a function of varied flow. There were shifts in the species of plants present as well. Some shifts in apparent habitat type (pool-riffle-run) were recorded, mainly as a function of changing flows. These differences can be largely attributed to differential rainfall when comparing results among years. In 2004 Lake Whitney experienced a drawdown of 6 feet for upgrades to the Whitney Dam. The drawdown began on July 5, 2004 and the refilling of the lake began on August 16, 2004. Stations 4 and 5 were influenced by tidal activity involving saltwater intrusion, as indicated by the presence of intertidal organisms such as cumaceans and spionid and capatellid polychaetes.

Average stream depth and width varied among seasons and years, with deeper and wider conditions in the spring, but considerable variability within seasons as well. The stream width was much narrower and the depth was generally lower under conditions of limited rainfall. Tide influenced stream depth at the downstream sites, with slight water level changes observed during data collection at stations 3, 4 and 5. However, as sampling at those sites was conducted under low tide conditions, observed fluctuations were minor in comparison with possible changes over the tidal cycle, some of which were observed to be substantial at other non-sampling times.

Inorganic substrates were generally coarser at the upstream sites (Stations 1 and 2) and progressively decreased in mean particle size in the downstream direction (Table 1). Fine-grained substrate such as silt was observed only at the most downstream stations (i.e., 4 and 5). However, the presence of relatively coarse substrate (gravel and even small cobble) was not completely stable over the sampling period. It is possible that larger storms caused high water velocities that flushed fine sediments and loosened gravel in the upstream reach. This gravel, in turn, was deposited as flow decreased due to widening of the river downstream. A more rigorous flow study would be necessary to better estimate particle transport patterns in the lower Mill River, but conditions are not static.

Quantity of detritus (e.g., logs, wood, leaf litter) remained at relatively low levels, indicating periodic flushing as would be expected in this large watershed. Most stations had similar percentages of detritus. Stations 4 and 5 had the greatest amount of detritus in most periods, but the relative amount was minimal in comparison with inorganic substrates. However, general amounts of detritus, both fine and coarse, appeared to be sufficient to support abundant populations of macroinvertebrates at all stations.

Living vegetation was more abundant in some years than others. Forms tolerant of high flow such as attached moss and filamentous green algae (Chlorophyta: Chlorophyceae) comprised the majority of the vegetation at the upstream stations (1 and 2), but presence of rooted macrophytes (mostly narrow-leaved pondweeds) was noted in the upstream area during some samplings. Filamentous algal abundance increased in spring in response to decreasing flows, but tended to decline during summer despite lower flows, possibly as a function of lower light as the tree canopy developed, and possibly related to lower nutrient inputs or availability at lower flows.

Waterlilies (*Nymphaea* sp.), a freshwater species that prefers slow-flowing to lentic waters, were observed at higher abundance during lower flow years and mainly at the downstream stations. Waterweed (*Elodea canadensis*) was observed intermittently as well over space and time. All the taxa of vascular plants encountered in the lower Mill River were common forms, tolerant of conditions such as low light, high nutrients, and salinity gradients (Crow and Hellquist 1980). Total plant coverage at the sites was within the typical ranges observed for temperate lotic systems (Allan 1995), but as with sediment, features are not static.

In general, habitat structure was suitable for macroinvertebrates at all stations. Substrate structural complexity (i.e., spatial heterogeneity) provides a diverse habitat for invertebrates, creating “niches” dominated by different food resources and hence varied invertebrate species, and/or providing crevices that protect invertebrates from predation or dislodgement by strong currents (Hixon & Menge 1991; Allan 1995). Macrophytes also contribute to increased spatial heterogeneity by providing a substrate rich in food resources (epiphytic algae and detritus covering the plants) (Diehl & Kornijów 1998). Physical substrate (cobble and gravel substrate) and/or macrophyte cover was sufficient to potentially support a rich and diverse macroinvertebrate community at all stations, although the quality of that habitat was not as high at stations 4 and 5 as at stations 1-3.

Selected water quality parameters were assessed in all years (Table 3). Assessed water quality was generally similar over the five study years, with spatial and temporal variability as might be

Table 3. Water quality ranges at the sampling locations. The 9/2/2004 sample is included with the August data from previous years.

	Station 1	
Parameter	**Jun**	**Aug**
water temperature (°C)	17.9-23.2	19.8-26.7
dissolved oxygen (mg/L)	8.3-9.7	5.7-9.4
dissolved oxygen (% saturation)	99-112	71-108
specific conductivity (µS/cm)	189-282	194-270
turbidity (NTU)	1.04-3.2	1.56-5.57
pH (SU)	7.2-8.5	6.8-8.4
	Station 2	
	Jun	**Aug**
water temperature (°C)	17.7-23.2	19.7-26.4
dissolved oxygen (mg/L)	8.0-10.4	7.3-9.0
dissolved oxygen (% saturation)	94-120	86-111
specific conductivity (µS/cm)	190-284	192-268
turbidity (NTU)	1.04-7.86	1.23-7.80
pH (SU)	7.2-8.5	7.6-8.81
	Station 3	
	Jun	**Aug**
water temperature (°C)	17.6-23.3	19.7-26.7
dissolved oxygen (mg/L)	7.9-10.2	5.9-9.3
dissolved oxygen (% saturation)	93-117	73-109
specific conductivity (µS/cm)	189-290	194-265
turbidity (NTU)	1.23-3.84	1.58-4.80
pH (SU)	7.2-8.6	7.6-8.2
	Station 4	
	Jun	**Aug**
water temperature (°C)	17.8-23.5	19.7-30.2
dissolved oxygen (mg/L)	7.9-11.8	6.1-8.9
dissolved oxygen (% saturation)	92-134	72-117
specific conductivity (µS/cm)	189-290	194-7013
turbidity (NTU)	1.18-4.57	1.89-8.42
pH (SU)	7.3-8.8	7.2-8.29
	Station 5	
	Jun	**Aug**
water temperature (°C)	18.3-24.7	19.7-28.8
dissolved oxygen (mg/L)	6.8-11.2	6.0-9.6
dissolved oxygen (% saturation)	80-135	70-107
specific conductivity (µS/cm)	193-296	197-7333
turbidity (NTU)	1.69-3.9	1.93-10.40
pH (SU)	7.3-8.6	7.14-8.5

expected in this area of variable hydrology and loading. Water temperature remained comparable among years, and varied only slightly between stations within the same month. Water temperature was higher in August than in June, as expected. Dissolved oxygen was always within the life-supporting range for most lotic fauna (Table 3). Decreasing oxygen levels with increasing tidal influence were observed in a separate study (CH2MHill 2001), but not in these data.

Specific conductivity was comparable between stations 1, 2 and 3, but was considerably higher at stations 4 and 5 during some samplings. Saltwater influence from the recent tide was undoubtedly responsible. Whether this was a function of the timing of sampling or greater saltwater intrusion under lower flows is not known, but there is evidence of saltwater intrusion at lower flows, extending upstream of Station 4 (CH2MHill 2001).

Turbidity varied among stations and dates to some degree, but was generally low to moderate at the time of sampling. Very high turbidity is known from the Mill River system upstream of Lake Whitney, but the lake acts as a detention basin and minimizes downstream transport of at least coarse particles much of the time. The pH of most samples was circumneutral to slightly basic (Table 3). Higher pH values might be attributed to increased algal influence. Even so, pH remained within the life-compatible 4.5 – 9.5 range for most aquatic biota (Wetzel 2001b).

Macroinvertebrates

This investigation focused on the invertebrate community as an indicator of conditions downstream of Lake Whitney. Invertebrates have long been used as indicators of environmental quality, and will reflect water quantity effects to the extent that water quantity affects water quality (e.g., dilution, runoff). In the extremes, water quantity can also affect invertebrates by altering the substrate (scouring or drying/oxidation), through dislodgment of biota with downstream transport, and through reduced available habitat under dry conditions. Most effects of water quantity are indirect, however, necessitating a considerable data base to allow an analysis that accounts for other potentially influential factors. An initial survey of the Mill River downstream of Lake Whitney was conducted in 1998, from which it was determined that invertebrates might provide suitable indication of the impact of changing flow as a consequence of the re-activation of Lake Whitney as a water supply. The results of more focused invertebrate studies conducted since 2000 are described here.

Raw data for benthic macroinvertebrates (Appendix B) has been analyzed in several ways relevant to questions of flow impacts. Total benthic macroinvertebrate abundance (Figure 2) varied considerably within and among stations. The obvious conclusion, supported visually and by statistical comparison (ANOVA, $P<0.05$), is that invertebrates are more abundant at stations 1-3 than at stations 4-5. There are both physical and chemical habitat changes between stations 3 and 4 that are more likely to be responsible for this difference than any variation in flow. The

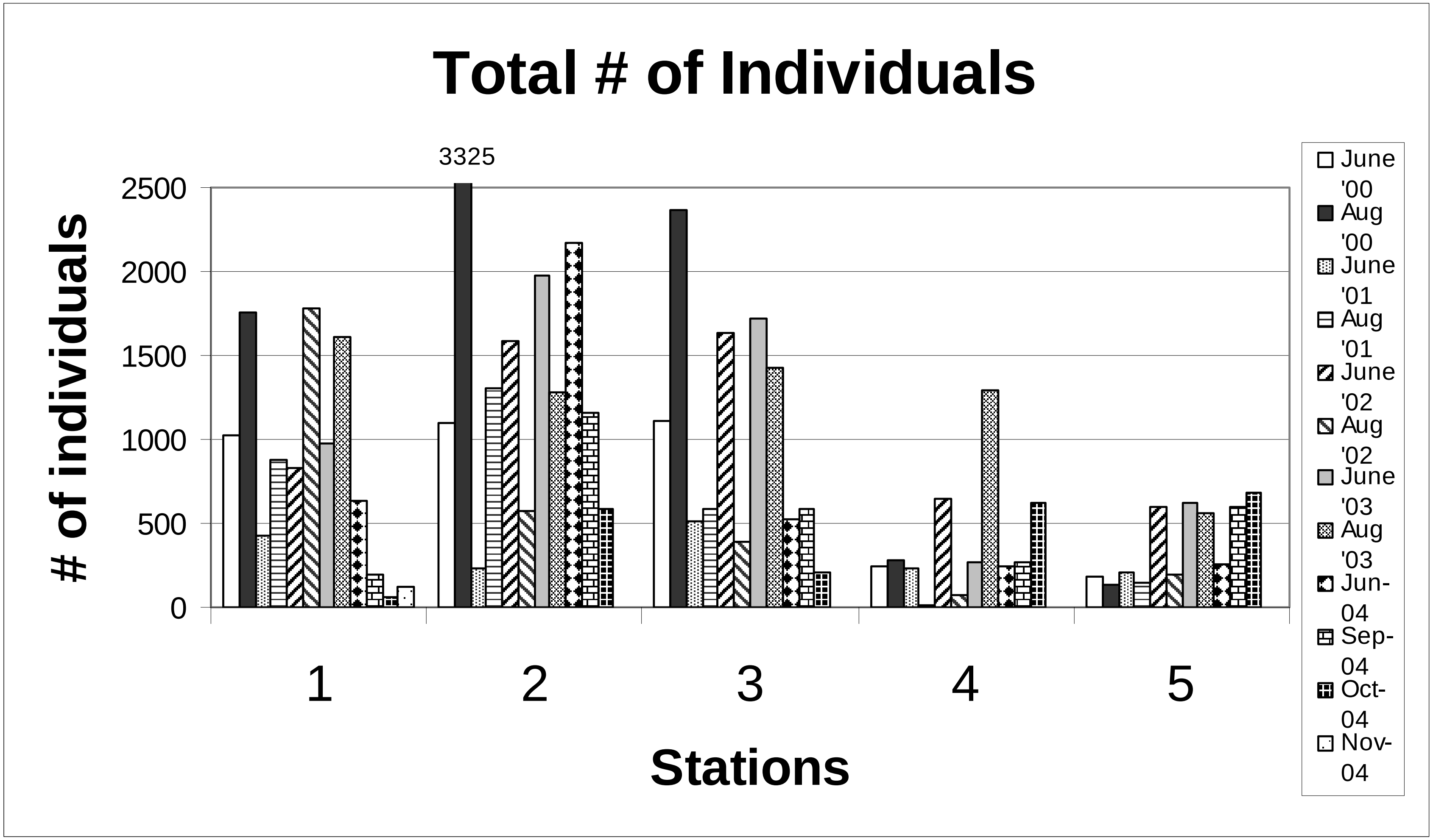

Figure 2. Abundance of benthic macroinvertebrates over space and time in the Mill River, downstream of Lake Whitney.

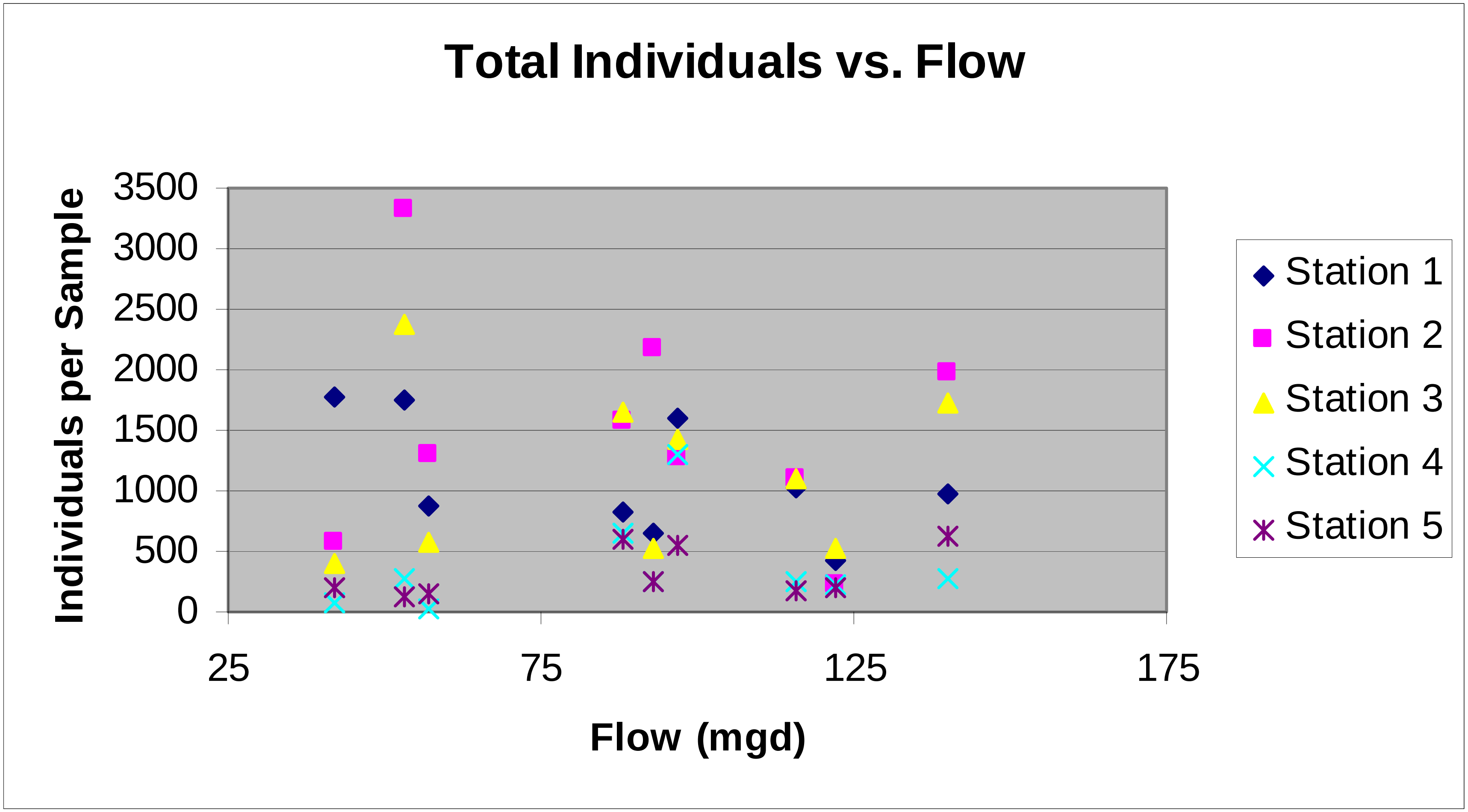

Figure 3. Relationship of benthic macroinvertebrate abundance to flow downstream of Lake Whitney.

primary influence is tidal, with slower water velocities, changing direction of flow, and oscillating salinity at stations 4 and 5. Assessment of the relationship between invertebrate abundance and flow (Figure 3) indicates no clear trend.

Taxonomically, the assemblage of invertebrates in the Mill River downstream of Lake Whitney exhibits variable richness (Table 4), with between 6 and 28 taxa identified at each station on any given date. There is no apparent relationship, however, between taxonomic richness and mean flow for the 10 week period preceding sampling (Figure 4) at any station. Statistically, there is no richness difference among stations (ANOVA, $P>0.05$), but there was among dates. However, when data were pooled by month (June vs. August), there was no significant difference. The difference among dates is largely a function of lower richness in August 2002 (lower flow) and higher richness in August 2003 (higher flow), but with the other four years of data added, the overall relationship was not significant.

Diversity (Table 5) is affected by the number of taxa present, and comparisons are better made with evenness, a normalized measure of diversity that puts all values on a scale of 0 (low) to 1 (high). Evenness for pooled samples from each station on each date (Table 6) was generally moderate. As with richness, there was no significant statistical difference among stations, but there was among dates. Also as with richness, that difference was not a function of season (June vs. August data). There is no apparent relationship between evenness and flow (Figure 5), although stations 4 and 5 exhibited slight declines in evenness with increasing flow. This was not a statistically significant trend, but could be related to scouring action in these more exposed habitats (less coarse material to harbor invertebrates).

The abundance of invertebrates within the more common taxa encountered (Figure 6), indicates that the two most common taxa (the Amphipod Gammarus and the midge family Chironomidae) are by far the most abundant, each more than five times more abundant overall than the next most abundant taxon (the caddisfly Macrostemum). The 15 most abundant taxa are shown in Figure 6, with the next 10 most abundant lumped together and the remaining 74 taxa lumped into yet another category for graphic comparison. With so many taxa found at very low density, distributional comparisons utilizing all individual taxa have minimal statistical power. In general, a few taxa dominated most samples, although those taxa were not always the same ones over space and time.

The common taxa observed in any one year were also encountered in the other years. Less common taxa were not consistently observed over time or space. Rare taxa tend to be patchily distributed, without a consistent location among years. Therefore, absence of such rare taxa in some samples or years may not mean that the taxa were not present in the lower Mill River system, but were simply too rare to be detected by the sampling method employed.

Table 4. Richness over space and time in the Mill River downstream of Lake Whitney.

	Station 1	Station 2	Station 3	Station 4	Station 5
Jun-00	14	18	18	13	8
Aug-00	15	21	19	10	9
Jun-01	15	14	10	11	6
Aug-01	13	17	14	6	13
Jun-02	9	16	11	9	11
Aug-02	10	10	7	6	8
Jun-03	19	16	15	12	14
Aug-03	17	11	13	25	28
Jun-04	11	9	11	13	13
Sep-04	11	9	10	12	10

Table 5. Diversity over space and time in the Mill River downstream of Lake Whitney.

	Station 1	Station 2	Station 3	Station 4	Station 5
Jun-00	1.65	1.69	1.50	1.05	0.70
Aug-00	1.14	1.25	1.13	1.00	1.10
Jun-01	1.44	2.02	1.68	1.31	0.97
Aug-01	1.57	1.76	1.59	1.71	1.37
Jun-02	1.46	2.20	1.69	1.03	0.81
Aug-02	1.13	1.62	1.01	1.64	0.93
Jun-03	1.92	1.52	1.26	0.97	0.90
Aug-03	1.41	1.37	1.35	1.86	1.43
Jun-04	1.34	0.92	1.59	1.78	1.84
Sep-04	1.00	1.43	1.57	1.61	1.25
Oct-04	2.18	1.76	1.64	1.68	1.01

Table 6. Evenness over space and time in the Mill River downstream of Lake Whitney.

	Station 1	Station 2	Station 3	Station 4	Station 5
Jun-00	0.61	0.57	0.51	0.40	0.32
Aug-00	0.41	0.41	0.38	0.43	0.50
Jun-01	0.53	0.77	0.73	0.55	0.54
Aug-01	0.61	0.62	0.60	0.96	0.54
Jun-02	0.61	0.60	0.63	0.49	0.35
Aug-02	0.44	0.70	0.55	0.81	0.50
Jun-03	0.65	0.55	0.47	0.39	0.34
Aug-03	0.50	0.57	0.53	0.58	0.43
Jun-04	0.56	0.42	0.66	0.69	0.72
Sep-04	0.42	0.65	0.68	0.65	0.54
Oct-04	0.91	0.63	0.79	0.64	0.49

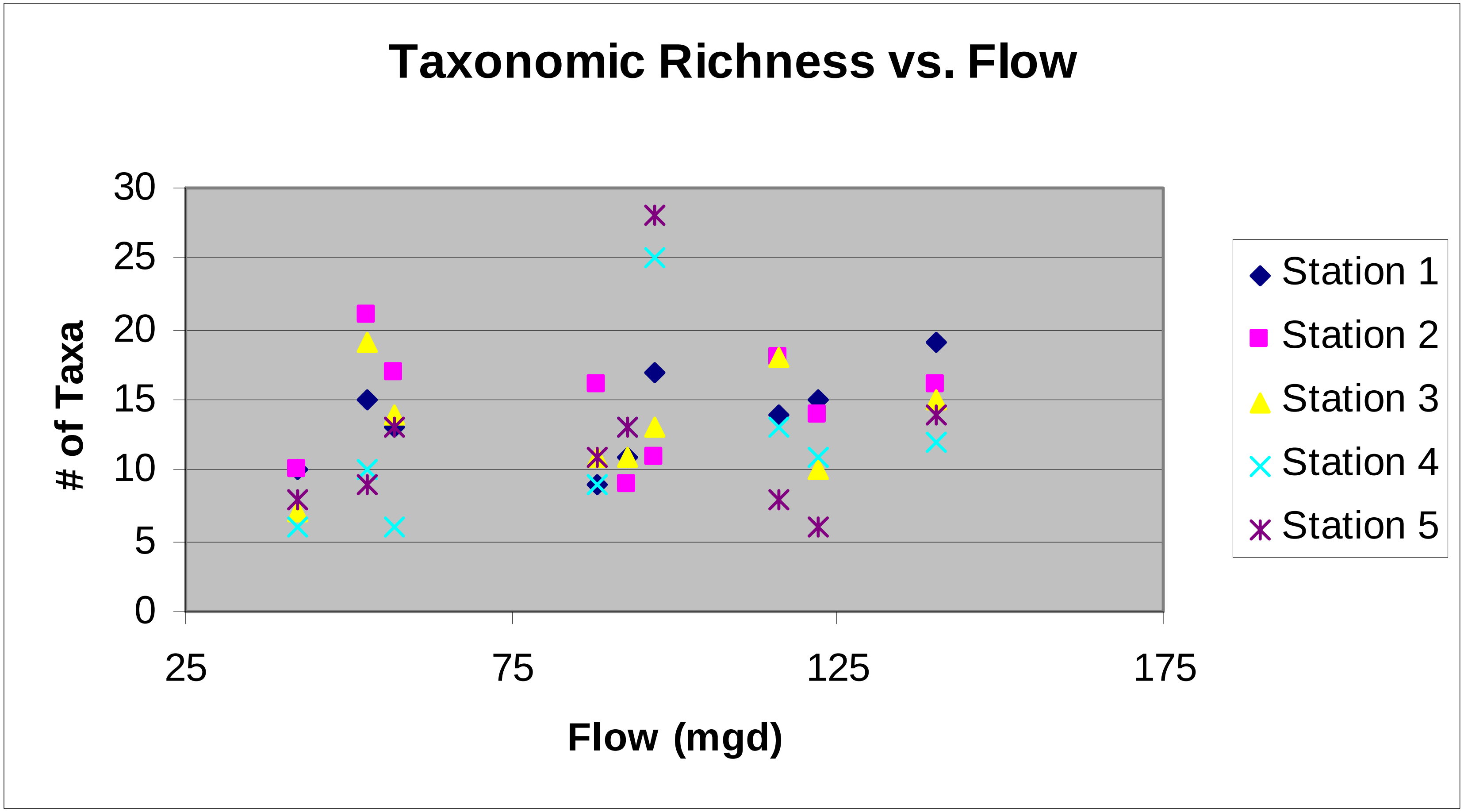

Figure 4. Relationship of benthic macroinvertebrate richness to flow downstream of Lake Whitney.

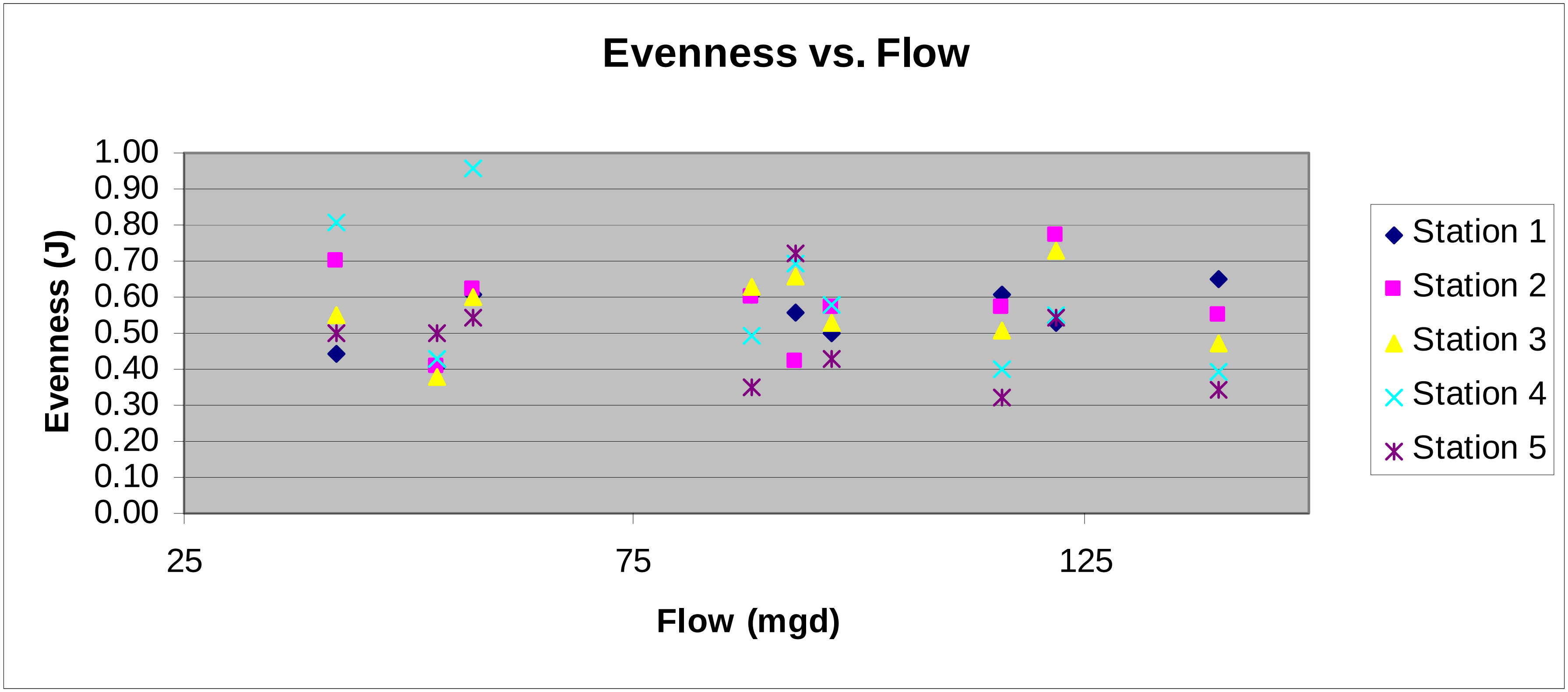

Figure 5. Relationship of benthic macroinvertebrate evenness to flow downstream of Lake Whitney.

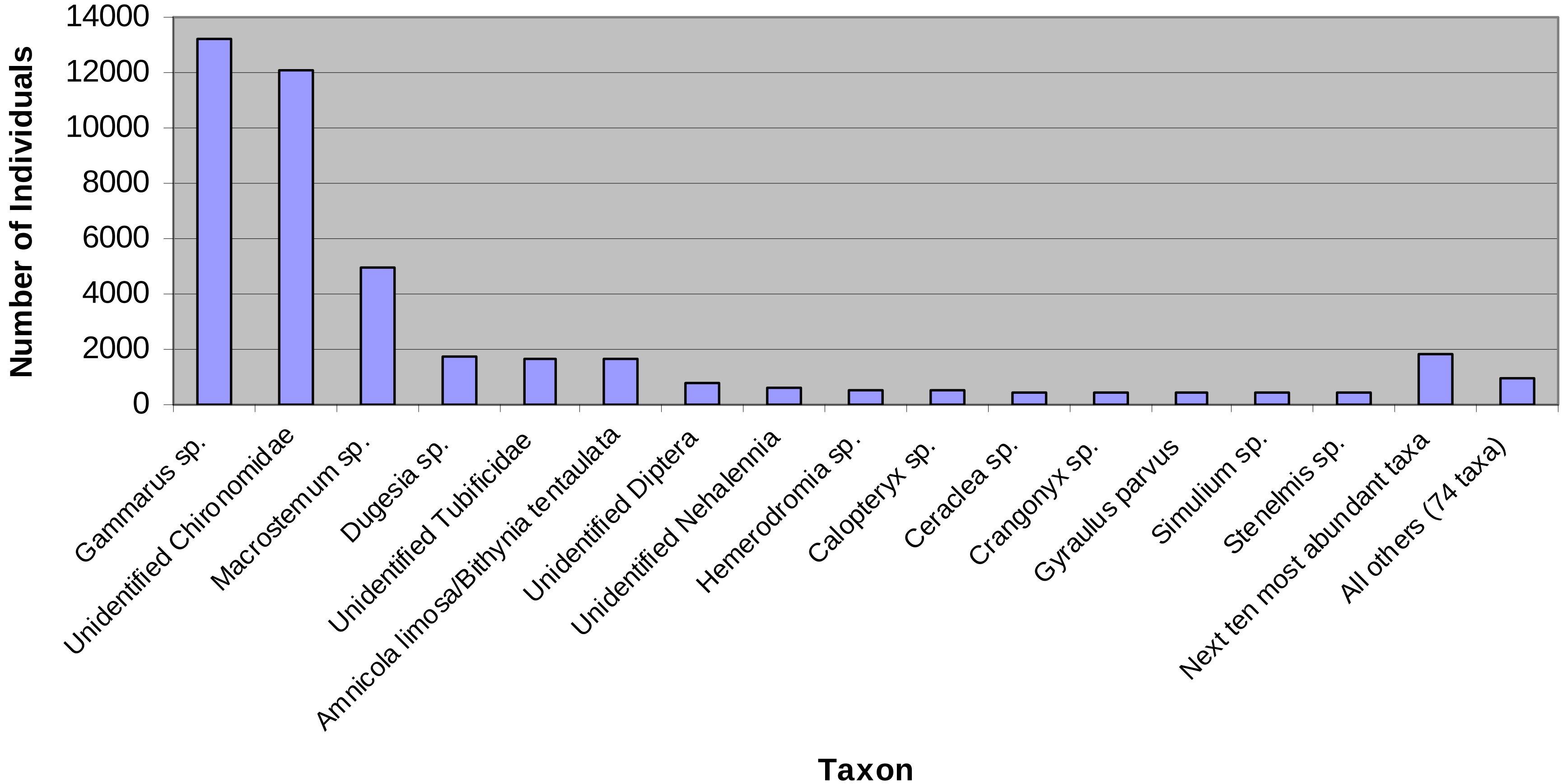

Figure 6. Abundance of all taxa from all stations and dates, except the October 2004 sample.

An alternative way to evaluate the macroinvertebrate data is to organize them by feeding groups. These groups have ecological meaning in terms of food resources and energy flow, and may be affected by flow insofar as flow affects food delivery from upstream, the growth of periphyton, and the accumulation of organic detritus. Lumping all data from sampled dates for each station (Figure 7), it is apparent that collectors, shredders and filterers are most abundant overall, with collectors and filterers declining in the downstream direction.

Shredders become more important downstream between stations 1 and 3, but then decline in abundance at stations 4 and 5. Despite the downstream decline, collectors are the dominant group at stations 4 and 5. Predators and scrapers contribute noticeably to the invertebrate community at most stations, but these and other groups are minor in comparison with the collectors, filterers and shredders.

The differences in feeding group relative abundance are significant (ANOVA, $P<0.05$) and indicative of available energy sources below a reservoir and in a wooded area. The changes in feeding group relative abundance over space is also statistically significant, with stations 1, 2 and 3 falling into one group and stations 4 and 5 into another. The shift matches the line of tidal influence and correlates with the differences in physical habitat as well. Changes in feeding groups in response to flow are not obvious, however (Figures 8 and 9), even separating the two groups of stations. There may be a slight (but not significant) increase in collectors with increased flow for both sets of stations, but none of the other feeding groups exhibits any discernible trend over the range of observed flows. If we look at individual stations (e.g., station 2 in Figure 10), the same patterns prevail.

DISCUSSION

Five years of monitoring using a consistent approach have now been completed prior to the new Lake Whitney Water Treatment Plant coming on-line, with facility start-up expected in 2005. Differences in macroinvertebrate taxonomic composition between the upstream (stations 1 through 3) and downstream stations (stations 4 and 5) may be ascribed mostly to differences in physical habitat and salinity exposure. Macroinvertebrate assemblages in the upstream stations were more indicative of riffle habitat and coarse substrates, and included several filter-feeding and collector taxa that feed on detritus. Caddisflies, mayflies, snails, blackflies and midges were found in much greater abundance in the upstream stations than in the downstream stations 4 and 5. Taxa that can tolerate influxes of marine water were found only at stations 4 and 5, including polychaete worms and crabs. Freshwater invertebrate tolerance to salinity is not well known, but some of the taxa found in the lower Mill River (e.g., scuds, damselflies, chironomid midges, beetles, and pulmonate snails) are found in relatively high numbers in moderately saline lakes (Colburn 1988; Alcocer et al. 1998). Taxa abundant at all stations included oligochaetes, amphipods and gastropods.

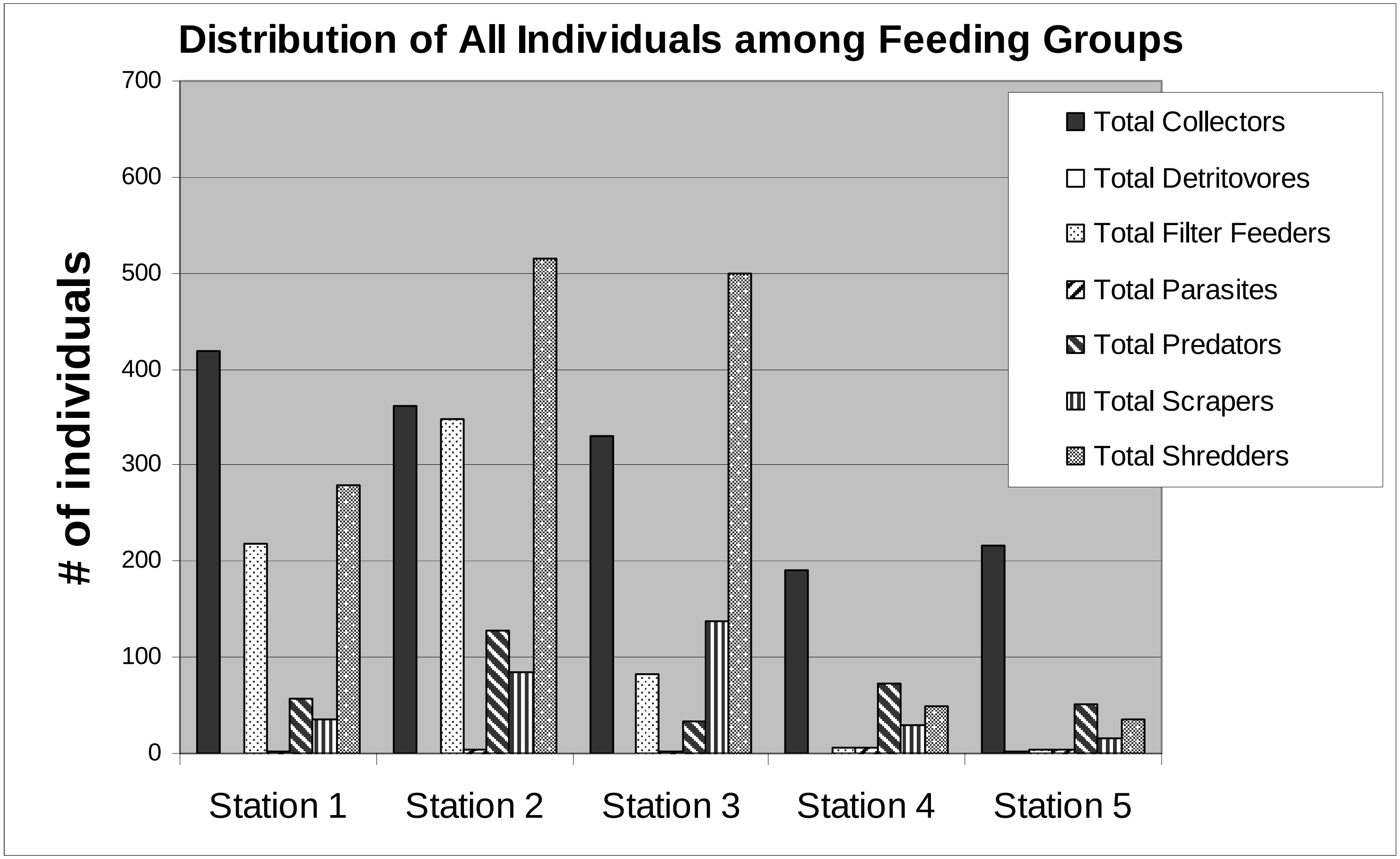

Figure 7. Abundance of feeding groups at stations (data for all dates averaged).

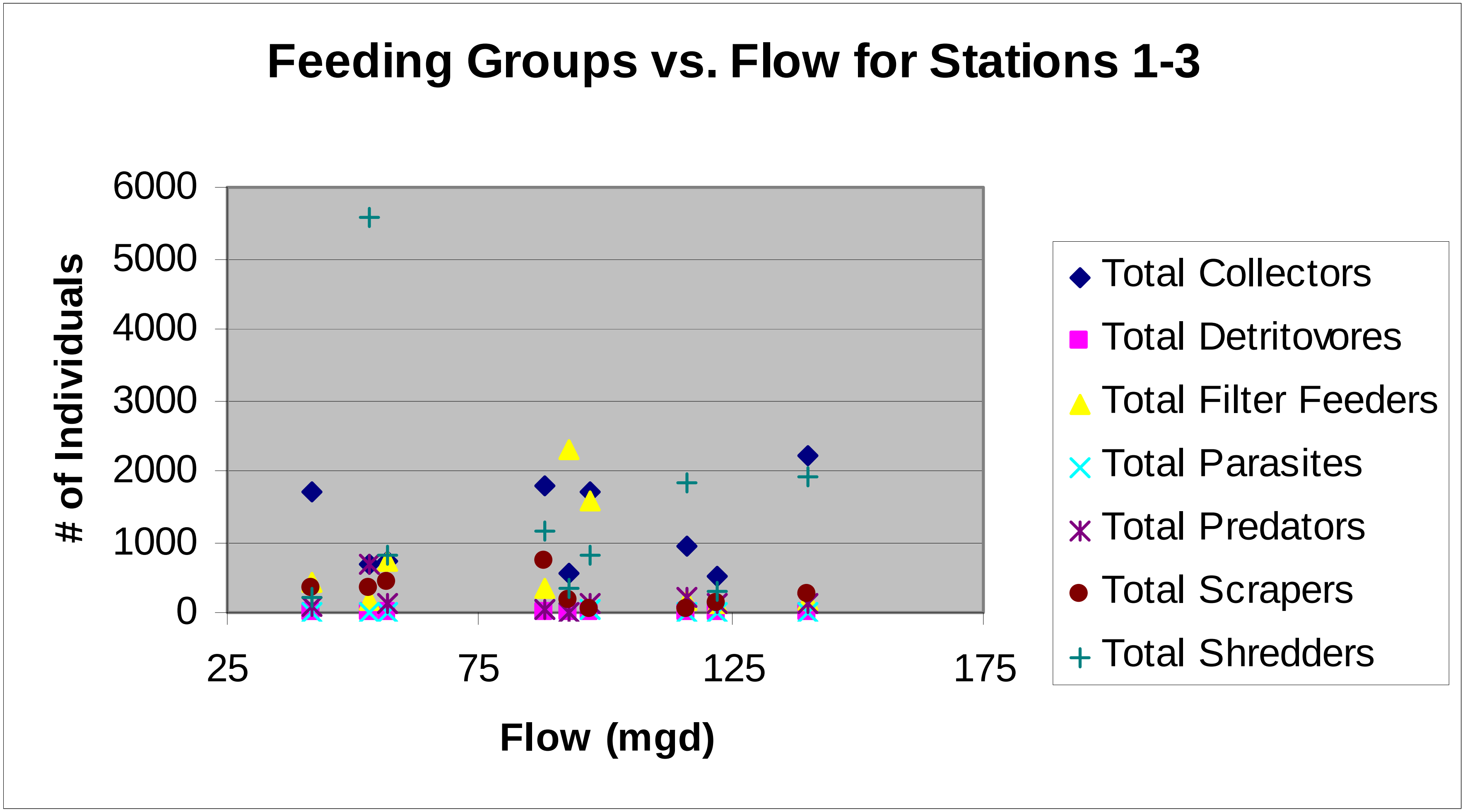

Figure 8. Relation between feeding groups and flow regime at station 1-3.

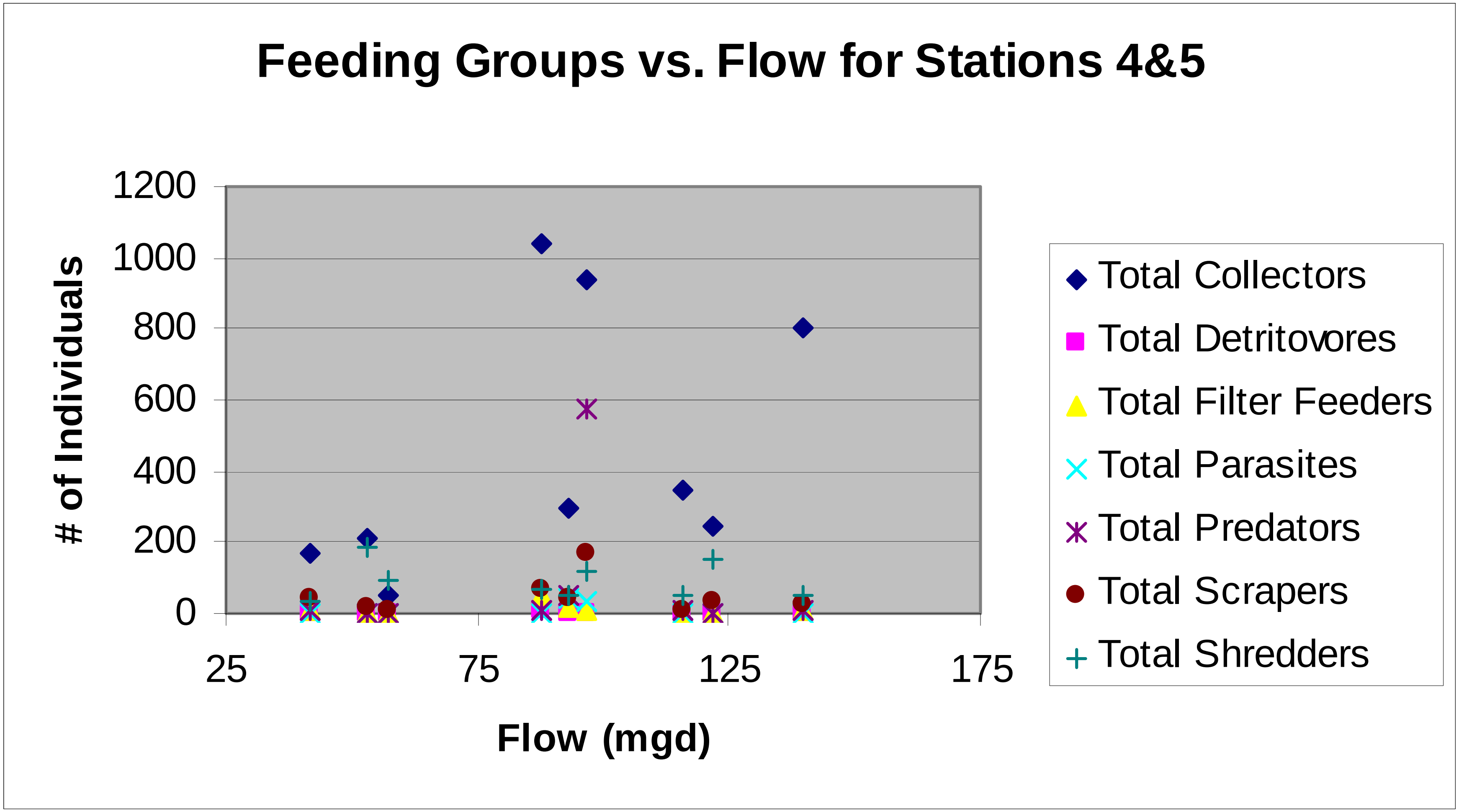

Figure 9. Relation between feeding groups and flow regime at station 4-5.

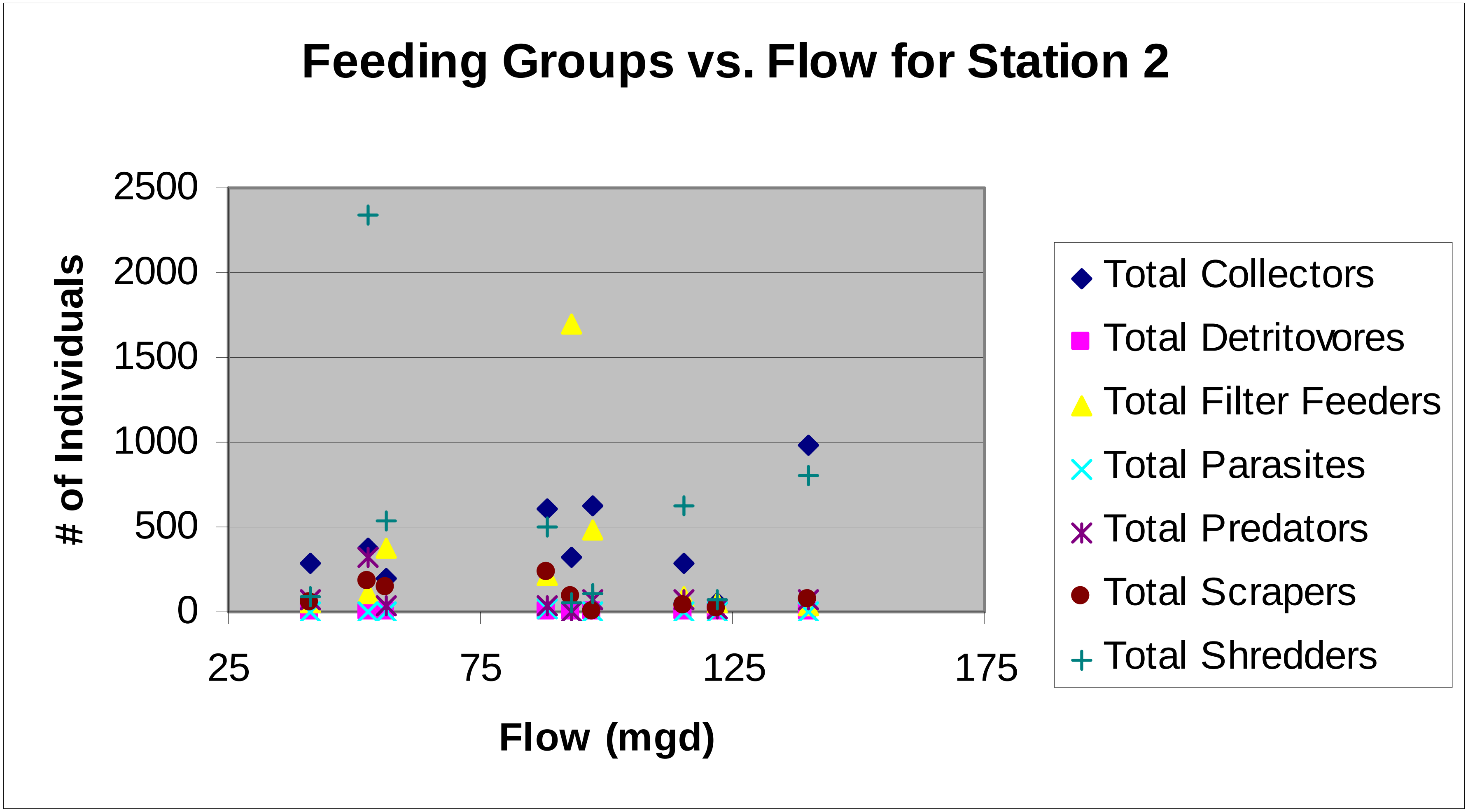

Figure 10. Relation between feeding groups and flow regime at station 2

In general, the macroinvertebrate assemblages observed in the Mill River were indicative of a moderately healthy stream community. The taxa collected at the five stations located along the Mill River may be commonly found in a range of environments (e.g., scuds, prosobranch snails, caddisflies, mayflies). Most taxa found were typical of urban freshwater habitats (Walsh et al. 2001), where water quality impacts are common. Midges (Diptera, Chironomidae), which were abundant, can be found in a variety of freshwater habitats (Wetzel 2001c), but their dominance in a community is often regarded as a sign of degraded conditions. Yet abundance of other taxa was substantial, evenness was not severely depressed, and a variety of feeding groups were present.

Changes in the invertebrate community over time may be a consequence of many environmental factors, including the desiccation of the stream during the dry summer months, changes in water quality, altered food abundance and quality, and predation effects. Flow is only one factor, and is likely to have more indirect effects at low levels. Direct effects are most pronounced at high levels, when scour can directly remove invertebrates. Variability in flow, inducing instability, may also be a potent factor in structuring the benthic macroinvertebrate community of the lower Mill River, and is linked to water quality issues (including dilution of contaminants from upstream and salinity from downstream), altered physical habitat, and available food resources.

The macroinvertebrate assemblage in the lower Mill River is the product of several factors acting simultaneously. Flow can be a major determinant of invertebrate assemblage structure (e.g., Brunke et al. 2001), influencing invertebrates directly or by altering physical instream habitat and physico-chemical characteristics such as temperature, oxygen, pH, and conductivity (Sabo et al. 1999). For example, the density of the scud *Crangonyx* sp. may be reduced by lower flow regimes, while the closely related but slow-water taxon *Gammarus* may increase (Beckett et al. 1998). However, effects may be highly localized in time and space. Any impacts relating to flow would be expected only during withdrawals that coincide with low flow periods, not from expected withdrawal during higher flows.

Reduced flow may decrease invertebrate density and diversity (Gørtz 1998; Brunke et al. 2001), but flow interacts closely with the physical structure of the habitat. Streams with relatively low flow but a high degree of habitat heterogeneity (coarse detritus, rocks, submerged vegetation) may still support high invertebrate density, taxonomic richness and diversity (Brunke et al. 2001). Increased vegetation cover may be expected at lower flow regimes, thus counterbalancing (at least in part) the potentially negative effects of decreased flow by increasing substrate heterogeneity. Although some changes in densities and relative abundances may occur, large scale changes in invertebrate community features in the lower Mill River are not expected after the withdrawal from Lake Whitney commences. Furthermore, relatively rapid response of invertebrate communities suggests that recovery will be swift when higher flows resume after a drought period.

Effects of increased salinity on the lower Mill River invertebrate assemblages are difficult to predict, but would seem likely to be more severe than minor changes in flow. Although reduced freshwater flow could increase salinity effects to a limited degree, the tide gates downstream constitute a more important salinity control. Most of the taxa found in this survey may withstand small increases in salinity, with invertebrate communities shaped more by physical habitat characteristics than expected fluctuations in salinity (Alcocer et al. 1998). However, effects of possible tide-related bursts in salinity, exacerbated by lower flow or removal of the tide gates, could shift the community to a taxa-poor, low-diversity assemblage dominated by high salinity tolerant taxa (Wolfram et al. 1999). The current community at stations 4 and 5, where salinity exposure is periodically high, already exhibits this condition to a large extent. However, the upstream portion of the lower Mill River (e.g., stations 1 through 3) appears unlikely to be significantly affected by tide-driven salinity bursts, because of its higher elevation.

Data collected to date suggest that alteration of flow associated with reactivation of Lake Whitney as a water supply appears to be only a minor potential influence on the lower Mill River. Also, and on a larger-scale basis, projected lower flow in the lower Mill River may not influence the downstream New Haven Harbor, since the lower Mill River's contribution to harbor hydrology and water chemistry is not large (Rozan & Benoit 2001).

When examining flow as an independent variable affecting features of the macroinvertebrate community, few reliable relationships were encountered. Several key questions can be postulated and addressed with the available data:

Key Question:
Is there a difference in the abundance of invertebrates over space (stations) or time (dates and flow)?

Conclusion from Available Data:
Stations 1, 2 and 3 have more invertebrates than stations 4 and 5, but the quantity at any one station does not differ significantly over time. Flow varies much more with time than by station, although components of flow (velocity, wetted area) do vary among the upper (1-3) and lower (4-5) stations. Data suggest that the invertebrate community is less sensitive to changes in flow and more sensitive to changes in station features (primarily substrate, but also possibly water quality and to some extent velocity).

Key Question:
Is there a difference in the number of types of invertebrate taxa (richness) over space (stations) or time (dates and flow)?

Conclusion from Available Data:
No station has consistently more taxa than another, but the variability within stations is high. It appears that high flow may aid taxonomic richness at stations 4-5 (possibly through less

saltwater influence) but not stations 1-3 (all freshwater). Substantially more taxa were encountered at stations 4 and 5 during the two assessments made in 2003 than had been documented previously. The 2003 assessment had the highest flows (in both June and August) of any year sampled to date. Flow impacts on stations 4-5 appear to relate to changed water quality, with salinity expected to be the most influential variable. The community at stations 1-3 appears less sensitive to changes in flow, but may be influenced by water quality variation other than salinity.

DRAWDOWN IMPACTS IN 2004

During the summer of 2004 the South Central Connecticut Regional Water Authority completed a drawdown of Lake Whitney to upgrade the Lake Whitney Dam in association with the new treatment facility. Drawdown of Lake Whitney began on July 5, 2004, with a maximum drawdown of 6 feet, and the refill process started on August 16, 2004 and was completed in late August. All flow that entered Lake Whitney was delivered to the Mill River, but the discharge point was a channel on the west side of the dam instead of over the spillway. Discharge in July and August therefore bypassed station 1 just below the dam. During the actual lowering of the water level, stations 2 and 3 would have experienced greater flows that they would have in the absence of the drawdown. The same could be said of stations 4 and 5, but with so much tidal influence at these downstream stations, it is not clear that this temporary flow increase would make any discernible difference.

Construction equipment worked in the western portion of station 1 for about two months, during the drawdown. Therefore, in addition to flow reductions, station 1 also experienced high levels of bottom disturbance, and new substrate was added to the western portion of the station as part of the construction work.

In addition to the June and September samples collected in 2004, macroinvertebrate samples were collected on October 4, 2004 for all stations, and again on November 26, 2004 at Station 1 only. The samples were preserved and analyzed using the same methodologies previously described in this document. Additional samples were collected to examine potential trends in macroinvertebrate abundance and diversity related to the drawdown, especially at station 1.

The number of taxa at each station during the 2004 sampling did not appear impacted by the drawdown. No discernable patterns of taxonomic increase or decrease are apparent in the 2004 data (Figure 11). However, stations 1 and 2 experienced a decrease in total invertebrate abundance between June and October, during the drawdown, while stations 4 and 5 experienced increases in invertebrate abundance. Total number of individuals at station 3 increased between June and September, but decreased in October (Figure 12).

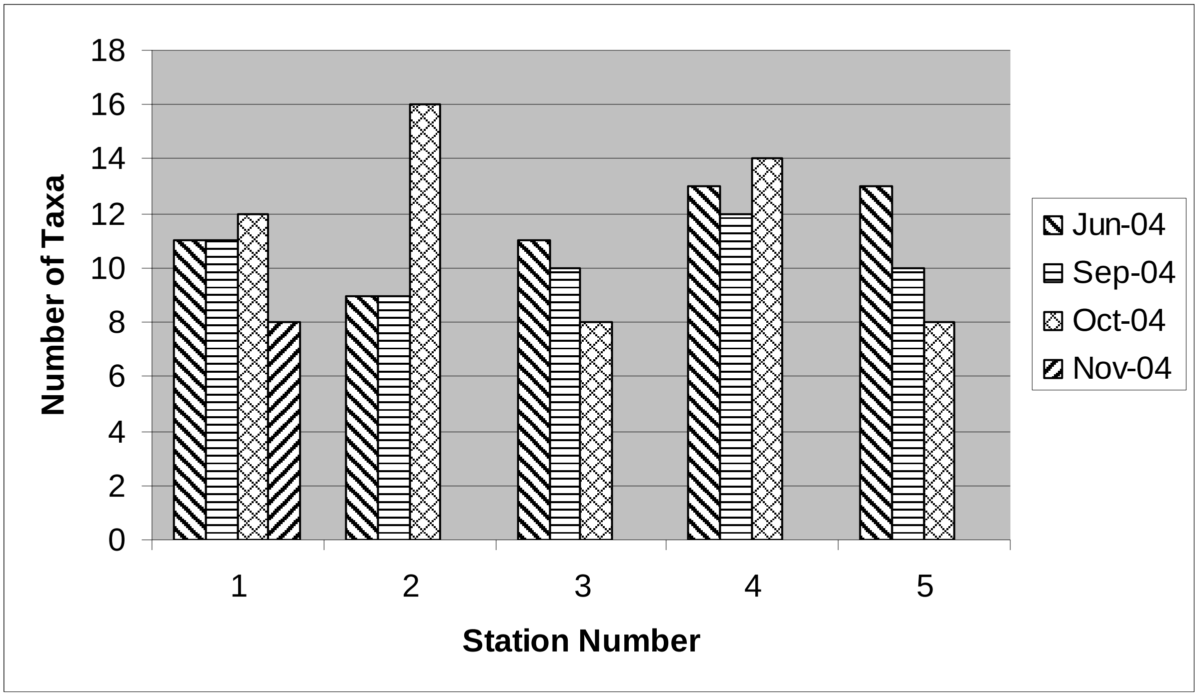

Figure 11. Total taxa for all stations during 2004.

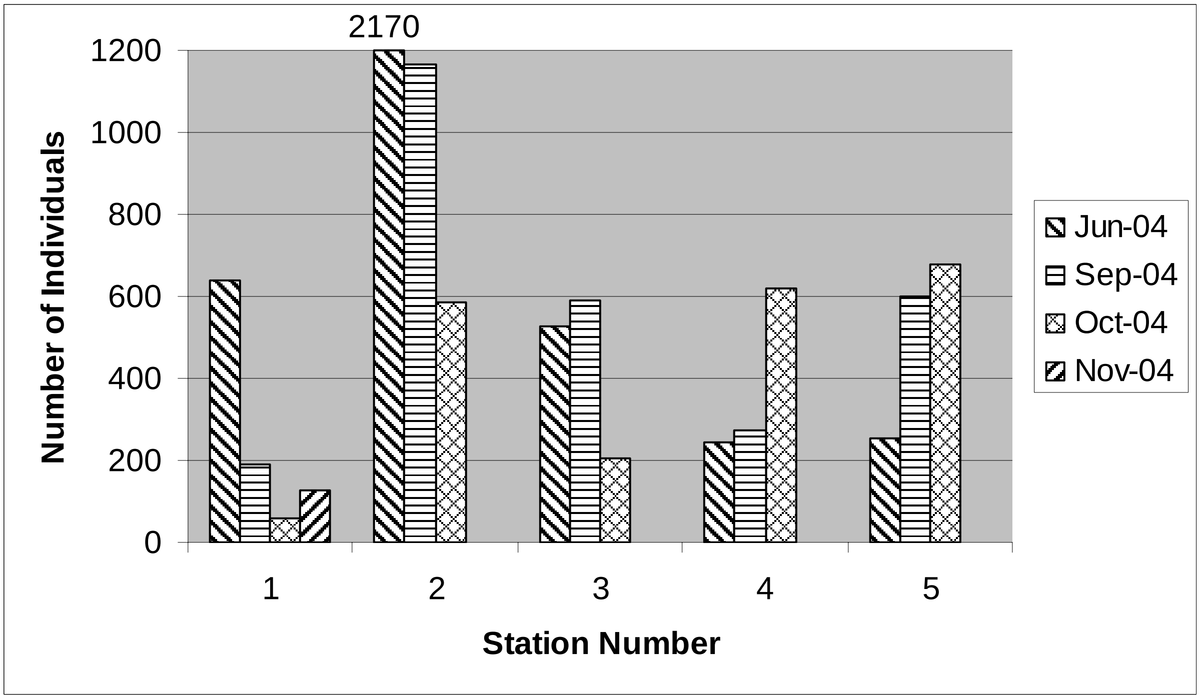

Figure 12. Total number of individuals for all stations during 2004.

Station 1

Station 1 experienced the greatest disturbance and reduction in flow from the 2004 drawdown of Lake Whitney. In an attempt to determine drawdown impacts, station 1 invertebrate subsamples were compared. Station 1A is the on western side of the channel, and station 1B is on the eastern side. Station 1A is the area within station 1 that experienced the heavy construction traffic and the addition of new cobble substrate. Flow through station 1A was reduced to zero during construction, while station 1B flow was minimal but not consistently absent. Increased periphyton growth was noted at station 1B, indicating wet conditions most of the time, but actual water movement was not observed on any sampling date.

Figures 13 and 14 give visual representations of changes in taxa and total number of individuals over time for stations 1A and 1B. The number of taxa at station 1A decreased slightly between June and September, during the drawdown period, and remained fairly stable after the drawdown ended, through the November sampling. Taxa at station 1B declined minimally during the drawdown, decreased further in October, and increased in November. Total number of individuals decreased at stations 1A and 1B between June and September, during the drawdown. Invertebrate abundance remained low in October, about a month after drawdown ended. Both stations experienced a slight increase in November, almost three months after termination of the drawdown. At no point during sampling did post-drawdown numbers of taxa or individuals reach pre-drawdown quantities.

Feeding group data for both stations are supplied as Figures 15 and 16. The two dominant feeding groups at station 1A during the June sampling were filter feeders and shredders. The September sample contained no shredders and very few filter feeders, with no feeding group increasing substantially to fill the available space. Station 1B was dominated by filter feeders in June and collectors in September, a logical shift with loss of flow. No feeding group was clearly dominant in October or November, after the drawdown ended.

Station 2

Flow at station 2 during the lowering of Lake Whitney was greater than the expected natural flows for this time of year, after which the flow was what it would have been independently of the drawdown (water was passed through Lake Whitney to maintain the lowered water level, roughly matching outflow to inflow). The number of taxa present at station 2 (Figure 11) did not change during the drawdown period, but increased markedly between the September and October samples. The total number of individuals present decreased both during and after the drawdown in 2004 (Figure 12). In the June sample, the dominant taxon at station 2 was the filter feeding caddisfly *Macrostemum* sp. By September, the dominant taxon had changed from *Macrostemum* sp. to *Dugesia* sp., a predatory flatworm. The increased presence of predators coincided with a marked decrease in filter feeding organisms (Figure 12). It is not clear how flow and other environmental variables interacted to produce the observed patterns.

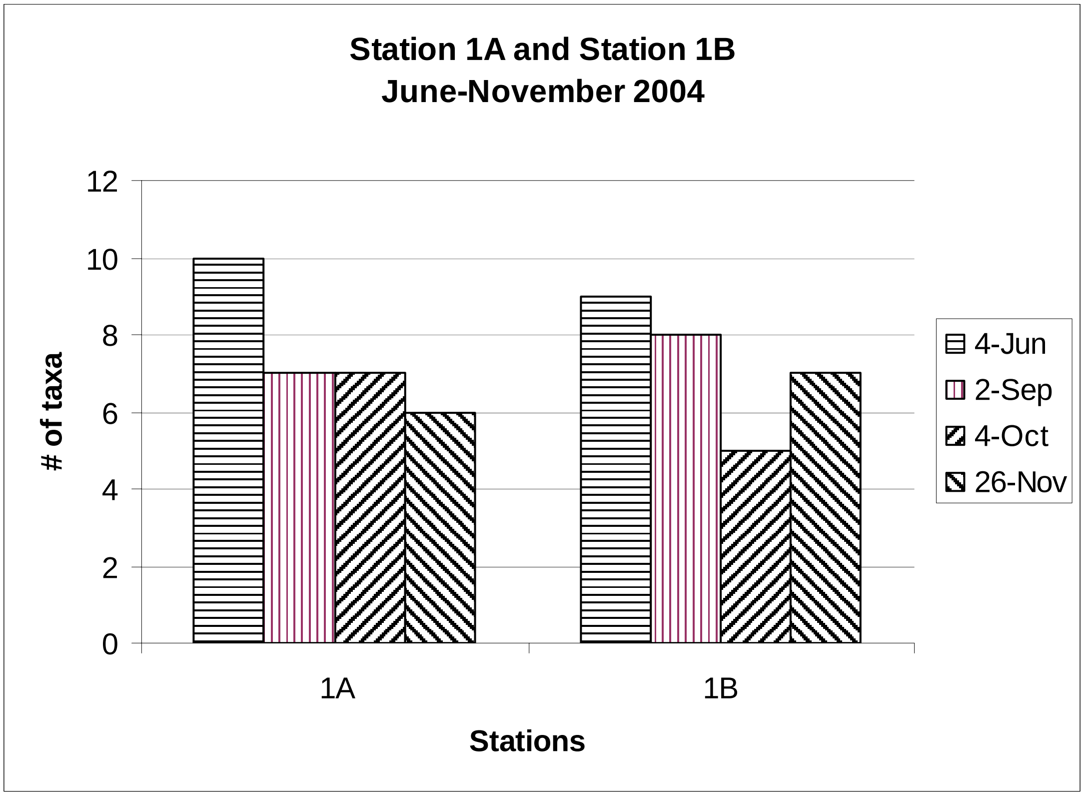

Figure 13. Taxa over time for stations 1A and 1B for 2004.

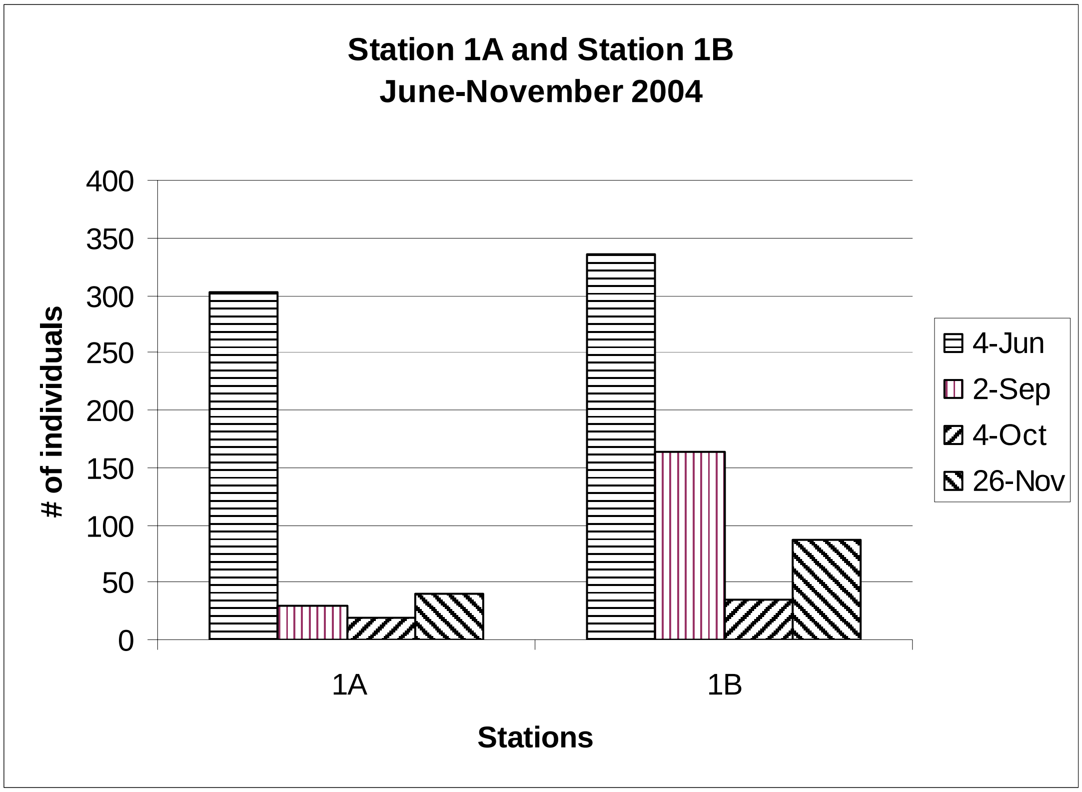

Figure 14. Total number of individuals for stations 1A and 1B for 2004.

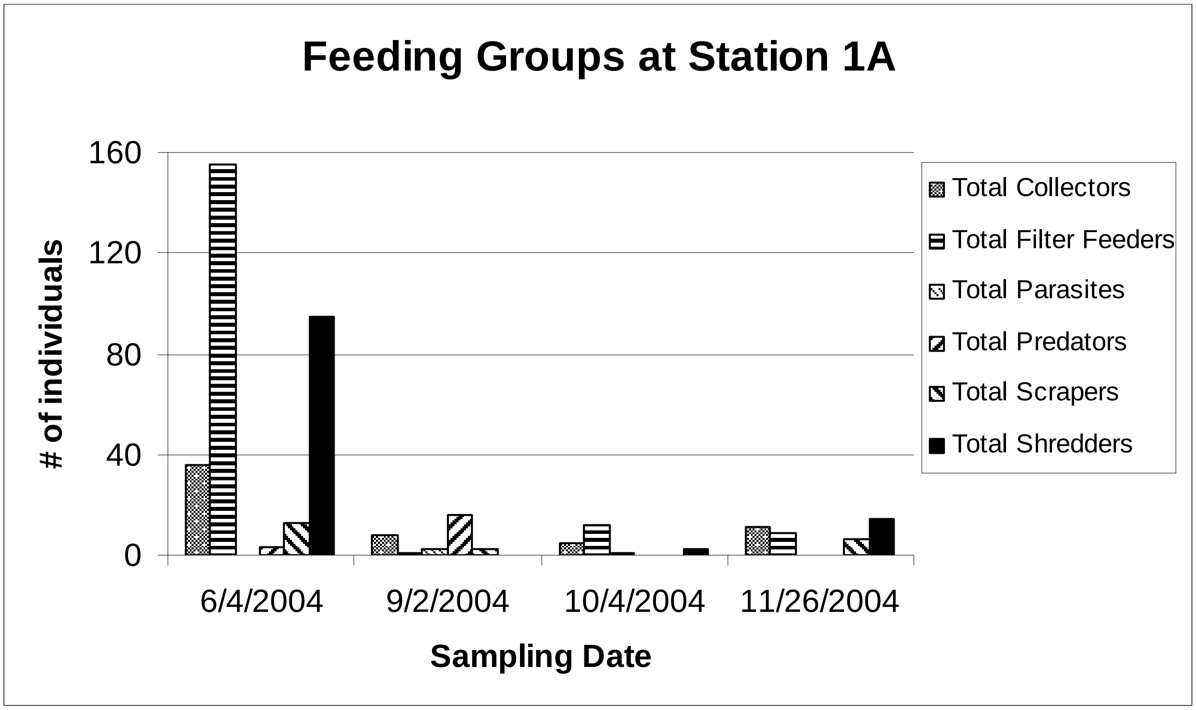

Figure 15. Feeding groups for station 1A during 2004.

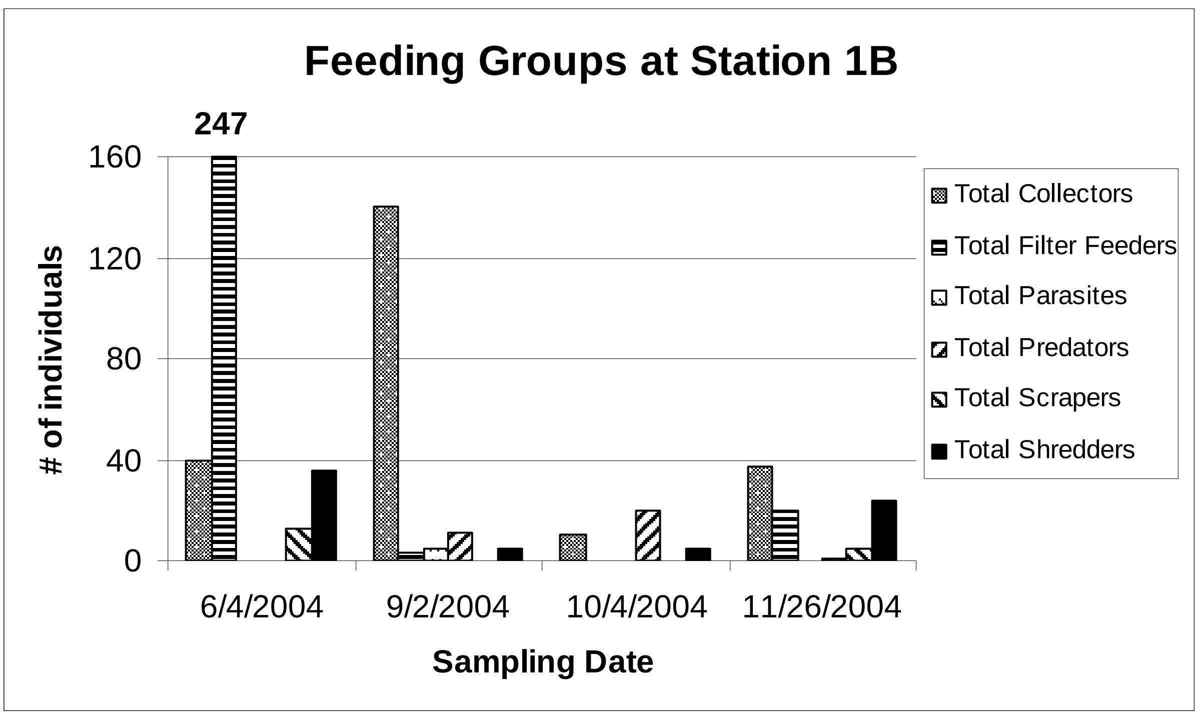

Figure 16. Feeding groups for station 1B during 2004.

Recovery After Drawdown

The loss of flow for a two month period at station 1 had an impact on the types and numbers of benthic macroinvertebrates at that location, and the effect persisted for at least two months after the drawdown ended. Maintaining wetness in part of the station reduced the impact somewhat, but the community was still clearly affected. Direct disturbance of the bottom substrate by construction equipment may have enhanced any effect of flow loss at station 1A. Changes at other stations do not reflect any pattern that can be easily attributed to drawdown influences on flow. Monitoring in 2005 will be needed to determine the total recovery time for station 1. The loss of flow experienced at Station 1 will largely be alleviated during future lake drawdowns by the installation of a downstream release pipe that outlets directly to the Lake Whitney spillway plunge pool, scheduled for completion in 2005.

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APPENDIX A

HABITAT ASSESSMENT AND

WATER QUALITY EVALUATION SHEETS

Lower Mill River habitat characterization – June and August 2000. Flow, as estimated at the Lake Whitney outlet, was 138 cfs on June 22 and 184 cfs on August 1. Watershed characteristics did not change from June to August.

	stn 1		**stn 2**		**stn 3**		**stn 4**		**stn 5**	
parameters	22 Jun	1 Aug	22 Jun	1 Aug	22 Jun	1 Aug	22 Jun	1 Aug	22 Jun	1 Aug
length of sampling segment	85 ft (26 m)		150 ft (46 m)		300 ft (91 m)		300 ft (91 m)		300 ft (91 m)	
♦ **watershed / bank features**										
predominant surrounding land use	forest/ residential		forest/ residential		forest/ residential		forest/ residential		forest/ residential	
local watershed pollution	some potential sources		obvious sources		obvious sources		obvious sources		obvious sources	
canopy cover	open		some shade (<40%)		mod. shade (40-80%)		some shade (<40%)		some shade (<40%)	
dominant riparian vegetation	shrubs		shrubs		trees		trees/shrubs		trees	
bank stability[1]	stable		stable		stable		stable		stable	
other notable features	upstream dam		upstream dam		upstream dam		upstream dam		upstream dam	
♦ **in-stream features**										
general habitat type (%) :										
riffle	100	100	90	90	70	95	-	-	-	-
run	-	-	10	10	30	5	75	40	80	-
pool	-	-	-	-	-	-	25	60	20	100
estimated stream width (ft) :	55	70	55	65	70	100	130	100	110	100
estimated stream depth (ft) :										
riffle	0.8	1.0	0.7	1.0	0.7	0.8	-	-	-	-
run	-	-	1.2	0.8	2.0	0.5	3.0	2.0	3.0	-
pool	-	-	-	-	-	-	4.0	2.0	4.0	2.5
inorganic substrate composition[2]										
bedrock	-	-	-	-	-	-	-	-	-	-
boulder (>256 mm)	10	10	10	10	5	-	5	5	5	5
cobble (64-256 mm)	75	70	70	60	40	40	20	20	15	20
gravel (2-64 mm)	15	20	20	20	40	40	10	5	20	30
sand (0.06-2 mm)	-	-	-	10	15	20	50	55	40	30
silt (0.004-0.006 mm)	-	-	-	-	-	-	15	15	20	15
clay (<0.004 mm)	-	-	-	-	-	-	-	-	-	-
organic substrate composition[2]										
detritus[3]	5	5	5	5	5	10	5	10	15	5
aquatic macrophytes	50	30	30	25	20	20	15	40	10	55
filamentous algae	50	30	25	25	15	traces	5	-	5	-
water lilies	-	-	-	-	-	20	5	-	-	-
clasping-leaf pondweed[4]	-	-	-	-	-	-	-	15	-	50
other pondweeds	-	-	5	-	5	-	5	15	-	5
waterweed	-	-	-	-	-	traces	-	10	5	-
other notable features					tidal influence		tidal influence		tidal influence	

(1) stable = minimal evidence of erosion or bank failure.

(2) % coverage

(3) logs, wood, coarse particulate organic matter

(4) *Potamogeton perfoliatus*

Lower Mill River habitat characterization – June and August 2001. Flow, as estimated at the Lake Whitney outlet, was 112 cfs on 13 June and 132 cfs on 21 August. Watershed characteristics did not change from June to August.

parameters	stn 1 13 Jun	stn 1 21 Aug	stn 2 13 Jun	stn 2 21 Aug	stn 3 13 Jun	stn 3 21 Aug	stn 4 13 Jun	stn 4 21 Aug	stn 5 13 Jun	stn 5 21 Aug
length of sampling segment	85 ft (26 m)		150 ft (46 m)		300 ft (91 m)		300 ft (91 m)		300 ft (91 m)	
♦ watershed / bank features										
predominant surrounding land use	forest/ residential		forest/ residential		forest/ residential		forest/ residential		forest/ residential	
local watershed pollution	some potential sources		obvious sources		obvious sources		obvious sources		obvious sources	
canopy cover	open		some shade (<40%)		mod. shade (40-80%)		some shade (<40%)		some shade (<40%)	
dominant riparian vegetation	shrubs		shrubs		trees		trees/shrubs		trees	
bank stability[1]	stable		stable		stable		stable		stable	
other notable features	upstream dam		upstream dam		upstream dam		upstream dam		upstream dam	
♦ in-stream features										
general habitat type (%) :										
riffle	100	100	100	95	-	5	-	-	-	-
run	-	-	-	5	100	95	50	20	90	70
pool	-	-	-	-	-	-	50	80	10	30
estimated stream width (ft) :	50	50	50	50	100	100	100	100	100	100
estimated stream depth (ft) :										
riffle	0.8	1.0	0.5	1.5	-	1.0	-	-	-	-
run	-	-	-	1.5	2.0	1.5	3.0	3.0	2.5	2.5
pool	-	-	-	-	-	-	3.0	3.0	4.0	4.0
inorganic substrate composition[2]										
bedrock	-	-	-	-	-	-	-	-	-	-
boulder (>256 mm)	10	10	10	10	5	5	5	5	5	5
cobble (64-256 mm)	75	80	70	70	40	45	20	10	15	15
gravel (2-64 mm)	15	10	20	20	40	50	10	5	20	25
sand (0.06-2 mm)	-	-	-	-	15	10	50	60	40	40
silt (0.004-0.006 mm)	-	-	-	-	-	-	15	20	20	15
clay (<0.004 mm)	-	-	-	-	-	-	-	-	-	-
organic substrate composition[2]										
detritus[3]	5	10	5	10	5	10	10	10	15	10
aquatic macrophytes	50	50	50	40	15	30	10	15	10	65
filamentous algae	50	20	45	10	10	5	5	-	5	30
water lilies	-	-	-	-	-	-	*traces*	15	-	-
Pondweeds[4]	-	-	-	15	-	25	-		-	25
moss	-	30	5	15	5	-	5		-	5
waterweed	-	-	-	-	-	*traces*	*traces*	*traces*	-	5
tidal influence	no	no	no	no	yes	yes	yes	yes	yes	yes
other notable features							recreation (swimming)		barnacle fragments	

[1] stable = minimal evidence of erosion or bank failure
[2] percent coverage
[3] logs, wood, coarse particulate organic matter
[4] Potamogeton richardsonii at stn 5 and narrow-leaved species at the other stations

Lower Mill River habitat characterization – June and August 2002. Flow, as estimated at the Lake Whitney outlet, was 128 cfs on 17 June and 33 cfs on 19 August. Watershed characteristics did not change from June to August.

	stn 1		**stn 2**		**stn 3**		**stn 4**		**stn 5**	
parameters	17 Jun	19 Aug	17 Jun	19 Aug	17 Jun	19 Aug	17 Jun	19 Aug	17 Jun	19 Aug
length of sampling segment	85 ft (26 m)		150 ft (46 m)		300 ft (91 m)		300 ft (91 m)		300 ft (91 m)	
♦ watershed / bank features										
predominant surrounding land use	forest/ residential		forest/ residential		forest/ residential		forest/ residential		forest/ residential	
canopy cover	open		some shade (<40%)		mod. shade (40-80%)		some shade (<40%)		some shade (<40%)	
dominant riparian vegetation	shrubs		shrubs		trees		trees/shrubs		trees	
bank stability(1)	stable		stable		stable		stable		stable	
other notable features	near dam		near dam		downstream of dam		downstream of dam		downstream of dam	
♦ in-stream features										
general habitat type (%) :										
riffle	100	100	100	100	50	40	-	-	-	-
run	-	-	-		50	60	50	20	95	20
pool	-	-	-		-	-	50	80	5	80
estimated stream width (ft) :	50	10	50	20	100	80	100	80	100	80
estimated stream depth (ft) :										
riffle	0.8	1.0	1.0	0.2	0.5	0.5	-	-	-	-
run	-	-	-	-	1.0	1.0	3.0	3.0	4.0	2.5
pool	-	-	-	-	-	-	3.0	3.0	2.5	3.0
inorganic substrate composition(2)										
bedrock	-	-	-	-	-	-	-	-	-	-
boulder (>256 mm)	10	0	10	5	-	5	5	5	1	-
cobble (64-256 mm)	75	95	70	75	10	20	5	10	2	10
gravel (2-64 mm)	15	5	20	20	80	50	40	5	40	60
sand (0.06-2 mm)	-	-	-	-	10	25	45	60	50	30
silt (0.004-0.006 mm)	-	-	-	-	-	-	5	20	7	
clay (<0.004 mm)	-	-	-	-	-	-	-	-	-	-
organic substrate composition(2)										
detritus(3)	5	5	5	5	5	5	20	5	15	5
aquatic macrophytes (total)	50	100	50	100	100	80	30	70	60	100
filamentous algae	50	100	50	20	95	20	30	25	60	-
water lilies (Nymphaea, Nuphar)	-	-	-	-	-	-	-	50	-	-
pondweeds (Potamogeton spp) (4)	-	-	40	80	5	80	-	25	-	100
moss	-	-	-	-	5	-	5	-	2	-
waterweed (Elodea canadensis)	-	-	25	5	25	5	25	5	25	5
tidal influence	no	no	no	no	no	no	yes	yes	yes	yes

(1) stable = minimal evidence of erosion or bank failure
(3) logs, wood, coarse particulate organic matter
(2) percent coverage
(4) *Potamogeton richardsonii* at stn 5 and narrow-leaved species at the other stations.

Lower Mill River habitat characterization – June and August 2003. Flow, as estimated at the Lake Whitney outlet, was 220 cfs on 19 June and 50 cfs on 26 August. Watershed characteristics did not change from June to August.

	stn 1		stn 2		stn 3		stn 4		stn 5	
parameters	19 Jun	26 Aug	19 Jun	26 Aug	19 Jun	26 Aug	19 Jun	26 Aug	19 Jun	26 Aug
length of sampling segment	85 ft (26 m)		150 ft (46 m)		300 ft (91 m)		300 ft (91 m)		300 ft (91 m)	
◆ watershed / bank features										
predominant surrounding land use	forest/ residential		forest/ residential		forest/ residential		forest/ residential		forest/ residential	
canopy cover	open		some shade (<40%)		mod. shade (30-50%)		Some shade (20%)		some shade (<40%)	
dominant riparian vegetation	shrubs		shrubs		trees		trees/shrubs		trees	
bank stability[1]	stable		stable		stable		stable		stable	
other notable features	near dam		near dam		downstream of dam		downstream of dam		downstream of dam	
◆ in-stream features										
general habitat type (%) :										
riffle	100	100	100	100	80	70	-	-	-	-
run	-	-	-		20	30	80	20	95	20
pool	-	-	-		-	-	20	80	5	80
estimated stream width (ft) :	100	10	100	25	100	80	100	90	120	70
estimated stream depth (ft) :										
riffle	2.0	0.5	2.0	0.3	1.0	0.4	-	-	-	-
run	-	-	-	-	1.3	0.6	3.3	2.5	3.0	1.5
pool	-	-	-	-	-	-	3.3	4.0	1.5	2.5
inorganic substrate composition[2]										
bedrock	-	-	-	-	-	-	-	-	-	-
boulder (>256 mm)	10	0	10	5	-	5	5	5	1	-
cobble (64-256 mm)	75	95	70	75	10	20	5	10	2	20
gravel (2-64 mm)	15	5	20	20	80	50	40	5	40	50
sand (0.06-2 mm)	-	-	-	-	10	25	45	60	50	30
silt (0.004-0.006 mm)	-	-	-	-	-	-	5	20	7	
clay (<0.004 mm)	-	-	-	-	-	-	-	-	-	-
organic substrate composition[2]										
detritus[3]	0	5	0	5	5	5	20	5	5	5
aquatic macrophytes (total)	50	50	50	30	35	30	30	50	20	40
filamentous algae	50	50	40	20	30	10	20	10	30	-
water lilies (Nymphaea, Nuphar)	-	-	-	-	-	-	10	10	-	-
pondweeds (Potamogeton spp)[4]	-	-	10	10	5	15	20	30	10	20
coontail (Ceratophyllum)	-	-	-	-	-	-	-	5	-	-
waterweed (Elodea canadensis)	-	-	-	5	-	5	5	5	10	20
tidal influence	no	no	no	no	no	no	yes	yes	yes	yes

(1) stable = minimal evidence of erosion or bank failure
(3) logs, wood, coarse particulate organic matter

(2) percent coverage
(4) *Potamogeton richardsonii* at stn 5 and narrow-leaved species plus *P. crispus* at the other stations. Some *Marsilea* at stn 3.

Lower Mill River habitat characterization – June and August 2004. Flow, as estimated at the Lake Whitney outlet, was cfs on 16 June and cfs on August. Watershed characteristics did not change from June to August.

parameters	stn 1 16 Jun	stn 1 2 Sept	stn 2 16 Jun	stn 2 2 Sept	stn 3 16 Jun	stn 3 2 Sept	stn 4 16 Jun	stn 4 2 Sept	stn 5 16 Jun	stn 5 2 Sept
length of sampling segment	85 ft (26 m)		150 ft (46 m)		300 ft (91 m)		300 ft (91 m)		300 ft (91 m)	
♦ **watershed / bank features**										
predominant surrounding land use	forest/ residential		forest/ residential		forest/ residential		forest/ residential		forest/ residential	
canopy cover	open		some shade (<40%)		mod. shade (30-50%)		Some shade (20%)		some shade (<40%)	
dominant riparian vegetation	shrubs		shrubs		trees		trees/shrubs		trees	
bank stability[1]	stable		stable		stable		stable		stable	
other notable features	near dam		near dam		downstream of dam		downstream of dam		downstream of dam	
♦ **in-stream features**										
general habitat type (%) :										
riffle	100	100	100	100	100	100	-	-	-	-
run	-	-	-	-	-	-	-	-	-	-
pool	-	-	-	-	-	-	100	100	100	100
estimated stream width (ft) :	25-30	20	30	30	104	100	100	95	100	100
estimated stream depth (ft) :										
riffle	0.5-1	0.5-1	0.5	0.5	0.35	0.25	-	-	-	-
run	-	-	-	-	-	-	-	-	-	-
pool	-	-	-	-	-	-	3.0	3.5	4.0	4.5
inorganic substrate composition[2]										
bedrock	-	-	-	-	-	-	-	-	-	-
boulder (>256 mm)	-	-	-	-	-	-	5	5	1	1
cobble (64-256 mm)	90	90	90	90	10	10	10	10	2	2
gravel (2-64 mm)	10	10	10	10	80	75	5	5	30	30
sand (0.06-2 mm)	-	-	-	-	10	15	60	60	60	60
silt (0.004-0.006 mm)	-	-	-	-	-	-	20	20	7	7
clay (<0.004 mm)	-	-	-	-	-	-	-	-	-	-
organic substrate composition[2]										
detritus[3]	0	0	0	0	5	10	5	5	5	10
aquatic macrophytes (total)	40	30	40	50	10	5	10	30	40	40
filamentous algae	A	A	A	A	C	C	C	P	C	C
water lilies (Nymphaea, Nuphar)	-	-	-	-	-	-	-	-	-	-
pondweeds (Potamogeton spp) [4]	-	-	-	P	C	C	C	C	C	C
coontail (Ceratophyllum)	-	-	-	-	-	-	-	-	-	-
waterweed (Elodea canadensis)	-	-	-	-	C	C	T	P	P	P
tidal influence	No	No	No	No	No	No	yes	yes	yes	yes

(1) stable = minimal evidence of erosion or bank failure (2) percent coverage
(3) logs, wood, coarse particulate organic matter (4) *Potamogeton richardsonii* at stn 5 and narrow-leaved species plus *P. crispus* at the other stations.

Water quality at the sampling locations, summer 2000.

parameter	station 1	
	22 Jun	1 Aug
water temperature (°C)	21.1	19.8
dissolved oxygen (mg/l)	9.0	9.4
dissolved oxygen (% saturation)	103	108
specific conductivity (µS/cm)	189	194
turbidity (NTU)	3.2	4.4
pH (SU)	7.8	7.6

	station 2	
	22 Jun	1 Aug
water temperature (°C)	21.3	19.7
dissolved oxygen (mg/l)	9.8	9.0
dissolved oxygen (% saturation)	112	100
specific conductivity (µS/cm)	190	192
turbidity (NTU)	3.3	2.8
pH (SU)	7.8	7.6

	station 3	
	22 Jun	1 Aug
water temperature (°C)	21.1	19.7
dissolved oxygen (mg/l)	9.6	9.3
dissolved oxygen (% saturation)	108	103
specific conductivity (µS/cm)	189	194
turbidity (NTU)	3.8	2.7
pH (SU)	7.6	7.6

	station 4	
	22 Jun	1 Aug
water temperature (°C)	21.9	19.7
dissolved oxygen (mg/l)	10.4	8.9
dissolved oxygen (% saturation)	114	99
specific conductivity (µS/cm)	189	194
turbidity (NTU)	3.5	3.1
pH (SU)	7.7	7.6

	station 5	
	22 Jun	1 Aug
water temperature (°C)	23.1	19.7
dissolved oxygen (mg/l)	9.0	9.6
dissolved oxygen (% saturation)	106	107
specific conductivity (µS/cm)	193	197
turbidity (NTU)	3.9	3.3
pH (SU)	7.4	7.6

Water quality at the sampling locations, summer 2001.

parameter	station 1 13 Jun	station 1 21 Aug
water temperature (°C)	22.5	25.6
dissolved oxygen (mg/l)	9.7	8.1
dissolved oxygen (% saturation)	112	99
specific conductivity (µS/cm)	199	270
turbidity (NTU)	1.72	4.24
pH (SU)	8.5	6.8

parameter	station 2 13 Jun	station 2 21 Aug
water temperature (°C)	22.4	25.6
dissolved oxygen (mg/l)	10.4	9.0
dissolved oxygen (% saturation)	120	111
specific conductivity (µS/cm)	199	268
turbidity (NTU)	2.04	2.57
pH (SU)	8.5	7.8

parameter	station 3 13 Jun	station 3 21 Aug
water temperature (°C)	22.3	25.9
dissolved oxygen (mg/l)	10.2	8.8
dissolved oxygen (% saturation)	117	109
specific conductivity (µS/cm)	200	265
turbidity (NTU)	2.38	4.80
pH (SU)	8.6	8.1

parameter	station 4 13 Jun	station 4 21 Aug
water temperature (°C)	23.5	26.1
dissolved oxygen (mg/l)	11.8	8.2
dissolved oxygen (% saturation)	134	98
specific conductivity (µS/cm)	199	270
turbidity (NTU)	1.99	2.74
pH (SU)	8.8	7.3

parameter	station 5 13 Jun	station 5 21 Aug
water temperature (°C)	24.7	25.5
dissolved oxygen (mg/l)	11.2	6.4
dissolved oxygen (% saturation)	135	75
specific conductivity (µS/cm)	207	411
turbidity (NTU)	2.25	3.90
pH (SU)	8.6	8.5

Water quality at the sampling locations, summer 2002.

parameter	station 1 17 Jun	station 1 19 Aug
water temperature (°C)	19.5	26.7
dissolved oxygen (mg/l)	9.2	5.7
dissolved oxygen (% saturation)	101	71
specific conductivity (µS/cm)	193	244
turbidity (NTU)	1.56	5.21
pH (SU)	7.2	8.4

parameter	station 2 17 Jun	station 2 19 Aug
water temperature (°C)	19.4	26.4
dissolved oxygen (mg/l)	9.3	8.0
dissolved oxygen (% saturation)	102	99
specific conductivity (µS/cm)	193	241
turbidity (NTU)	1.99	7.80
pH (SU)	7.7	8.81

parameter	station 3 17 Jun	station 3 19 Aug
water temperature (°C)	19.4	26.7
dissolved oxygen (mg/l)	9.2	5.9
dissolved oxygen (% saturation)	100	73
specific conductivity (µS/cm)	194	245
turbidity (NTU)	1.23	4.02
pH (SU)	7.7	8.2

parameter	station 4 17 Jun	station 4 19 Aug
water temperature (°C)	20.4	30.2
dissolved oxygen (mg/l)	9.4	8.5
dissolved oxygen (% saturation)	104	117
specific conductivity (µS/cm)	195	7013
turbidity (NTU)	3.16	8.42
pH (SU)	7.9	8.29

parameter	station 5 17 Jun	station 5 19 Aug
water temperature (°C)	21.5	28.8
dissolved oxygen (mg/l)	9.5	6.6
dissolved oxygen (% saturation)	108	87.4
specific conductivity (µS/cm)	198	7333
turbidity (NTU)	2.00	10.40
pH (SU)	7.9	8.1

Water quality at the sampling locations, summer 2003.

parameter	station 1	
	19 Jun	26 Aug
water temperature (°C)	17.9	23.8
dissolved oxygen (mg/l)	9.4	7.4
dissolved oxygen (% saturation)	99	87
specific conductivity (µS/cm)	282	226
turbidity (NTU)	2.15	1.56
pH (SU)	7.2	7.8
	station 2	
	19 Jun	26 Aug
water temperature (°C)	17.7	23.7
dissolved oxygen (mg/l)	9.6	7.3
dissolved oxygen (% saturation)	101	86
specific conductivity (µS/cm)	284	230
turbidity (NTU)	7.86	1.23
pH (SU)	7.2	7.8
	station 3	
	19 Jun	26 Aug
water temperature (°C)	17.6	23.4
dissolved oxygen (mg/l)	9.5	7.5
dissolved oxygen (% saturation)	100	88
specific conductivity (µS/cm)	290	231
turbidity (NTU)	3.84	1.58
pH (SU)	7.2	7.8
	station 4	
	19 Jun	26 Aug
water temperature (°C)	17.8	22.7
dissolved oxygen (mg/l)	9.4	6.1
dissolved oxygen (% saturation)	99	72
specific conductivity (µS/cm)	298	234
turbidity (NTU)	4.57	1.89
pH (SU)	7.3	7.3
	station 5	
	19 Jun	26 Aug
water temperature (°C)	18.3	23.1
dissolved oxygen (mg/l)	9.5	6.0
dissolved oxygen (% saturation)	101	70
specific conductivity (µS/cm)	296	385
turbidity (NTU)	3.06	1.93
pH (SU)	7.3	7.4

Water quality at sampling location 2004

	Station 1	
Parameter	**June**	**September**
water temperature (°C)	23.2	23.68
dissolved oxygen (mg/L)	8.3	8.17
dissolved oxygen (% saturation)	96	96.6
specific conductivity (µS/cm)	225	245
turbidity (NTU)	1.04	5.57
pH (SU)	8.4	7.87
	Station 2	
	June	**September**
water temperature (°C)	23.2	23.57
dissolved oxygen (mg/L)	8.0	7.89
dissolved oxygen (% saturation)	94	93
specific conductivity (µS/cm)	223	245
turbidity (NTU)	1.04	5.49
pH (SU)	8.2	7.82
	Station 3	
	June	**September**
water temperature (°C)	23.3	22.34
dissolved oxygen (mg/L)	7.9	7.90
dissolved oxygen (% saturation)	93	91.1
specific conductivity (µS/cm)	233	220
turbidity (NTU)	1.61	2.31
pH (SU)	8.3	7.59
	Station 4	
	June	**September**
water temperature (°C)	23.0	21.3
dissolved oxygen (mg/L)	7.9	7.15
dissolved oxygen (% saturation)	92	80.8
specific conductivity (µS/cm)	222	218
turbidity (NTU)	1.18	2.72
pH (SU)	8.4	7.21
	Station 5	
	June	**September**
water temperature (°C)	23.1	22.48
dissolved oxygen (mg/L)	6.8	6.89
dissolved oxygen (% saturation)	80	80.2
specific conductivity (µS/cm)	250	2280
turbidity (NTU)	1.69	4.32
pH (SU)	8.1	7.14

APPENDIX B

MACROINVERTEBRATE DATA

				22-Jun-00					1-Aug-00				
				Stations					Stations				
				1	2	3	4	5	1	2	3	4	5
Class	**Order**	**Family**	**Genus/Species**										
Annelida	Hirudinea	Glossiphoniidae	Glossiphonia complanata				1		5	1	2		
Annelida	Hirudinea	Glossiphoniidae	Placobdella sp.					3					
Annelida	Oligochaeta	Lumbriculidae	Unidentified Lumbriculidae	1	1		1						
Annelida	Oligochaeta	Naididae	Nais communis										
Annelida	Oligochaeta	Tubificidae	Limnodrilus hoffmeisteri										
Annelida	Oligochaeta	Tubificidae	Unidentified Tubificidae					15					1
Annelida	Oligochaeta	Unidentified Oligochaeta	Unidentified Oligochaeta										
Annelida	Polychaeta	Ampherididae	Unidentified Ampherididae										
Annelida	Polychaeta	Capitellidae	Heteromastus filiformis										
Annelida	Polychaeta	Spionidae	Marenzellaria viridis										
Annelida	Polychaeta	Spionidae	Polydora sp.										
Arachnida	Trombidiformes	Lebertiidae	Lebertia sp.										
Arachnoidea	Hydracarina	Arrenuridae	Unidentified Arrenuridae										
Bivalvia	Veneorida	Pisidiidae	Pisidium sp.										
Crustacea	Amphipoda	Corophiidae	Corophium sp. (juvenile)										
Crustacea	Amphipoda	Crangonyctidae	Crangonyx sp.	80	87	20	2		86	19	18		
Crustacea	Amphipoda	Gammaridae	Gammarus sp.	419	540	623	48	1	1212	2311	1904	159	24
Crustacea	Cumacea	Nannasticidae	Almyracuma proximoculi										
Crustacea	Decapoda	Palaemonidae	Paleomonetes vulgaris										
Crustacea	Decapoda	Portunidae	Carcinus maenus										
Crustacea	Isopoda	Asellidae	Caecidotea communis										
Crustacea	Isopoda	Asellidae	Lirceus/Acellus sp. (communis)	32		9	1		9	9	8		
Hydrozoa	Hydroida	Hydridae	Hydra sp.							1			
Insecta	Coleoptera	Brachyceridae	Brachycerus sp.										
Insecta	Coleoptera	Curculionidae	Unidentifed Curculionidae										
Insecta	Coleoptera	Dryopidae	Helichus sp.										
Insecta	Coleoptera	Elmidae	Stenelmis sp.										
Insecta	Coleoptera	Hydrophilidae	Berosus sp.		3	8	1			5	7		
Insecta	Coleoptera	Psephenidae	Unidentified Psephenidae										
Insecta	Coleoptera	Unidentified Coleoptera	Unidentified Coleoptera										
Insecta	Diptera	Ceratopognidae	Unidentified Ceratopognidae										
Insecta	Diptera	Chironomidae	Unidenitifed Chironomidae	354	272	273	177	151	50	336	206	102	86
Insecta	Diptera	Empididae	Empididae										
Insecta	Diptera	Empididae	Hemerodromia sp.	1	25	13			8	98	23		1
Insecta	Diptera	Simuliidae	Simulium sp.	51	36	2			5	6			1
Insecta	Diptera	Tipulidae	Unidentified Tipulidae										
Insecta	Diptera	Unidentified Diptera	Unidentified Diptera										
Insecta	Ephemeroptera	Baetidae	Baetis sp										
Insecta	Ephemeroptera	Caenidae	Caenis sp.	1			1		1	2	2		14
Insecta	Ephemeroptera	Ephemerellidae	Unidentified Ephemerellidae										
Insecta	Ephemeroptera	Heptageniidae	Stenonema sp.										
Insecta	Ephemeroptera	Oligoneuridae	Isonychia sp.							1		2	
Insecta	Hemiptera	Unidentified Hemiptera	Unidentified Hemiptera										
Insecta	Heteroptera	Gerridae	Unidentified Gerridae										
Insecta	Heteroptera	Gerridae	Rheumatobates sp.										
Insecta	Heteroptera	Mesoveliidae	Mesovelia sp.										
Insecta	Neuroptera	Sysiridae	Sysira sp.						1				
Insecta	Odonata	Calopterygidae	Calopteryx spp										
Insecta	Odonata	Coenagrionidae	Argia sp.		5	1	3	3					
Insecta	Odonata	Coenagrionidae	Ischnura/Enallagma sp.							1		2	1
Insecta	Odonata	Corduliidae	Didymops sp.										
Insecta	Odonata	Corduliidae	Somatochlora sp.										
Insecta	Trichoptera	Brachycentridae	Brachycentrus sp.										
Insecta	Trichoptera	Brachycentridae	Micrasema sp.										
Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.										
Insecta	Trichoptera	Hydropsychidae	Macrostemum sp.	10	19	3			1	8	8		
Insecta	Trichoptera	Hydropsychidae	Parapsyche sp.	13	6	3	3		9		1	1	
Insecta	Trichoptera	Hydroptilidae	Agraylea sp.										
Insecta	Trichoptera	Hydroptilidae	Orthotrichia sp.					2					
Insecta	Trichoptera	Hydroptilidae	Oxyethira sp.							3		1	
Insecta	Trichoptera	Leptoceridae	Ceraclea sp.		4	44	2		12	36	35		
Insecta	Trichoptera	Leptoceridae	Mystacides sp.								1		
Insecta	Trichoptera	Leptoceridae	Triaenodes sp.		1						1		
Insecta	Trichoptera	Limnephilidae	Rossiana sp.										
Insecta	Trichoptera	Limnephilidae	Unidentified Limnephilidae										
Insecta	Trichoptera	Philopotamidae	Chimarra spp										
Insecta	Trichoptera	Psychomyiidae	Psychomyia sp.									2	3
Maxillopoda	Sessilia	Balanidae	Balanus improvisus										
Mollusca	Bivalvia	Sphaeriidae	Unidentified Sphaeriidae	1	5	4	1			1	4	1	
Mollusca	Gastropoda	Ancylidae	Ferrissia rivularis		5	1				3	5		
Mollusca	Gastropoda	Hydrobiidae	Amnicola limosa/Bithynia tentaulata										
Mollusca	Gastropoda	Hydrobiidae	Pomatiopsis sp.										
Mollusca	Gastropoda	Lymnaeidae	Lymnaea columella										
Mollusca	Gastropoda	Physidae	Physa sp.		15	3	4	1	11	25	4	9	
Mollusca	Gastropoda	Planorbidae	Gyraulus circumstriatus			2					6		
Mollusca	Gastropoda	Planorbidae	Gyraulus deflectus	2		1				3			
Mollusca	Gastropoda	Planorbidae	Gyraulus parvus	1	4	10		1	22	147	117	2	1
Mollusca	Gastropoda	Planorbidae	Helisoma sp.		1								
Mollusca	Gastropoda	Pleuroceridae	Pleurocera sp.										
Mollusca	Gastropoda	Valvatidae	Valvata tricarinata										
Mollusca	Gastropoda	Unidentified Gastropoda	Unidentified Gastropoda										
Nemertea	Unidentified Nemertea	Unidentified Nemertea	Unidentified Nemertea										
Turbellaria	Tricladida	Dugesiidae	Dugesia sp.	58	63	84			325	309	16		
			TOTAL NUMBER OF INDIVIDUALS	1024	1092	1104	245	177	1757	3325	2368	281	132
			TOTAL NUMBER OF TAXA	14	18	18	13	8	15	21	19	10	9

				13-Jun-01					21-Aug-01				
						Stations					Stations		
				1	2	3	4	5	1	2	3	4	5
Class	**Order**	**Family**	**Genus/Species**										
Annelida	Hirudinea	Glossiphoniidae	Glossiphonia complanata				1			2		4	
Annelida	Hirudinea	Glossiphoniidae	Placobdella sp.										
Annelida	Oligochaeta	Lumbriculidae	Unidentified Lumbriculidae										
Annelida	Oligochaeta	Naididae	Nais communis										
Annelida	Oligochaeta	Tubificidae	Limnodrilus hoffmeisteri										
Annelida	Oligochaeta	Tubificidae	Unidentified Tubificidae					5				2	
Annelida	Oligochaeta	Unidentified Oligochaeta	Unidentified Oligochaeta										
Annelida	Polychaeta	Ampherididae	Unidentified Ampherididae										
Annelida	Polychaeta	Capitellidae	Heteromastus filiformis										
Annelida	Polychaeta	Spionidae	Marenzellaria viridis										
Annelida	Polychaeta	Spionidae	Polydora sp.										
Arachnida	Trombidiformes	Lebertiidae	Lebertia sp.										
Arachnoidea	Hydracarina	Arrenuridae	Unidentified Arrenuridae										
Bivalvia	Veneorida	Pisidiidae	Pisidium sp.										
Crustacea	Amphipoda	Corophiidae	Corophium sp. (juvenile)										
Crustacea	Amphipoda	Crangonyctidae	Crangonyx sp.	8	4	5					2		
Crustacea	Amphipoda	Gammaridae	Gammarus sp.	19	69	185	92	64	36	540	212	3	88
Crustacea	Cumacea	Nannasticidae	Almyracuma proximoculi										
Crustacea	Decapoda	Palaemonidae	Paleomonetes vulgaris										
Crustacea	Decapoda	Portunidae	Carcinus maenus										
Crustacea	Isopoda	Asellidae	Caecidotea communis										
Crustacea	Isopoda	Asellidae	Lirceus/Acellus sp. (communis)	8	4	2				2			
Hydrozoa	Hydroida	Hydridae	Hydra sp.							8			
Insecta	Coleoptera	Brachyceridae	Brachycerus sp.										
Insecta	Coleoptera	Curculionidae	Unidentifed Curculionidae										
Insecta	Coleoptera	Dryopidae	Helichus sp.		1								
Insecta	Coleoptera	Elmidae	Stenelmis sp.										
Insecta	Coleoptera	Hydrophilidae	Berosus sp.			4			2	2			1
Insecta	Coleoptera	Psephenidae	Unidentified Psephenidae										
Insecta	Coleoptera	Unidentified Coleoptera	Unidentified Coleoptera										
Insecta	Diptera	Ceratopognidae	Unidentified Ceratopognidae										
Insecta	Diptera	Chironomidae	Unidenitifed Chironomidae	273	50	112	103	126	394	188	78	2	30
Insecta	Diptera	Empididae	Empididae										
Insecta	Diptera	Empididae	Hemerodromia sp.	1	1				42	40			
Insecta	Diptera	Simuliidae	Simulium sp.	33	4				37	30			
Insecta	Diptera	Tipulidae	Unidentified Tipulidae										
Insecta	Diptera	Unidentified Diptera	Unidentified Diptera										
Insecta	Ephemeroptera	Baetidae	Baetis sp										
Insecta	Ephemeroptera	Caenidae	Caenis sp.	1									1
Insecta	Ephemeroptera	Ephemerellidae	Unidentified Ephemerellidae										
Insecta	Ephemeroptera	Heptageniidae	Stenonema sp.										
Insecta	Ephemeroptera	Oligoneuridae	Isonychia sp.										1
Insecta	Hemiptera	Unidentified Hemiptera	Unidentified Hemiptera										
Insecta	Heteroptera	Gerridae	Unidentified Gerridae										
Insecta	Heteroptera	Gerridae	Rheumatobates sp.										
Insecta	Heteroptera	Mesoveliidae	Mesovelia sp.										
Insecta	Neuroptera	Sysiridae	Sysira sp.										
Insecta	Odonata	Calopterygidae	Calopteryx spp										
Insecta	Odonata	Coenagrionidae	Argia sp.										
Insecta	Odonata	Coenagrionidae	Ischnura/Enallagma sp.										2
Insecta	Odonata	Corduliidae	Didymops sp.										
Insecta	Odonata	Corduliidae	Somatochlora sp.										
Insecta	Trichoptera	Brachycentridae	Brachycentrus sp.							1	1		
Insecta	Trichoptera	Brachycentridae	Micrasema sp.										
Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	14	32		3		2				
Insecta	Trichoptera	Hydropsychidae	Macrostemum sp.	9	18				264	303	1		
Insecta	Trichoptera	Hydropsychidae	Parapsyche sp.										
Insecta	Trichoptera	Hydroptilidae	Agraylea sp.										
Insecta	Trichoptera	Hydroptilidae	Orthotrichia sp.										
Insecta	Trichoptera	Hydroptilidae	Oxyethira sp.						6				
Insecta	Trichoptera	Leptoceridae	Ceraclea sp.	11	7	45	5	5	8	12	11		5
Insecta	Trichoptera	Leptoceridae	Mystacides sp.								12		10
Insecta	Trichoptera	Leptoceridae	Triaenodes sp.									2	
Insecta	Trichoptera	Limnephilidae	Rossiana sp.				1			10	2		1
Insecta	Trichoptera	Limnephilidae	Unidentified Limnephilidae								10		3
Insecta	Trichoptera	Philopotamidae	Chimarra spp										
Insecta	Trichoptera	Psychomyiidae	Psychomyia sp.	1									
Maxillopoda	Sessilia	Balanidae	Balanus improvisus										
Mollusca	Bivalvia	Sphaeriidae	Unidentified Sphaeriidae			5	2			2			
Mollusca	Gastropoda	Ancylidae	Ferrissia rivularis								3		
Mollusca	Gastropoda	Hydrobiidae	Amnicola limosa/Bithynia tentaulata	7	22	95			36	62	201		3
Mollusca	Gastropoda	Hydrobiidae	Pomatiopsis sp.					6					
Mollusca	Gastropoda	Lymnaeidae	Lymnaea columella				4						
Mollusca	Gastropoda	Physidae	Physa sp.	3	1		1			43			1
Mollusca	Gastropoda	Planorbidae	Gyraulus circumstriatus						2				
Mollusca	Gastropoda	Planorbidae	Gyraulus deflectus										
Mollusca	Gastropoda	Planorbidae	Gyraulus parvus	3	3	9	17		4	26	19		2
Mollusca	Gastropoda	Planorbidae	Helisoma sp.										
Mollusca	Gastropoda	Pleuroceridae	Pleurocera sp.					1					
Mollusca	Gastropoda	Valvatidae	Valvata tricarinata								1		
Mollusca	Gastropoda	Unidentified Gastropoda	Unidentified Gastropoda										
Nemertea	Unidentified Nemertea	Unidentified Nemertea	Unidentified Nemertea										
Turbellaria	Tricladida	Dugesiidae	Dugesia sp.	32	19	51	4		50	33	28	1	
			TOTAL NUMBER OF INDIVIDUALS	423	235	513	233	207	883	1304	581	14	148
			TOTAL NUMBER OF TAXA	15	14	10	11	6	13	17	14	6	13

				17-Jun-02					19-Aug-02				
				Stations					Stations				
				1	2	3	4	5	1	2	3	4	5
Class	**Order**	**Family**	**Genus/Species**										
Annelida	Hirudinea	Glossiphoniidae	Glossiphonia complanata										
Annelida	Hirudinea	Glossiphoniidae	Placobdella sp.										
Annelida	Oligochaeta	Lumbriculidae	Unidentified Lumbriculidae										
Annelida	Oligochaeta	Naididae	Nais communis										
Annelida	Oligochaeta	Tubificidae	Limnodrilus hoffmeisteri										
Annelida	Oligochaeta	Tubificidae	Unidentified Tubificidae	418	48	292	436	404	20			16	28
Annelida	Oligochaeta	Unidentified Oligochaeta	Unidentified Oligochaeta										
Annelida	Polychaeta	Ampheridiidae	Unidentified Ampheridiidae					4	4				
Annelida	Polychaeta	Capitellidae	Heteromastus filiformis					4					
Annelida	Polychaeta	Spionidae	Marenzellaria viridis					4					
Annelida	Polychaeta	Spionidae	Polydora sp.										
Arachnida	Trombidiformes	Lebertiidae	Lebertia sp.										
Arachnoidea	Hydracarina	Arrenuridae	Unidentified Arrenuridae		20	4				4			
Bivalvia	Veneorida	Pisidiidae	Pisidium sp.										
Crustacea	Amphipoda	Corophiidae	Corophium sp. (juvenile)										
Crustacea	Amphipoda	Crangonyctidae	Crangonyx sp.										
Crustacea	Amphipoda	Gammaridae	Gammarus sp.	152	479	488	4	37	116	92	16		32
Crustacea	Cumacea	Nannasticidae	Almyracuma proximoculi					28					4
Crustacea	Decapoda	Palaemonidae	Paleomonetes vulgaris										
Crustacea	Decapoda	Portunidae	Carcinus maenus										
Crustacea	Isopoda	Asellidae	Caecidotea communis										
Crustacea	Isopoda	Asellidae	Lirceus/Acellus sp. (communis)		16								
Hydrozoa	Hydroida	Hydridae	Hydra sp.										
Insecta	Coleoptera	Brachyceridae	Brachycerus sp.										
Insecta	Coleoptera	Curculionidae	Unidentifed Curculionidae										
Insecta	Coleoptera	Dryopidae	Helichus sp.										
Insecta	Coleoptera	Elmidae	Stenelmis sp.										
Insecta	Coleoptera	Hydrophilidae	Berosus sp.		12	4							4
Insecta	Coleoptera	Psephenidae	Unidentified Psephenidae							8			8
Insecta	Coleoptera	Unidentified Coleoptera	Unidentified Coleoptera										
Insecta	Diptera	Ceratopognidae	Unidentified Ceratopognidae		8								
Insecta	Diptera	Chironomidae	Unidenitifed Chironomidae	108	548	360	136	60	1252	280	140	32	92
Insecta	Diptera	Empididae	Empididae										
Insecta	Diptera	Empididae	Hemerodromia sp.	20	112	76	16	8	48	20	4	4	4
Insecta	Diptera	Simuliidae	Simulium sp.		8								
Insecta	Diptera	Tipulidae	Unidentified Tipulidae										
Insecta	Diptera	Unidentified Diptera	Unidentified Diptera				4						
Insecta	Ephemeroptera	Baetidae	Baetis sp										
Insecta	Ephemeroptera	Caenidae	Caenis sp.										
Insecta	Ephemeroptera	Ephemerellidae	Unidentified Ephemerellidae		4								
Insecta	Ephemeroptera	Heptageniidae	Stenonema sp.										
Insecta	Ephemeroptera	Oligoneuridae	Isonychia sp.										
Insecta	Hemiptera	Unidentified Hemiptera	Unidentified Hemiptera										
Insecta	Heteroptera	Gerridae	Unidentified Gerridae										
Insecta	Heteroptera	Gerridae	Rheumatobates sp.										
Insecta	Heteroptera	Mesoveliidae	Mesovelia sp.										
Insecta	Neuroptera	Sysiridae	Sysira sp.										
Insecta	Odonata	Calopterygidae	Calopteryx spp										
Insecta	Odonata	Coenagrionidae	Argia sp.										
Insecta	Odonata	Coenagrionidae	Ischnura/Enallagma sp.							68			
Insecta	Odonata	Corduliidae	Didymops sp.										
Insecta	Odonata	Corduliidae	Somatochlora sp.										
Insecta	Trichoptera	Brachycentridae	Brachycentrus sp.	12	52	4	20		64		4		
Insecta	Trichoptera	Brachycentridae	Micrasema sp.									4	
Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	20	36				228	40			
Insecta	Trichoptera	Hydropsychidae	Macrostemum sp.										
Insecta	Trichoptera	Hydropsychidae	Parapsyche sp.										
Insecta	Trichoptera	Hydroptilidae	Agraylea sp.										
Insecta	Trichoptera	Hydroptilidae	Orthotrichia sp.										
Insecta	Trichoptera	Hydroptilidae	Oxyethira sp.										
Insecta	Trichoptera	Leptoceridae	Ceraclea sp.										
Insecta	Trichoptera	Leptoceridae	Mystacides sp.										
Insecta	Trichoptera	Leptoceridae	Triaenodes sp.										
Insecta	Trichoptera	Limnephilidae	Rossiana sp.										
Insecta	Trichoptera	Limnephilidae	Unidentified Limnephilidae										
Insecta	Trichoptera	Philopotamidae	Chimarra spp										
Insecta	Trichoptera	Psychomyiidae	Psychomyia sp.										
Maxillopoda	Sessilia	Balanidae	Balanus improvisus										
Mollusca	Bivalvia	Sphaeriidae	Unidentified Sphaeriidae			32	16	28	4		12	12	
Mollusca	Gastropoda	Ancylidae	Ferrissia rivularis										
Mollusca	Gastropoda	Hydrobiidae	Amnicola limosa/Bithynia tentaulata	88	188	360		16	44	40	200	8	24
Mollusca	Gastropoda	Hydrobiidae	Pomatiopsis sp.										
Mollusca	Gastropoda	Lymnaeidae	Lymnaea columella										
Mollusca	Gastropoda	Physidae	Physa sp.		32	4				8			
Mollusca	Gastropoda	Planorbidae	Gyraulus circumstriatus										
Mollusca	Gastropoda	Planorbidae	Gyraulus deflectus										
Mollusca	Gastropoda	Planorbidae	Gyraulus parvus	8	4	16			4	8	12		
Mollusca	Gastropoda	Planorbidae	Helisoma sp.				8						
Mollusca	Gastropoda	Pleuroceridae	Pleurocera sp.										
Mollusca	Gastropoda	Valvatidae	Valvata tricarinata										
Mollusca	Gastropoda	Unidentified Gastropoda	Unidentified Gastropoda										
Nemertea	Unidentified Nemertea	Unidentified Nemertea	Unidentified Nemertea										
Turbellaria	Tricladida	Dugesiidae	Dugesia sp.	4	16		4	4					
			TOTAL NUMBER OF INDIVIDUALS	830	1583	1640	644	597	1784	568	388	76	196
			TOTAL NUMBER OF TAXA	9	16	11	9	11	10	10	7	6	8

				19-Jun-03					26-Aug-03				
				Stations					Stations				
				1	2	3	4	5	1	2	3	4	5
Class	**Order**	**Family**	**Genus/Species**										
Annelida	Hirudinea	Glossiphoniidae	Glossiphonia complanata										
Annelida	Hirudinea	Glossiphoniidae	Placobdella sp.										
Annelida	Oligochaeta	Lumbriculidae	Unidentified Lumbriculidae										
Annelida	Oligochaeta	Naididae	Nais communis	23			3	93					3
Annelida	Oligochaeta	Tubificidae	Limnodrilus hoffmeisteri					7					
Annelida	Oligochaeta	Tubificidae	Unidentified Tubificidae										1
Annelida	Oligochaeta	Unidentified Oligochaeta	Unidentified Oligochaeta				3						
Annelida	Polychaeta	Ampherididae	Unidentified Ampherididae					1					
Annelida	Polychaeta	Capitellidae	Heteromastus filiformis										
Annelida	Polychaeta	Spionidae	Marenzellaria viridis										
Annelida	Polychaeta	Spionidae	Polydora sp.					1					1
Arachnida	Trombidiformes	Lebertiidae	Lebertia sp.		1						3		
Arachnoidea	Hydracarina	Arrenuridae	Unidentified Arrenuridae									2	
Bivalvia	Veneorida	Pisidiidae	Pisidium sp.	2		13						1	1
Crustacea	Amphipoda	Corophiidae	Corophium sp. (juvenile)										1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx sp.	18	14	3							
Crustacea	Amphipoda	Gammaridae	Gammarus sp.	42	800	1054	34	9	434	103	287	100	17
Crustacea	Cumacea	Nannasticidae	Almyracuma proximoculi										3
Crustacea	Decapoda	Palaemonidae	Paleomonetes vulgaris										1
Crustacea	Decapoda	Portunidae	Carcinus maenus					3					1
Crustacea	Isopoda	Asellidae	Caecidotea communis	79	39	6	2		4		3	7	
Crustacea	Isopoda	Asellidae	Lirceus/Acellus sp. (communis)										
Hydrozoa	Hydroida	Hydridae	Hydra sp.										
Insecta	Coleoptera	Brachyceridae	Brachycerus sp.	1								15	7
Insecta	Coleoptera	Curculionidae	Unidentifed Curculionidae					1					
Insecta	Coleoptera	Dryopidae	Helichus sp.										
Insecta	Coleoptera	Elmidae	Stenelmis sp.	32	17	59	10		6	3	12	57	
Insecta	Coleoptera	Hydrophilidae	Berosus sp.	1	12	13						1	
Insecta	Coleoptera	Psephenidae	Unidentified Psephenidae										
Insecta	Coleoptera	Unidentified Coleoptera	Unidentified Coleoptera	3					6		1		
Insecta	Diptera	Ceratopognidae	Unidentified Ceratopognidae				1	1	1	1		1	1
Insecta	Diptera	Chironomidae	Unidenitifed Chironomidae	467	735	378	199	472	285	577	712	390	388
Insecta	Diptera	Empididae	Empididae		43	2			1	67	33		2
Insecta	Diptera	Empididae	Hemerodromia sp.										
Insecta	Diptera	Simuliidae	Simulium sp.	59	6	4			42	31			1
Insecta	Diptera	Tipulidae	Unidentified Tipulidae	2									
Insecta	Diptera	Unidentified Diptera	Unidentified Diptera	104	149	82	7	10	45	45	29	7	13
Insecta	Ephemeroptera	Baetidae	Baetis sp									13	2
Insecta	Ephemeroptera	Caenidae	Caenis sp.										
Insecta	Ephemeroptera	Ephemerellidae	Unidentified Ephemerellidae										
Insecta	Ephemeroptera	Heptageniidae	Stenonema sp.									1	
Insecta	Ephemeroptera	Oligoneuridae	Isonychia sp.										
Insecta	Hemiptera	Unidentified Hemiptera	Unidentified Hemiptera						2			4	1
Insecta	Heteroptera	Gerridae	Unidentified Gerridae									1	1
Insecta	Heteroptera	Gerridae	Rheumatobates sp.									3	1
Insecta	Heteroptera	Mesoveliidae	Mesovelia sp.									3	
Insecta	Neuroptera	Sysiridae	Sysira sp.										
Insecta	Odonata	Calopterygidae	Calopteryx spp	1	5		2	1				476	37
Insecta	Odonata	Coenagrionidae	Argia sp.										
Insecta	Odonata	Coenagrionidae	Ischnura/Enallagma sp.										
Insecta	Odonata	Corduliidae	Didymops sp.									4	
Insecta	Odonata	Corduliidae	Somatochlora sp.									36	2
Insecta	Trichoptera	Brachycentridae	Brachycentrus sp.										
Insecta	Trichoptera	Brachycentridae	Micrasema sp.										
Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.										
Insecta	Trichoptera	Hydropsychidae	Macrostemum sp.	41	36	5			743	434	311	2	1
Insecta	Trichoptera	Hydropsychidae	Parapsyche sp.										
Insecta	Trichoptera	Hydroptilidae	Agraylea sp.				1		1	1	21	16	22
Insecta	Trichoptera	Hydroptilidae	Orthotrichia sp.										
Insecta	Trichoptera	Hydroptilidae	Oxyethira sp.										
Insecta	Trichoptera	Leptoceridae	Ceraclea sp.	36	54	29	1	2			3	84	7
Insecta	Trichoptera	Leptoceridae	Mystacides sp.										
Insecta	Trichoptera	Leptoceridae	Triaenodes sp.										
Insecta	Trichoptera	Limnephilidae	Rossiana sp.										
Insecta	Trichoptera	Limnephilidae	Unidentified Limnephilidae										
Insecta	Trichoptera	Philopotamidae	Chimarra spp							13	1		
Insecta	Trichoptera	Psychomyiidae	Psychomyia sp.										
Maxillopoda	Sessilia	Balanidae	Balanus improvisus					6					
Mollusca	Bivalvia	Sphaeriidae	Unidentified Sphaeriidae										
Mollusca	Gastropoda	Ancylidae	Ferrissia rivularis										8
Mollusca	Gastropoda	Hydrobiidae	Amnicola limosa/Bithynia tentaulata	32	53	69	2	15			9		6
Mollusca	Gastropoda	Hydrobiidae	Pomatiopsis sp.										
Mollusca	Gastropoda	Lymnaeidae	Lymnaea columella										
Mollusca	Gastropoda	Physidae	Physa sp.						19			40	18
Mollusca	Gastropoda	Planorbidae	Gyraulus circumstriatus										
Mollusca	Gastropoda	Planorbidae	Gyraulus deflectus			2						1	14
Mollusca	Gastropoda	Planorbidae	Gyraulus parvus										
Mollusca	Gastropoda	Planorbidae	Helisoma sp.						4			26	
Mollusca	Gastropoda	Pleuroceridae	Pleurocera sp.										
Mollusca	Gastropoda	Valvatidae	Valvata tricarinata										
Mollusca	Gastropoda	Unidentified Gastropoda	Unidentified Gastropoda						1				
Nemertea	Unidentified Nemertea	Unidentified Nemertea	Unidentified Nemertea	1	1				4	1			
Turbellaria	Tricladida	Dugesiidae	Dugesia sp.	30	6	6			9				
			TOTAL NUMBER OF INDIVIDUALS	974	1971	1725	265	622	1607	1276	1425	1291	561
			TOTAL NUMBER OF TAXA	19	16	15	12	14	17	11	13	25	28

				4-Jun-04					2-Sep-04					4-Oct-04					26-Nov-04
				Stations					Stations					Stations					Stations
				1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1
Class	**Order**	**Family**	**Genus/Species**																
Annelida	Hirudinea	Glossiphoniidae	Glossiphonia complanata																
Annelida	Hirudinea	Glossiphoniidae	Placobdella sp.																
Annelida	Oligochaeta	Lumbriculidae	Unidentified Lumbriculidae																
Annelida	Oligochaeta	Naididae	Nais communis				8	33											
Annelida	Oligochaeta	Tubificidae	Limnodrilus hoffmeisteri																
Annelida	Oligochaeta	Tubificidae	Unidentified Tubificidae																
Annelida	Oligochaeta	Unidentified Oligochaeta	Unidentified Oligochaeta					8			7			3					
Annelida	Polychaeta	Ampheridiidae	Unidentified Ampherididae																
Annelida	Polychaeta	Capitellidae	Heteromastus filiformis																
Annelida	Polychaeta	Spionidae	Marenzellaria viridis																
Annelida	Polychaeta	Spionidae	Polydora sp.																
Arachnida	Trombidiformes	Lebertiidae	Lebertia sp.																
Arachnoidea	Hydracarina	Arrenuridae	Unidentified Arrenuridae																
Bivalvia	Veneorida	Pisidiidae	Pisidium sp.											1	10				
Crustacea	Amphipoda	Corophiidae	Corophium sp. (juvenile)																
Crustacea	Amphipoda	Crangonyctidae	Crangonyx sp.	58	15	2			5					7	26				1
Crustacea	Amphipoda	Gammaridae	Gammarus sp.	73	45	128	32	10		20	27	9	8		10	23	48		37
Crustacea	Cumacea	Nannasticidae	Almyracuma proximoculi																
Crustacea	Decapoda	Palaemonidae	Paleomonetes vulgaris																
Crustacea	Decapoda	Portunidae	Carcinus maenus																
Crustacea	Isopoda	Asellidae	Caecidotea communis	21	75				1						6				
Crustacea	Isopoda	Asellidae	Lirceus/Acellus sp. (communis)																
Hydrozoa	Hydroida	Hydridae	Hydra sp.																
Insecta	Coleoptera	Brachyceridae	Brachycerus sp.					8					49				12	67	
Insecta	Coleoptera	Curculionidae	Unidentifed Curculionidae																
Insecta	Coleoptera	Dryopidae	Helichus sp.																
Insecta	Coleoptera	Elmidae	Stenelmis sp.		53	44	41			13	38	6	8		65	45			11
Insecta	Coleoptera	Hydrophilidae	Berosus sp.												6				
Insecta	Coleoptera	Psephenidae	Unidentified Psephenidae																
Insecta	Coleoptera	Unidentified Coleoptera	Unidentified Coleoptera																
Insecta	Diptera	Ceratopognidae	Unidentified Ceratopognidae					3											
Insecta	Diptera	Chironomidae	Unidenitifed Chironomidae	33	110	96	103	118	144	143	275	22	107	2	41	14	58	40	37
Insecta	Diptera	Empididae	Empididae			2			1	20	24			10	73	87			
Insecta	Diptera	Empididae	Hemerodromia sp.																
Insecta	Diptera	Simuliidae	Simulium sp.						1	50	3				6				
Insecta	Diptera	Tipulidae	Unidentified Tipulidae																
Insecta	Diptera	Unidentified Diptera	Unidentified Diptera	22	135	42	9	8	2	37	30		8	5			33	27	11
Insecta	Ephemeroptera	Baetidae	Baetis sp									9					7	7	
Insecta	Ephemeroptera	Caenidae	Caenis sp.																
Insecta	Ephemeroptera	Ephemerellidae	Unidentified Ephemerellidae																
Insecta	Ephemeroptera	Heptageniidae	Stenonema sp.																
Insecta	Ephemeroptera	Oligoneuridae	Isonychia sp.																
Insecta	Hemiptera	Unidentified Hemiptera	Unidentified Hemiptera																
Insecta	Heteroptera	Gerridae	Unidentified Gerridae																
Insecta	Heteroptera	Gerridae	Rheumatobates sp.			4						2							
Insecta	Heteroptera	Mesoveliidae	Mesovelia sp.																
Insecta	Neuroptera	Sisyridae	Sisyira sp.	3															
Insecta	Odonata	Calopterygidae	Calopteryx spp																
Insecta	Odonata	Coenagrionidae	Argia sp.																
Insecta	Odonata	Coenagrionidae	Ischnura/Enallagma sp.																
Insecta	Odonata	Corduliidae	Didymops sp.																
Insecta	Odonata	Corduliidae	Somatochlora sp.																
Insecta	Trichoptera	Brachycentridae	Brachycentrus sp.																
Insecta	Trichoptera	Brachycentridae	Micrasema sp.																
Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.																
Insecta	Trichoptera	Hydropsychidae	Macrostemum sp.	402	1700	202			3	307	152			9	12	8			29
Insecta	Trichoptera	Hydropsychidae	Parapsyche sp.																
Insecta	Trichoptera	Hydroptilidae	Agraylea sp.				2	10				6					5		
Insecta	Trichoptera	Hydroptilidae	Orthotrichia sp.																
Insecta	Trichoptera	Hydroptilidae	Oxyethira sp.																
Insecta	Trichoptera	Leptoceridae	Ceraclea sp.																
Insecta	Trichoptera	Leptoceridae	Mystacides sp.																
Insecta	Trichoptera	Leptoceridae	Triaenodes sp.																
Insecta	Trichoptera	Limnephilidae	Rossiana sp.																
Insecta	Trichoptera	Limnephilidae	Unidentified Limnephilidae																
Insecta	Trichoptera	Philopotamidae	Chimarra spp																
Insecta	Trichoptera	Psychomyiidae	Psychomyia sp.																
Maxillopoda	Sessilia	Balanidae	Balanus improvisus																
Mollusca	Bivalvia	Sphaeriidae	Unidentified Sphaeriidae																
Mollusca	Gastropoda	Ancylidae	Ferrissia rivularis														5		
Mollusca	Gastropoda	Hydrobiidae	Amnicola limosa/Bithynia tentaulata	5	25	4					3				6	6			
Mollusca	Gastropoda	Hydrobiidae	Pomatiopsis sp.																
Mollusca	Gastropoda	Lymnaeidae	Lymnaea columella																
Mollusca	Gastropoda	Physidae	Physa sp.	12						7		7			10		30	27	1
Mollusca	Gastropoda	Planorbidae	Gyraulus circumstriatus																
Mollusca	Gastropoda	Planorbidae	Gyraulus deflectus																
Mollusca	Gastropoda	Planorbidae	Gyraulus parvus																
Mollusca	Gastropoda	Planorbidae	Helisoma sp.	6	13		3		2			16			4		13		
Mollusca	Gastropoda	Pleuroceridae	Pleurocera sp.																
Mollusca	Gastropoda	Valvatidae	Valvata tricarinata																
Mollusca	Gastropoda	Unidentified Gastropoda	Unidentified Gastropoda																
Nemertea	Unidentified Nemertea	Unidentified Nemertea	Unidentified Nemertea						3					0					
Turbellaria	Tricladida	Dugesiidae	Dugesia sp.						22	567	32			10	300	19			
Turbellaria			Unidentified turbellaria																1
Annelida	Hirudinea		Hirudinia						8					1					
Branchiopoda	Diplostraca		cladocera				6	15						2	6				
Crustacea	Decapoda	Palaemonidae	Paleomonetes paludosus										8						
Insecta	Coleoptera	Haliplidae	haliplidae (adult)														7	7	
Insecta	Coleoptera	Haliplidae	Peltodytes				2	3										7	
Insecta	Diptera	Atrichopogon	Atrichopogon					5					8						
Insecta	Diptera	Chironomidae	Dictrotendipes (adult)											5	4				
Insecta	Diptera	Tabanidae	tabanidae									7							
Insecta	Diptera	Tachinidae	Ceracia				29												
Insecta	Heteroptera	Veliidae	Microvelia			2													
Insecta	Homoptera	Aphididae	aphididae									16							
Insecta	Odonata	Coenagrionidae	Nehalennia				2	33				160	379				332	500	
Insecta	Odonata	Cordulegastridae	Epitheca					3					18						
Insecta	Odonata	Libellulidae	Libellula														7		
Insecta	Odonata		Anisoptera (juvenile)									11							
Insecta	Odonata		zygoptera fragments				1												
Insecta	Trichoptera	Glossosomatidae	Glossosoma	3		2													
Malacostraca	Amphipoda	Hyalellidae	Hyalella azteca				4										60		
Malacostraca	Decapoda	Cambaridae	Orconectes limosus										9			3	1		
			TOTAL NUMBER OF INDIVIDUALS	635	2170	524	198	196	185	1164	590	78	179	47.8	575	203	211	167	128
			TOTAL NUMBER OF TAXA	10	9	9	7	8	10	9	10	8	5	9	14	7	9	5	8

					22-Jun-00					1-Aug-00				
					Stations					Stations				
					1	2	3	4	5	1	2	3	4	5
Class	**Order**	**Family**	**Genus/Species**	**Feeding Groups**										
Annelida	Oligochaeta	Lumbriculidae	Unidentified Lumbriculidae	collector	1	1		1						
Annelida	Oligochaeta	Tubificidae	Unidentified Tubificidae	collector					15					1
Insecta	Diptera	Chironomidae	Unidenitifed Chironomidae	collector	354	272	273	177	151	50	336	206	102	86
Insecta	Diptera		Unidentified dipteran	collector										
Insecta	Ephemeroptera	Caenidae	Caenis sp.	collector	1			1		1	2	2		14
Insecta	Ephemeroptera	Ephemerellidae	Unidentified Ephemerellidae	collector										
Insecta	Ephemeroptera	Oligoneuridae	Isonychia sp.	collector							1		2	
Insecta	Trichoptera	Leptoceridae	Ceraclea sp.	collector		4	44	2		12	36	35		
Insecta	Trichoptera	Leptoceridae	Mystacides sp.	collector								1		
Insecta	Trichoptera	Psychomyiidae	Psychomyia sp.	collector									2	3
				Total Collectors	**356**	**277**	**317**	**181**	**166**	**63**	**375**	**244**	**106**	**104**
Annelida	Polychaeta	Amphերididae	Unidentified Ampherididae	detritivore										
Annelida	Polychaeta	Capitellidae	Heteromastus filiformis sp.	detritivore										
				Total Detritovores	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Annelida	Polychaeta	Spionidae	Marenzellaria viridis sp.	filter feeder										
Insecta	Diptera	Empididae	Hemerodromia sp.	filter feeder	1	25	13			8	98	23		1
Insecta	Diptera	Simuliidae	Simulium sp.	filter feeder	51	36	2			5	6			1
Insecta	Trichoptera	Brachycentridae	Brachycentrus sp.	filter feeder										
Insecta	Trichoptera	Brachycentridae	Micrasema sp.	filter feeder										
Insecta	Trichoptera	Hydropsychidae	Macrostemum sp.	filter feeder	10	19	3			1	8	8		
Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	filter feeder										
Insecta	Trichoptera	Helicopsychidae	Parapsyche sp.	filter feeder	13	6	3	3		9		1	1	
				Total Filter Feeders	**75**	**86**	**21**	**3**	**0**	**23**	**112**	**32**	**1**	**2**
Annelida	Hirudinea	Glossiphoniidae	Glossiphonia complanata sp.	parasite				1		5	1	2		
Annelida	Hirudinea	Glossiphoniidae	Placobdella sp.	parasite					3					
Arachnoidea	Hydracarina	Arrenuridae	Unidentified Arrenuridae	parasite										
				Total Parasites	**0**	**0**	**0**	**1**	**3**	**5**	**1**	**2**	**0**	**0**
Hydrozoa	Hydroida	Hydridae	Hydra sp.	predator							1			
Insecta	Coleoptera	Dryopidae	Helichus sp.	predator										
Insecta	Coleoptera	Hydrophilidae	Berosus sp.	predator		3	8	1			5	7		
Insecta	Coleoptera	Psephenidae	Unidentified Psephenidae	predator										
Insecta	Diptera	Ceratopognidae	Unidentified Ceratopognidae	predator										
Insecta	Neuroptera	Sysiridae	Sysira sp.	predator						1				
Insecta	Odonata	Coenagrionidae	Ischnura/Enallagma sp.	predator							1		2	1
Insecta	Odonata	Coenagrionidae	Argia sp.	predator		5	1	3	3					
Insecta	Trichoptera	Hydroptilidae	Oxyethira sp.	predator							3		1	
Insecta	Trichoptera	Hydroptilidae	Orthotrichia sp.	predator					2					
Turbellaria	Tricladida	Dugesiidae	Dugesia sp.	predator	58	63	84			325	309	16		
				Total Predators	**58**	**71**	**93**	**4**	**5**	**326**	**319**	**23**	**3**	**1**
Insecta	Trichoptera	Limnephilidae	Rossiana	scraper										
Insecta	Trichoptera	Limnephilidae	Unidentified Limnephilidae	scraper										
Mollusca	Bivalvia	Sphaeriidae	Unidentified Sphaeriidae	scraper	1	5	4	1			1	4	1	
Mollusca	Gastropoda	Ancylidae	Ferrissia rivularis sp.	scraper		5	1				3	5		
Mollusca	Gastropoda	Hydrobiidae	Amnicola limosa/Bithynia tentaulata sp.	scraper										
Mollusca	Gastropoda	Hydrobiidae	Pomatiopsis sp.	scraper										
Mollusca	Gastropoda	Lymnaeidae	Lymnaea columella sp.	scraper										
Mollusca	Gastropoda	Physidae	Physa gyrina sp.	scraper		15	3	4	1	11	25	4	9	
Mollusca	Gastropoda	Planorbidae	Gyraulus parvus sp.	scraper	1	4	10		1	22	147	117	2	1
Mollusca	Gastropoda	Planorbidae	Gyraulus circumstriatus sp.	scraper			2					6		
Mollusca	Gastropoda	Planorbidae	Helisoma sp.	scraper		1								
Mollusca	Gastropoda	Planorbidae	Gyraulus deflectus sp.	scraper	2		1				3			
Mollusca	Gastropoda	Pleuroceridae	Pleurocera sp.	scraper										
Mollusca	Gastropoda	Valvatidae	Valvata tricarinata sp.	scraper										
				Total Scrapers	**4**	**30**	**21**	**5**	**2**	**33**	**179**	**136**	**12**	**1**
Crustacea	Amphipoda	Gammaridae	Crangonyx sp.	shredder	80	87	20	2		86	19	18		
Crustacea	Amphipoda	Gammaridae	Gammarus spp.	shredder	419	540	623	48	1	1212	2311	1904	159	24
Crustacea	Isopoda	Asellidae	Lirceus/Acellus sp. (communis)	shredder	32		9	1		9	9	8		
Insecta	Trichoptera	Leptoceridae	Triaenodes sp.	shredder		1						1		
Crustacea	Cumacea	Nannasticidae	Almyracuma proximoculi sp.	shredder										
				Total Shredders	**531**	**628**	**652**	**51**	**1**	**1307**	**2339**	**1931**	**159**	**24**
		TOTAL NUMBER OF INDIVIDUALS			1024	1092	1104	245	177	1757	3325	2368	281	132
		TOTAL NUMBER OF TAXA			53	53	53	53	53	53	53	53	53	53

							13-Jun-01					21-Aug-01		
							Stations					Stations		
					1	2	3	4	5	1	2	3	4	5
Class	**Order**	**Family**	**Genus/Species**	**Feeding Groups**										
Annelida	Oligochaeta	Lumbriculidae	Unidentified Lumbriculidae	collector										
Annelida	Oligochaeta	Tubificidae	Unidentified Tubificidae	collector					5				2	
Insecta	Diptera	Chironomidae	Unidenitifed Chironomidae	collector	273	50	112	103	126	394	188	78	2	30
Insecta	Diptera		Unidentified dipteran	collector										
Insecta	Ephemeroptera	Caenidae	Caenis sp.	collector	1									1
Insecta	Ephemeroptera	Ephemerellidae	Unidentified Ephemerellidae	collector										
Insecta	Ephemeroptera	Oligoneuridae	Isonychia sp.	collector										1
Insecta	Trichoptera	Leptoceridae	Ceraclea sp.	collector	11	7	45	5	5	8	12	11		5
Insecta	Trichoptera	Leptoceridae	Mystacides sp.	collector								12		10
Insecta	Trichoptera	Psychomyiidae	Psychomyia sp.	collector	1									
				Total Collectors	**286**	**57**	**157**	**108**	**136**	**402**	**200**	**101**	**4**	**47**
Annelida	Polychaeta	Ampherididae	Unidentified Ampherididae	detritivore										
Annelida	Polychaeta	Capitellidae	Heteromastus filiformis sp.	detritivore										
				Total Detritovores	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Annelida	Polychaeta	Spionidae	Marenzellaria viridis sp.	filter feeder										
Insecta	Diptera	Empididae	Hemerodromia sp.	filter feeder	1	1				42	40			
Insecta	Diptera	Simuliidae	Simulium sp.	filter feeder	33	4				37	30			
Insecta	Trichoptera	Brachycentridae	Brachycentrus sp.	filter feeder							1	1		
Insecta	Trichoptera	Brachycentridae	Micrasema sp.	filter feeder										
Insecta	Trichoptera	Hydropsychidae	Macrostemum sp.	filter feeder	9	18				264	303	1		
Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	filter feeder	14	32		3		2				
Insecta	Trichoptera	Helicopsychidae	Parapsyche sp.	filter feeder										
				Total Filter Feeders	**57**	**55**	**0**	**3**	**0**	**345**	**374**	**2**	**0**	**0**
Annelida	Hirudinea	Glossiphoniidae	Glossiphonia complanata sp.	parasite				1			2		4	
Annelida	Hirudinea	Glossiphoniidae	Placobdella sp.	parasite										
Arachnoidea	Hydracarina	Arrenuridae	Unidentified Arrenuridae	parasite										
				Total Parasites	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**4**	**0**
Hydrozoa	Hydroida	Hydridae	Hydra sp.	predator							8			
Insecta	Coleoptera	Dryopidae	Helichus sp.	predator		1								
Insecta	Coleoptera	Hydrophilidae	Berosus sp.	predator			4			2	2			1
Insecta	Coleoptera	Psephenidae	Unidentified Psephenidae	predator										
Insecta	Diptera	Ceratopognidae	Unidentified Ceratopognidae	predator										
Insecta	Neuroptera	Sysiridae	Sysira sp.	predator										
Insecta	Odonata	Coenagrionidae	Ischnura/Enallagma sp.	predator										2
Insecta	Odonata	Coenagrionidae	Argia sp.	predator										
Insecta	Trichoptera	Hydroptilidae	Oxyethira sp.	predator						6				
Insecta	Trichoptera	Hydroptilidae	Orthotrichia sp.	predator										
Turbellaria	Tricladida	Dugesiidae	Dugesia sp.	predator	32	19	51	4		50	33	28	1	
				Total Predators	**32**	**20**	**55**	**4**	**0**	**58**	**43**	**28**	**1**	**3**
Insecta	Trichoptera	Limnephilidae	Rossiana	scraper				1			10	2		1
Insecta	Trichoptera	Limnephilidae	Unidentified Limnephilidae	scraper								10		3
Mollusca	Bivalvia	Sphaeriidae	Unidentified Sphaeriidae	scraper			5	2			2			
Mollusca	Gastropoda	Ancylidae	Ferrissia rivularis sp.	scraper								3		
Mollusca	Gastropoda	Hydrobiidae	Amnicola limosa/Bithynia tentaulata sp.	scraper	7	22	95			36	62	201		3
Mollusca	Gastropoda	Hydrobiidae	Pomatiopsis sp.	scraper					6					
Mollusca	Gastropoda	Lymnaeidae	Lymnaea columella sp.	scraper				4						
Mollusca	Gastropoda	Physidae	Physa gyrina sp.	scraper	3	1		1			43			1
Mollusca	Gastropoda	Planorbidae	Gyraulus parvus sp.	scraper	3	3	9	17		4	26	19		2
Mollusca	Gastropoda	Planorbidae	Gyraulus circumstriatus sp.	scraper						2				
Mollusca	Gastropoda	Planorbidae	Helisoma sp.	scraper										
Mollusca	Gastropoda	Planorbidae	Gyraulus deflectus sp.	scraper										
Mollusca	Gastropoda	Pleuroceridae	Pleurocera sp.	scraper					1					
Mollusca	Gastropoda	Valvatidae	Valvata tricarinata sp.	scraper								1		
				Total Scrapers	**13**	**26**	**109**	**25**	**7**	**42**	**143**	**236**	**0**	**10**
Crustacea	Amphipoda	Gammaridae	Crangonyx sp.	shredder	8	4	5					2		
Crustacea	Amphipoda	Gammaridae	Gammarus spp.	shredder	19	69	185	92	64	36	540	212	3	88
Crustacea	Isopoda	Asellidae	Lirceus/Acellus sp. (communis)	shredder	8	4	2				2			
Insecta	Trichoptera	Leptoceridae	Triaenodes sp.	shredder									2	
Crustacea	Cumacea	Nannasticidae	Almyracuma proximoculi sp.	shredder										
				Total Shredders	**35**	**77**	**192**	**92**	**64**	**36**	**542**	**214**	**5**	**88**
		TOTAL NUMBER OF INDIVIDUALS			423	235	513	233	207	883	1304	581	14	148
		TOTAL NUMBER OF TAXA			53	53	53	53	53	53	53	53	53	53

							17-Jun-02					19-Aug-02		
							Stations					Stations		
					1	2	3	4	5	1	2	3	4	5
Class	**Order**	**Family**	**Genus/Species**	**Feeding Groups**										
Annelida	Oligochaeta	Lumbriculidae	Unidentified Lumbriculidae	collector										
Annelida	Oligochaeta	Tubificidae	Unidentified Tubificidae	collector	418	48	292	436	404	20			16	28
Insecta	Diptera	Chironomidae	Unidenitifed Chironomidae	collector	108	548	360	136	60	1252	280	140	32	92
Insecta	Diptera		Unidentified dipteran	collector				4						
Insecta	Ephemeroptera	Caenidae	Caenis sp.	collector										
Insecta	Ephemeroptera	Ephemerellidae	Unidentified Ephemerellidae	collector		4								
Insecta	Ephemeroptera	Oligoneuridae	Isonychia sp.	collector										
Insecta	Trichoptera	Leptoceridae	Ceraclea sp.	collector										
Insecta	Trichoptera	Leptoceridae	Mystacides sp.	collector										
Insecta	Trichoptera	Psychomyiidae	Psychomyia sp.	collector										
				Total Collectors	**526**	**600**	**652**	**576**	**464**	**1272**	**280**	**140**	**48**	**120**
Annelida	Polychaeta	Ampherididae	Unidentified Ampherididae	detritivore					4	4				
Annelida	Polychaeta	Capitellidae	Heteromastus filiformis sp.	detritivore					4					
				Total Detritovores	**0**	**0**	**0**	**0**	**8**	**4**	**0**	**0**	**0**	**0**
Annelida	Polychaeta	Spionidae	Marenzellaria viridis sp.	filter feeder					4					
Insecta	Diptera	Empididae	Hemerodromia sp.	filter feeder	20	112	76	16	8	48	20	4	4	4
Insecta	Diptera	Simuliidae	Simulium sp.	filter feeder		8								
Insecta	Trichoptera	Brachycentridae	Brachycentrus sp.	filter feeder	12	52	4	20		64		4		
Insecta	Trichoptera	Brachycentridae	Micrasema sp.	filter feeder									4	
Insecta	Trichoptera	Hydropsychidae	Macrostemum sp.	filter feeder										
Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	filter feeder	20	36				228	40			
Insecta	Trichoptera	Helicopsychidae	Parapsyche sp.	filter feeder										
				Total Filter Feeders	**52**	**208**	**80**	**36**	**12**	**340**	**60**	**8**	**8**	**4**
Annelida	Hirudinea	Glossiphoniidae	Glossiphonia complanata sp.	parasite										
Annelida	Hirudinea	Glossiphoniidae	Placobdella sp.	parasite										
Arachnoidea	Hydracarina	Arrenuridae	Unidentified Arrenuridae	parasite		20	4				4			
				Total Parasites	**0**	**20**	**4**	**0**	**0**	**0**	**4**	**0**	**0**	**0**
Hydrozoa	Hydroida	Hydridae	Hydra sp.	predator										
Insecta	Coleoptera	Dryopidae	Helichus sp.	predator										
Insecta	Coleoptera	Hydrophilidae	Berosus sp.	predator		12	4							4
Insecta	Coleoptera	Psephenidae	Unidentified Psephenidae	predator							8			8
Insecta	Diptera	Ceratopognidae	Unidentified Ceratopognidae	predator		8								
Insecta	Neuroptera	Sysiridae	Sysira sp.	predator										
Insecta	Odonata	Coenagrionidae	Ischnura/Enallagma sp.	predator							68			
Insecta	Odonata	Coenagrionidae	Argia sp.	predator										
Insecta	Trichoptera	Hydroptilidae	Oxyethira sp.	predator										
Insecta	Trichoptera	Hydroptilidae	Orthotrichia sp.	predator										
Turbellaria	Tricladida	Dugesiidae	Dugesia sp.	predator	4	16		4	4					
				Total Predators	**4**	**36**	**4**	**4**	**4**	**0**	**76**	**0**	**0**	**12**
Insecta	Trichoptera	Limnephilidae	Rossiana	scraper										
Insecta	Trichoptera	Limnephilidae	Unidentified Limnephilidae	scraper										
Mollusca	Bivalvia	Sphaeriidae	Unidentified Sphaeriidae	scraper			32	16	28	4		12	12	
Mollusca	Gastropoda	Ancylidae	Ferrissia rivularis sp.	scraper										
Mollusca	Gastropoda	Hydrobiidae	Amnicola limosa/Bithynia tentaulata sp.	scraper	88	188	360		16	44	40	200	8	24
Mollusca	Gastropoda	Hydrobiidae	Pomatiopsis sp.	scraper										
Mollusca	Gastropoda	Lymnaeidae	Lymnaea columella sp.	scraper										
Mollusca	Gastropoda	Physidae	Physa gyrina sp.	scraper		32	4				8			
Mollusca	Gastropoda	Planorbidae	Gyraulus parvus sp.	scraper	8	4	16			4	8	12		
Mollusca	Gastropoda	Planorbidae	Gyraulus circumstriatus sp.	scraper										
Mollusca	Gastropoda	Planorbidae	Helisoma sp.	scraper				8						
Mollusca	Gastropoda	Planorbidae	Gyraulus deflectus sp.	scraper										
Mollusca	Gastropoda	Pleuroceridae	Pleurocera sp.	scraper										
Mollusca	Gastropoda	Valvatidae	Valvata tricarinata sp.	scraper										
				Total Scrapers	**96**	**224**	**412**	**24**	**44**	**52**	**56**	**224**	**20**	**24**
Crustacea	Amphipoda	Gammaridae	Crangonyx sp.	shredder										
Crustacea	Amphipoda	Gammaridae	Gammarus spp.	shredder	152	479	488	4	37	116	92	16		32
Crustacea	Isopoda	Asellidae	Lirceus/Acellus sp. (communis)	shredder		16								
Insecta	Trichoptera	Leptoceridae	Triaenodes sp.	shredder										
Crustacea	Cumacea	Nannasticidae	Almyracuma proximoculi sp.	shredder					28					4
				Total Shredders	**152**	**495**	**488**	**4**	**65**	**116**	**92**	**16**	**0**	**36**
		TOTAL NUMBER OF INDIVIDUALS			830	1583	1640	644	597	1784	568	388	76	196
		TOTAL NUMBER OF TAXA			53	53	53	53	53	53	53	53	53	53

					19-Jun-03					26-Aug-03				
					Stations					Stations				
					1	2	3	4	5	1	2	3	4	5
Class	**Order**	**Family**	**Genus/Species**	**Feeding Groups**										
Insecta	Coleoptera	Brachyceridae	Brachycerus sp.	Collector	1								15	7
Insecta	Ephemeroptera	Baetidae	Baetis sp.	Collector									13	2
Crustacea	Isopoda	Asellidae	Caecidotea communis	Collector	79	39	6	2		4		3	7	
Crustacea	Amphipoda	Crangonyctidae	Crangonyx sp.	Collector	18	14	3							
Annelida	Oligochaeta	Tubificidae	Limnodrilus hoffmeisteri	Collector					7					
Annelida	Oligochaeta	Naididae	Nais communis	Collector	23			3	93					3
Annelida	Oligochaeta	Unidentified Oligochaeta	Unidentified Oligochaeta	Collector				3						
Annelida	Oligochaeta	Lumbriculidae	Unidentified Lumbriculidae	Collector										
Annelida	Oligochaeta	Tubificidae	Unidentified Tubificidae	Collector										1
Insecta	Diptera	Chironomidae	Unidenitifed Chironomidae	Collector	467	735	378	199	472	285	577	712	390	388
Insecta	Diptera	Unidentified Diptera	Unidentified Diptera	Collector	104	149	82	7	10	45	45	29	7	13
Insecta	Ephemeroptera	Caenidae	Caenis sp.	Collector										
Insecta	Ephemeroptera	Ephemerellidae	Unidentified Ephemerellidae	Collector										
Insecta	Ephemeroptera	Oligoneuridae	Isonychia sp.	Collector										
Insecta	Trichoptera	Leptoceridae	Ceraclea sp.	Collector	36	54	29	1	2			3	84	7
Insecta	Trichoptera	Leptoceridae	Mystacides sp.	Collector										
Insecta	Trichoptera	Psychomyiidae	Psychomyia sp.	Collector										
				Total Collectors	**728**	**991**	**498**	**215**	**584**	**334**	**622**	**747**	**516**	**421**
Annelida	Polychaeta	Spionidae	Polydora sp.	Detritovore					1					1
Annelida	Polychaeta	Ampherididae	Unidentified Ampherididae	Detritovore					1					
Annelida	Polychaeta	Capitellidae	Heteromastus filiformis	Detritovore										
				Total Detritovores					**2**					**1**
Maxillopoda	Sessilia	Balanidae	Balanus improvisus	Filter Feeder					6					
Insecta	Trichoptera	Philopotamidae	Chimarra spp	Filter Feeder							13	1		
Crustacea	Amphipoda	Corophiidae	Corophium sp. (juvenile)	Filter Feeder										1
Bivalvia	Veneorida	Pisidiidae	Pisidium sp	Filter Feeder	2		13						1	1
Annelida	Polychaeta	Spionidae	Marenzellaria viridis	Filter Feeder										
Insecta	Diptera	Empididae	Hemerodromia sp.	Filter Feeder										
Insecta	Diptera	Simuliidae	Simulium sp.	Filter Feeder	59	6	4			42	31			1
Insecta	Trichoptera	Brachycentridae	Brachycentrus sp.	Filter Feeder										
Insecta	Trichoptera	Brachycentridae	Micrasema sp.	Filter Feeder										
Insecta	Trichoptera	Hydropsychidae	Macrostemum sp.	Filter Feeder	41	36	5			743	434	311	2	1
Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	Filter Feeder										
Insecta	Trichoptera	Helicopsychidae	Parapsyche sp.	Filter Feeder										
				Total Filter Feeders	**102**	**42**	**22**		**6**	**785**	**478**	**312**	**3**	**4**
Insecta	Trichoptera	Hydroptilidae	Agraylea sp.	Parasite				1		1	1	21	16	22
Annelida	Hirudinea	Glossiphoniidae	Glossiphonia complanata	Parasite										
Nemertea	Unidentified Ner	Unidentified Nemertea	Unidentified Nemertea	Parasite	1	1				4	1			
Annelida	Hirudinea	Glossiphoniidae	Placobdella sp.	Parasite										
Arachnoidea	Hydracarina	Arrenuridae	Unidentified Arrenuridae	Parasite										
				Total Parasites	**1**	**1**		**1**		**5**	**2**	**21**	**16**	**22**
Insecta	Odonata	Corduliidae	Somatochlora sp.	Predator									36	2
Arachnida	Trombidiformes	Arrenuridae	Unidentified Arrenuridae	Predator									2	
Insecta	Odonata	Calopterygidae	Calopteryx spp	Predator	1	5		2	1				476	37
Insecta	Coleoptera	Unidentified Coleoptera	Unidentified Coleoptera	Predator	3					6		1		
Insecta	Odonata	Corduliidae	Didymops sp.	Predator									4	
Insecta	Diptera	Empididae	Unidentified Empididae	Predator		43	2			1	67	33		2
Insecta	Heteroptera	Gerridae	Unidentified Gerridae	Predator									1	1
Insecta	Hemiptera	Unidentified Hemiptera	Unidentified Hemiptera	Predator						2			4	1
Arachnida	Trombidiformes	Lebertiidae	Lebertia sp.	Predator		1						3		
Insecta	Heteroptera	Mesoveliidae	Mesovelia sp.	Predator									3	
Insecta	Heteroptera	Gerridae	Rheumatobates sp.	Predator									3	1
Hydrozoa	Hydroida	Hydridae	Hydra sp.	Predator										
Insecta	Coleoptera	Dryopidae	Helichus sp.	Predator										
Insecta	Coleoptera	Hydrophilidae	Berosus sp.	Predator	1	12	13						1	
Insecta	Coleoptera	Psephenidae	Unidentified Psephenidae	Predator										
Insecta	Diptera	Ceratopognidae	Unidentified Ceratopognidae	Predator				1	1	1	1		1	1
Insecta	Neuroptera	Sysiridae	Sysira sp.	Predator										
Insecta	Odonata	Coenagrionidae	Ischnura/Enallagma sp.	Predator										
Insecta	Odonata	Coenagrionidae	Argia sp.	Predator										
Insecta	Trichoptera	Hydroptilidae	Oxyethira sp.	Predator										
Insecta	Trichoptera	Hydroptilidae	Orthotrichia sp.	Predator										
Turbellaria	Tricladida	Dugesiidae	Dugesia sp.	Predator	30	6	6			9				
				Total Predators	**35**	**67**	**21**	**3**	**2**	**19**	**68**	**37**	**531**	**45**
Mollusca	Gastropoda	Unidentified Gastropoda	Unidentified Gastropoda	Scraper						1				
Insecta	Coleoptera	Elmidae	Stenelmis sp.	Scraper	32	17	59	10		6	3	12	57	
Insecta	Ephemeroptera	Heptageniidae	Stenonema sp.	Scraper									1	
Insecta	Trichoptera	Limnephilidae	Rossiana sp.	Scraper										
Insecta	Trichoptera	Limnephilidae	Unidentified Limnephilidae	Scraper										
Mollusca	Bivalvia	Sphaeriidae	Unidentified Sphaeriidae	Scraper										
Mollusca	Gastropoda	Ancylidae	Ferrissia rivularis	Scraper										8
Mollusca	Gastropoda	Hydrobiidae	Amnicola limosa/Bithynia tentaulata	Scraper	32	53	69	2	15			9		6
Mollusca	Gastropoda	Hydrobiidae	Pomatiopsis sp.	Scraper										
Mollusca	Gastropoda	Lymnaeidae	Lymnaea columella	Scraper										
Mollusca	Gastropoda	Physidae	Physa sp.	Scraper						19			40	18
Mollusca	Gastropoda	Planorbidae	Gyraulus parvus	Scraper										
Mollusca	Gastropoda	Planorbidae	Gyraulus circumstriatus	Scraper										
Mollusca	Gastropoda	Planorbidae	Helisoma sp.	Scraper						4			26	
Mollusca	Gastropoda	Planorbidae	Gyraulus deflectus	Scraper			2						1	14
Mollusca	Gastropoda	Pleuroceridae	Pleurocera sp.	Scraper										
Mollusca	Gastropoda	Valvatidae	Valvata tricarinata	Scraper										
				Total Scrapers	**64**	**70**	**130**	**12**	**15**	**30**	**3**	**21**	**125**	**46**
Crustacea	Decapoda	Portunidae	Carcinus maenas	Shredder					3					1
Crustacea	Decapoda	Palaemonidae	Paleomonetes vulgaris	Shredder										1
Insecta	Coleoptera	Curculionidae	Unidentified Curculionidae	Shredder					1					
Insecta	Diptera	Tipulidae	Unidentified Tipulidae	Shredder	2									
Crustacea	Amphipoda	Gammaridae	Crangonyx sp.	Shredder										
Crustacea	Amphipoda	Gammaridae	Gammarus sp.	Shredder	42	800	1054	34	9	434	103	287	100	17
Crustacea	Isopoda	Asellidae	Lirceus/Acellus (communis)	Shredder										
Insecta	Trichoptera	Leptoceridae	Triaenodes sp.	Shredder										
Crustacea	Cumacea	Nannasticidae	Almyracuma proximoculi	Shredder										3
				Total Shredders	**44**	**800**	**1054**	**34**	**13**	**434**	**103**	**287**	**100**	**22**

					4-Jun-04					2-Sep-04					4-Oct-04					26-Nov-04
					Stations					Stations					Stations					Station
					1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1
Class	**Order**	**Family**	**Genus/Species**	**Feeding Groups**																
Insecta	Coleoptera	Brachyceridae	Brachycerus sp.	Collector					8					49				12	67	
Insecta	Ephemeroptera	Baetidae	Baetis sp.	Collector									9					7	7	
Crustacea	Isopoda	Asellidae	Caecidotea communis	Collector	21	75				1						6				
Crustacea	Amphipoda	Crangonyctidae	Crangonyx sp.	Collector																
Annelida	Oligochaeta	Tubificidae	Limnodrilus hoffmeisteri	Collector																
Annelida	Oligochaeta	Naididae	Nais communis	Collector				8	33											
Annelida	Oligochaeta	Unidentified Oligochaeta	Unidentified Oligochaeta	Collector					8			7			3					
Malacostraca	Amphipoda	Hyalellidae	Hyalella azteca	Collector				4										60		
Annelida	Oligochaeta	Lumbriculidae	Unidentified Lumbriculidae	Collector																
Annelida	Oligochaeta	Tubificidae	Unidentified Tubificidae	Collector																
Insecta	Diptera	Chironomidae	Dictrotendipes	Collector											5	4				
Insecta	Diptera	Chironomidae	Unidenitifed Chironomidae	Collector	33	110	96	103	118	144	143	275	22	107	2	41	14	58	40	37
Insecta	Diptera	Unidentified Diptera	Unidentified Diptera	Collector	22	135	42	9	8	2	37	30		8	5			33	27	11
Insecta	Ephemeroptera	Caenidae	Caenis sp.	Collector																
Insecta	Ephemeroptera	Ephemerellidae	Unidentified Ephemerellidae	Collector																
Insecta	Ephemeroptera	Oligoneuridae	Isonychia sp.	Collector																
Insecta	Trichoptera	Leptoceridae	Ceraclea sp.	Collector																
Insecta	Trichoptera	Leptoceridae	Mystacides sp.	Collector																
Insecta	Trichoptera	Psychomyiidae	Psychomyia sp.	Collector																
				Total Collectors	**76**	**320**	**138**	**124**	**175**	**147**	**180**	**312**	**31**	**164**	**15**	**51**	**14**	**170**	**141**	**48**
Annelida	Polychaeta	Spionidae	Polydora sp.	Detritovore																
Annelida	Polychaeta	Ampherididae	Unidentified Ampherididae	Detritovore																
Annelida	Polychaeta	Capitellidae	Heteromastus filiformis	Detritovore																
				Total Detritovores	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Maxillopoda	Sessilia	Balanidae	Balanus improvisus	Filter Feeder																
Insecta	Trichoptera	Philopotamidae	Chimarra spp	Filter Feeder																
Crustacea	Amphipoda	Corophiidae	Corophium sp. (juvenile)	Filter Feeder																
Bivalvia	Veneorida	Pisidiidae	Pisidium sp	Filter Feeder											1	10				
Bivalvia	Diplostraca		Cladocera	Filter Feeder				6	15						2	6				
Annelida	Polychaeta	Spionidae	Marenzellaria viridis	Filter Feeder																
Insecta	Diptera	Empididae	Hemerodromia sp.	Filter Feeder																
Insecta	Diptera	Simuliidae	Simulium sp.	Filter Feeder						1	50	3				6				
Insecta	Trichoptera	Brachycentridae	Brachycentrus sp.	Filter Feeder																
Insecta	Trichoptera	Brachycentridae	Micrasema sp.	Filter Feeder																
Insecta	Trichoptera	Hydropsychidae	Macrostemum sp.	Filter Feeder	402	1700	202			3	307	152			9	12	8			29
Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	Filter Feeder																
Insecta	Trichoptera	Helicopsychidae	Parapsyche sp.	Filter Feeder																
				Total Filter Feeders	**402**	**1700**	**202**	**6**	**15**	**4**	**357**	**155**	**0**	**0**	**12**	**34**	**8**	**0**	**0**	**29**
Insecta	Trichoptera	Hydroptilidae	Agraylea sp.	Parasite				2	10				6					5		
Annelida	Hirudinea	Glossiphoniidae	Glossiphonia complanata	Parasite																
Insecta	Diptera	Tachinidae	Ceracia	Parasite				29												
Nemertea	Unidentified Nemertea	Unidentified Nemertea	Unidentified Nemertea	Parasite																
Annelida	Hirudinea	Glossiphoniidae	Placobdella sp.	Parasite																
Annelida	Hirudinea		Unidentified Hirudinia	Parasite						8					1					
Arachnoidea	Hydracarina	Arrenuridae	Unidentified Arrenuridae	Parasite																
				Total Parasites	**0**	**0**	**0**	**31**	**10**	**8**	**0**	**0**	**6**	**0**	**1**	**0**	**0**	**5**	**0**	**0**
Insecta	Odonata	Corduliidae	Somatochlora sp.	Predator																
Arachnida	Trombidiformes	Arrenuridae	Unidentified Arrenuridae	Predator																
Insecta	Odonata	Calopterygidae	Calopteryx spp	Predator																
Insecta	Coleoptera	Unidentified Coleoptera	Unidentified Coleoptera	Predator																
Insecta	Odonata	Corduliidae	Didymops sp.	Predator																
Insecta	Diptera	Empididae	Unidentified Empididae	Predator			2			1	20	24			10	73	87			
Insecta	Diptera	Atrichopogon	Atrichopogon	Predator					5					8						
Insecta	Heteroptera	Gerridae	Unidentified Gerridae	Predator																
Insecta	Diptera	Tabanidae	Unidentified Tabanidae	Predator									7							
Insecta	Hemiptera	Unidentified Hemiptera	Unidentified Hemiptera	Predator																
Arachnida	Trombidiformes	Lebertiidae	Lebertia sp.	Predator																
Insecta	Heteroptera	Mesoveliidae	Mesovelia sp.	Predator																
Insecta	Odonata	Libellulidae	Lebellula	Predator														7		
Insecta	Heteroptera	Gerridae	Rheumatobates sp.	Predator			4						2							
Hydrozoa	Hydroida	Hydridae	Hydra sp.	Predator																
Insecta	Heteroptera	Veliidae	Microvelia	Predator			2													
Insecta	Odonata		Zygoptera	Predator				1												
Insecta	Odonata		Anisoptera	Predator									11							
Insecta	Coleoptera	Dryopidae	Helichus sp.	Predator																
Insecta	Coleoptera	Hydrophilidae	Berosus sp.	Predator												6				
Insecta	Coleoptera	Psephenidae	Unidentified Psephenidae	Predator																
Insecta	Diptera	Ceratopognidae	Unidentified Ceratopognidae	Predator					3											
Insecta	Neuroptera	Sisyridae	Sisyra sp.	Predator	3															
Insecta	Odonata	Coenagrionidae	Ischnura/Enallagma sp.	Predator																
Insecta	Odonata	Cordulestridae	Epitheca	Predator					3					18						
Insecta	Odonata	Coenagrionidae	Nehalennia	Predator				2	33				160	379				332	500	
Insecta	Odonata	Coenagrionidae	Argia sp.	Predator																
Insecta	Trichoptera	Hydroptilidae	Oxyethira sp.	Predator																
Nemertea			Unidentified Nemertea	Predator						3										
Turbellaria			Unidentified Turbellaria	Predator																1
Insecta	Trichoptera	Hydroptilidae	Orthotrichia sp.	Predator																
Turbellaria	Tricladida	Dugesiidae	Dugesia sp.	Predator						22	567	32			10	300	19			
				Total Predators	**3**	**0**	**8**	**3**	**44**	**26**	**587**	**56**	**180**	**405**	**20**	**379**	**106**	**339**	**500**	**1**
Mollusca	Gastropoda	Unidentified Gastropoda	Unidentified Gastropoda	Scraper																
Insecta	Coleoptera	Elmidae	Stenelmis sp.	Scraper		53	44	41			13	38	6	8		65	45			11
Insecta	Ephemeroptera	Heptageniidae	Stenonema sp.	Scraper																
Insecta	Trichoptera	Limnephilidae	Rossiana sp.	Scraper																
Insecta	Trichoptera	Glossosomatidae	Glossosoma	Scraper	3		2													
Insecta	Trichoptera	Limnephilidae	Unidentified Limnephilidae	Scraper																
Mollusca	Bivalvia	Sphaeriidae	Unidentified Sphaeriidae	Scraper																
Mollusca	Gastropoda	Ancylidae	Ferrissia rivularis	Scraper																
Mollusca	Gastropoda	Ancylidae	Ferrissia sp.	Scraper														5		
Mollusca	Gastropoda	Hydrobiidae	Amnicola sp.	Scraper	5	25	4					3				6	6			
Mollusca	Gastropoda	Hydrobiidae	Amnicola limosa/Bithynia tentaulata	Scraper																
Mollusca	Gastropoda	Hydrobiidae	Pomatiopsis sp.	Scraper																
Mollusca	Gastropoda	Lymnaeidae	Lymnaea columella	Scraper																
Mollusca	Gastropoda	Physidae	Physa sp.	Scraper	12						7		7			10		30	27	1
Mollusca	Gastropoda	Planorbidae	Gyraulus parvus	Scraper																
Mollusca	Gastropoda	Planorbidae	Gyraulus circumstriatus	Scraper																
Mollusca	Gastropoda	Planorbidae	Helisoma sp.	Scraper	6	13		3		2			16			4		13		
Mollusca	Gastropoda	Planorbidae	Gyraulus deflectus	Scraper																
Mollusca	Gastropoda	Pleuroceridae	Pleurocera sp.	Scraper																
Mollusca	Gastropoda	Valvatidae	Valvata tricarinata	Scraper																
				Total Scrapers	**26**	**91**	**50**	**44**	**0**	**2**	**20**	**41**	**29**	**8**	**0**	**85**	**51**	**48**	**27**	**12**
Crustacea	Decapoda	Portunidae	Carcinus maenas	Shredder																
Crustacea	Decapoda	Palaemonidae	Paleomonetes vulgaris	Shredder																
Crustacea	Decapoda	Palaemonidae	Paleomonetes paludosus	Shredder										8						
Insecta	Coleoptera	Curculionidae	Unidentified Curculionidae	Shredder																
Insecta	Diptera	Tipulidae	Unidentified Tipulidae	Shredder																
Insecta	Coleoptera	Haliplidae	Peltodytes	Shredder				2	3										7	
Insecta	Coleoptera	Haliplidae	Unidentified Haliplidae	Shredder														7	7	
Malacostraca	Decapoda	Cambaridae	Orconectes limosus	Shredder										9			3	1		
Crustacea	Amphipoda	Gammaridae	Crangonyx sp.	Shredder																
Crustacea	Amphipoda	Crangonyctidae	Crangonyx pseudogracilis	Shredder	58	15	2			5					7	26				1
Crustacea	Amphipoda	Gammaridae	Gammarus sp.	Shredder																
Crustacea	Amphipoda	Gammaridae	Gammarus fasciatus	Shredder	73	45	128	32	10		20	27	9	8		10	23	48		37
Crustacea	Isopoda	Asellidae	Lirceus/Acellus (communis)	Shredder																
Insecta	Trichoptera	Leptoceridae	Triaenodes sp.	Shredder																
Crustacea	Cumacea	Nannasticidae	Almyracuma proximoculi	Shredder																
				Total Shredders	**131**	**60**	**130**	**34**	**13**	**5**	**20**	**27**	**9**	**25**	**7**	**36**	**26**	**56**	**14**	**38**