CHAPTER 4 EMERGING MACROINVERTEBRATE DISTRIBUTION, ABUNDANCE AND HABITAT USE

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INTRODUCTION

Macroinvertebrates—particularly insects, are diverse and abundant zoological components of freshwater aquatic systems. Of all invertebrates, the trophic diversity and numerical abundance of insects, and especially the Diptera (true flies), make this group the most important taxa in streams, lakes and other water environments. Unique adaptations have evolved in their life-history patterns (breeding, oviposition, hatching and development), morphological and physiological characteristics (respiration) and behavioral traits (lotic/lentic habitat affinities, functional feeding groups) to enable them to occupy most wetland habitats and trophic levels.

Recent research focusing on aquatic invertebrates in wetlands, indicates the importance of insects in energy and nutrient transfer within aquatic ecosystems (Rosenberg and Danks 1987). They furnish food for other invertebrates (e.g., predatory insects and arachnids such as mites and spiders) and comprise significant portions of the nutritional requirements of amphibians, water birds and small mammals. They are especially important to rearing fish (e.g., Salmonidae, game fishes), contributing to commercial and sport fisheries.

Diptera as well as other aquatic insects are pivotal components of complex food webs, significantly increasing the number of links in the web with their richness and abundance. As filter feeders, shredders and scrapers they convert and assimilate microorganisms and vegetation into biomass of aquatic insects providing significant production available to secondary and tertiary consumers. Alternately, insects are sometimes thought detrimental to human health. Dipteran families including Simuliidae (black flies) and Culicidae (mosquitoes) are vectors of disease and can be pests to humans, livestock and other mammals. Consequently, they may be of medical and economic importance (Courtney et al. 1996).

The distribution and abundance of macroinvertebrates in running waters and lakes have long been recognized as important tools in describing and assessing the condition of these aquatic ecosystems (Rosenberg and Resh 1993). However, it has been relatively recently that they were identified as providing an indication of the condition of palustrine environments (Ludwa and Richter, this volume), particularly wetlands of watersheds undergoing urbanization (Ludwa 1994, Hicks 1996). This is primarily because basic information regarding their spatial and seasonal distribution and abundances in palustrine wetlands is uncommon. Moreover, specific hydrologic, water quality and other habitat characteristics that may account for invertebrate, and specifically insects, remain unavailable.

Consequently, in this paper we characterize the emergent macroinvertebrates in palustrine wetlands in the Pacific Northwest by describing the distribution and abundance of taxa collected in emergence traps at 19 wetlands of the Puget Sound region. Moreover, we determine characteristics of wetlands and watersheds that may account for their occurrences.

METHODS

We collected adult macroinvertebrates (e.g., most often insects of minimum of 5mm in size and easy to see with unaided eye), encompassing a wide diversity of taxa using emergence traps (Figure 4-1). We used emergence traps rather than dip nets (e.g., sweep nets) or benthic sampling because captures in emergent traps represent the final component of insect production, allows quantification of cumulative production over variable time periods and presorts species on their ability to climb or fly into the collecting chamber facilitating identification procedures. In addition, emergence traps exhibit less sampling variability compared to sediment sampling.

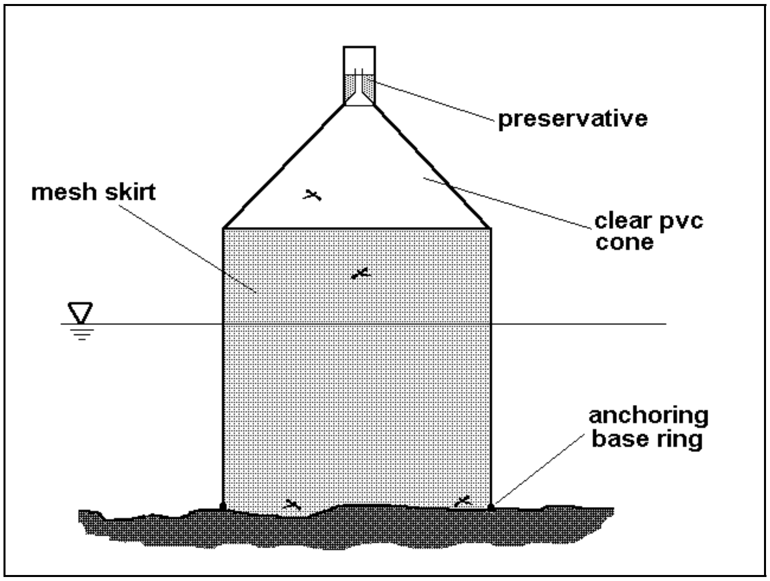

Figure 4-1. Side view cross-section of aquatic macroinvertebrate emergence trap.

The traps function by funneling emerging invertebrates upward into a glass jar at the top of the trap containing a liquid preservative. We placed three replicate traps, each covering a circular area of 0.25 M^2 within approximately one meter of each other in the deepest (maximum 1m deep) areas of wetlands that could be reached with chest waders during spring when invertebrates were first expected to emerge. Substrate and vegetation characteristics present at the trapping locations are described for individual wetlands in Table 4-1.

Traps were installed with base rings embedded in the substrate or flush to the ground. In September 1988 we installed traps in 14 wetlands with traps at five additional wetlands added in May 1989. We emptied traps semi-monthly. Traps were not emptied from mid-November 1988 to March 1989 and during other winter periods because of low or non-existent winter emergence. We attempted to empty traps within a three day period, although in some cases we took 19 days to collect samples. We captured and summarized macroinvertebrate data for all 19 wetlands in 1989 (including captures from September 15,1988 through September 31, 1989) and 1993 (including captures from April 10, 1993 through April 9, 1994). In 1995 we trapped in 18 wetlands (deleted TC13) from January 1, 1995 through October 30, 1995. Since winter emergence was low, our data essentially represents values for invertebrate years 1989, 1993 and 1995.

We identified emergent macroinvertebrates and placed them into broad groupings (adult arthropods, terrestrial arthropods, aquatic and semi-aquatic insects) for descriptive and statistical analysis. We use 1989 as our comprehensive description of macroinvertebrate distribution and abundance in Pacific Northwest wetlands in that we identified all invertebrates to the lowest taxa feasible—generally genus and species. In subsequent years we classified only to major taxa (e.g., Orders) except for Diptera, for which we identified captures to family and further limited our taxonomic efforts to the numerically dominant chironomid midges (suborder Nematocera, lower dipteran flies) with other Nematocera identified only to family. The suborder Brachycera (higher dipteran flies) were not identified because of the specialized expertise required for their taxonomy and because of the possibility they entered traps from adjacent areas during low water. We assigned the Dipterans to the aquatic group, since the vast majority of taxa within this order have larval stages developing in water or in saturated soils (Courtney et al. 1996). We identified wetland-associated terrestrial forms as species in which all life stages are found in terrestrial habitats.

The majority of the wetlands chosen for study are small palustrine systems ranging from several hectares to less than one hectare in size. We classified wetlands according to the level of development within their watersheds and flooding regime. Thus within watersheds of various levels of urbanization, wetlands were identified as to whether they were perennially or seasonally flooded during the monitoring year. Permanent wetlands exhibited standing water the entire year whereas seasonally flooded sites generally dried out between April and June and were re-flooded only after the onset of autumn rains in mid-October.

Table 4-1. Aquatic invertebrate emergence trap conditions (from Ludwa 1994).

	Flow		Substrate			Vegetation																						
Wetland	still water	discernible flow	gravel	sand	silt/mud	moss	periphyton	*Alnus rubra*	*Athyrium*	*Carex*	*Epilobium*	*Equisetum*	*Glyceria*	*Juncus*	*Lemna*	*Lysichtum*	*Nuphar*	*Oenanthe*	*Phalaris*	*Potentilla*	*Salix*	*Scirpus*	*Solanum*	*Sparganium emersum*	*Spirea*	*Typha*	*Veronica*	unidentified plants
AL3	×					×																						
B31		×	×	×	×			×		×		×							×			×						
BBC24	×																					×				×	×	
ELS39	×				×		×			×				×											×			
ELS61	×						×								×											×		
ELW1		×			×	×			×				×						×								×	
FC1		×			×		×						×		×				×									
HC13	×				×			×					×						×			×						
JC28	×				×			×								×												
LCR93		×															×	×							×	×		×
LPS9		×																×	×									
MGR36	×												×		×					×	×					×	×	
NFIC12	×				×	×	×							×														
PC12	×									×			×		×				×			×			×	×		
RR5	×									×				×								×						
SC4	×				×	×	×	×			×																×	
SC84	×					×	×											×					×				×	
SR24	×									×														×				
TC13	×				×	×	×											×				×				×	×	

We ran three Detrended Correspondence Analysis (DCA), iterations of the 1989 wetland data (Hill 1979, Hill & Gauch 1980) as follows; 1) all taxa; including terrestrial, aquatic and semiaquatic taxa identified to the lowest level reported, 2) all aquatic/semi-aquatic taxa, including the Brachycera, identified to the lowest level reported and 3) all chironomid midge taxa identified to the lowest level reported. Taxa abundances were log transformed prior to running the DCA program.

RESULTS AND DISCUSSION

Annual Overall Arthropod Richness and Abundance

Annual arthropod yield is presented in Table 4-2 (Table 4-2 and all subsequent tables may be found in Appendix 4-1). Terrestrial abundance was highest in 1989 (but see wetland NFIC12).   Low numbers of arthropods were captured at wetlands both in 1993 and 1995. Total aquatic and semi-aquatic taxa richness and abundance varied widely between years and wetlands but were consistently dominated by Diptera in both categories. Aquatic and semi-aquatic abundance was highest in LCR93 with

21,501 invertebrates counted in 1995 and lowest in ELW1 with 256 animals tallied in 1995.

Terrestrial Arthropod Richness and Abundance

Arachnids and hexpods insects were the two terrestrial arthropod classes most frequently captured in emergence traps (Table 4-3). Arachnids are common predators (spiders) and parasites (mites) on aquatic insects and other invertebrates. Of the insects, we captured a total of nine terrestrial orders. Homoptera—particularly Aphididae (aphids), Coleoptera (beetles) and Hymenoptera (e.g., Parasitoid wasps) were represented in the greatest numbers. The captured taxa of these orders are often associated with emergent plant parts above water which were enclosed by the traps. That is probably why they were captured in our traps and not because they are obligate wetland species.

Total terrestrial arthropod richness ranged from a high of ten to a low of seven major invertebrate taxa in a single year (Table 4-3). Neuroptera were missing from eight wetlands (AL3, ELS39, ELW1, PC12, RR5, SC84, SR24 and TC13) and Hemiptera from five (AL3, BBC24, FC1, SR24 and TC13). Densities ranged from 56,439 M^2 in BBC24 for 1989 to a low of 9 M^2 at JC28 in 1993. The most abundant terrestrial taxa were Aphididae (e.g., aphids-Homoptera) mostly because of their reproductive characteristics, communal feeding and small size. Aphids frequently feed on exposed broad-leaved aquatic vegetation (personal observation) and therefore are abundant in open water wetlands that are characterized by water lilies such as found in BBC24. They are largely missing from forested and scrub-shrub wetlands without such plant species as for example JC28 and AL3.

Aquatic and Semi-Aquatic Insect Richness and Abundance

Five aquatic and semi-aquatic insect orders, Ephemeroptera (mayflies), Odonata (dragonflies/damselflies), Plecoptera (stoneflies), Trichoptera and Diptera, were collected within wetlands. Ephemeroptera were captured at 12 wetlands during the survey (Table 4-4). Their abundance was low (<25) except at LCR93 and JC28 at which maximum numbers were 232 and 206 individuals respectively. In the 1989 survey they represented only two taxa (Table 4-5). Ephemeroptera, in general, inhabit both lentic and lotic waters where adequate supplies of dissolved oxygen are found. The taxa we identified, *Callibaetis* and *Paraleptophlebia,* are also found mostly in perennial and seasonal wetlands respectively. Overall, Ephemeroptera richness and abundance were greater at perennial than in annually/seasonally flooded sites. Moreover, they were patchily represented in non-urbanized sites (AL3, SC4, HC13, LCR93, MGR36, SR24, TC13, PC12) and moderately urbanized (BBC24, ELW1, ELS61, ELS39, JC28, NFIC12, RR5, SC84, LPS9) sites but were not found at both highly urbanized sites (B3I and FC1).

Surprisingly, Odonata were captured at only three wetlands, and in low (<2 at ELS61 and LPS9, <25 at BBC24) numbers. A total of three species of damselflies were found at BBC24 and ELS61. Odonata require year-round standing water, and therefore are generally not found in temporary and seasonal wetlands.

Plecoptera, a lotic insect order, was encountered at eight wetlands. In 1989 this represented eight taxa including a new species, *Capni*. We found Plecoptera in large numbers (1576) at LCR93 in 1989, moderate numbers (101) at NFIC12 in 1995 and low numbers of 42 and 32 animals/ M^2 in 1995 at RR5 and 1989 at JC28 respectively (Table 4-4). In all other wetlands and years they were collected in low numbers (<10). Plecoptera was usually found in wetlands with flow-through channels.

Trichoptera taxa richness is relatively high with 24 taxa identified during 1989 alone (Table 4-6). Regardless of wetland, the majority of larvae belonged to the family Limnephilidae. Oxyethira, a hydroptilid, was common at BBC24. Numbers of Trichoptera were low (<200) at many wetlands with the exception of 1995 at LPS9.

Insect emergence was clearly dominated by Diptera (Table 4-2). The abundance of individuals within these taxa often varied widely with the highest number of Diptera being as much as 13 times greater than the lowest numbers (e.g., ELS61 versus ELW1). Most often variations between high counts are between two to six times the low counts. More extreme are abundance data for chironomids in which numbers in high years are as much as 190, 84 and 36 times the numbers found in low year counts as in RR5, MGR36 and NFIC12, respectively, whereas the ranges at most other wetlands differed by five to 20. Nevertheless, the relative ranking of taxa abundance by wetlands was often relatively constant with the same wetlands retaining their lowest or highest relative ranking from among all wetlands. B3I and ELS61, for example, ranked in the top three in Cecidomyiidae and Tipulidae abundance in at least two of three years. Other common dipteran families captured included the Psychodidae, Tipulidae, and Empididae.

Actual dipteran numbers ranged from a high of high of 20,781 M^2 in ELS61 in 1989 to a low of 256 M^2 in ELW1 in 1995. In fact, ELW1 consistently had the lowest number and ELS61 the highest number of Diptera during the three-years of monitoring. Low dipteran numbers of under 1,000 M^2 in two out of three years were also identified at JC28 and high numbers of 10,000 M^2 or more at LCR93 and NFIC12. As expected significantly fewer aquatic and semi-aquatic forms and numbers were present in the higher dipteran suborder Brachycera, than the largely aquatic Nematocera (longhorned flies).

In the Nematocera, members of the family Chironomidae (midges) were clearly represented by the greatest number of taxa and often also by numbers. Chironomid midges have been found to be one of the most abundant and diverse groups in other regions of North America (Wrubleski 1987) and therefore these findings were expected. In 1989 we identified a high of 42 taxa in BBC24 and counted a high total abundance of 11,925 animals at ELS61 (Table 4-6). Chironomid taxa richness was consistently high in the perennial, non-urbanized wetlands, and consistently low in the non-urbanized wetlands that dried out in the summer. Table 4-7 provides the abundance rankings of all Chironomid taxa within our 1989 wetland characterization scheme.

Non-chironomid families of numerical importance include the Sciaridae, Cecidomyiidae (gall gnats that sometimes live in the tissues of live aquatic vegetation), Dixidae (dixid midges), and Tipulidae (crane flies). Rarely found non-Chironomids included the Anisopodidae, Bibionidae, Scatopsidae, Simuliidae (black flies) and Trichoceridae. Certain Psychodidae are often found in water and sewage-treatment facilities (Courtney at al. 1996). Psychodidae, Ptychopteridae and Syrphidae are collector-gatherers feeding on decaying fine organic matter associated with microorganisms. Collector-filterers include most Culicidae and Simuliidae. Tipulidae and Ephydridae are considered shredders.

Taxa richness of semi-aquatic and aquatic insects was generally higher (>40 taxa) in persistent than seasonal wetlands that dried out in summer (but see LCR93; Table 4-6). Both high and low richness was found in wetlands whose watersheds were largely non-urbanized depending on whether they remained flooded or dried out in summer. Interestingly, the three wetlands in non-urbanized watersheds that dried out in summer 1989 (AL3, NFIC12 and TC13) exhibited the lowest overall richness values as did the wetlands that dried out in highly urbanized watersheds (ELS39, LPS9, and SC84). Richness values for these wetlands ranged from 20-30 total taxa, with only 8-16 Chironomid taxa.

In 1989 we identified a high of 62 non-Brachycera taxa at BBC24 with 8570 animals M^2. The lowest richness of one third this highest value was observed at NFIC12, AL3 and ELS39. Densities were lowest at 655 animals M^2 in ELW1.

Shannon and Pielou diversity indices (Shannon and Weaver 1949, Pielou 1966) calculated for the full compliment of aquatic/semiaquatic invertebrates as well as the chironomid communities (Table 4-6) indicate that most wetlands within highly urbanized watersheds have lower richness than those in less urbanized watersheds. Most wetlands characterized by water permanence generally also exhibited higher richness than those that dried out.

In all three analyses using DCA, permanent wetlands were clearly distinguished from summer dry sites along axis 1 (Figures 4-2, 4-3 and 4-4). Axis 1 is most easily interpreted as representing a gradient progressing form wetlands experiencing lengthy summer drying, to wetlands having year-round standing water. Also, those summer dry site communities which experience highly fluctuating water levels are found at the extreme of axis 1, for example B3I, with one of the most urbanized watersheds. In general, insect communities of wetlands characterized by summer drought and flashy hydrology are harsh and unpredictable environments are less diverse; most likely because fluctuating environments generally exhibit simpler food chains or, fewer linkages per species, than stable ecosystems.

Axis 2 of the DCA plots are not satisfactorily related to an environmental gradient. Summer dry, moderately and highly urbanized sites were scattered more widely on this axis than were wet sites. The four wet, non-urbanized sites by being closely clustered and showing little separation on either axes, indicate very similar invertebrate communities. Though, the moderately and highly urbanized, wet sites could also be distinguished form the dry sites, they displayed more separation on both axis 1 and 2 than the non-urbanized wet sites. The BBC24 community was usually distant on axis 1 from the other wet sites. This wetland exhibited high taxa richness, and contained many Odonata, Trichoptera and Chironomidae taxa which were not typical of other wetlands.

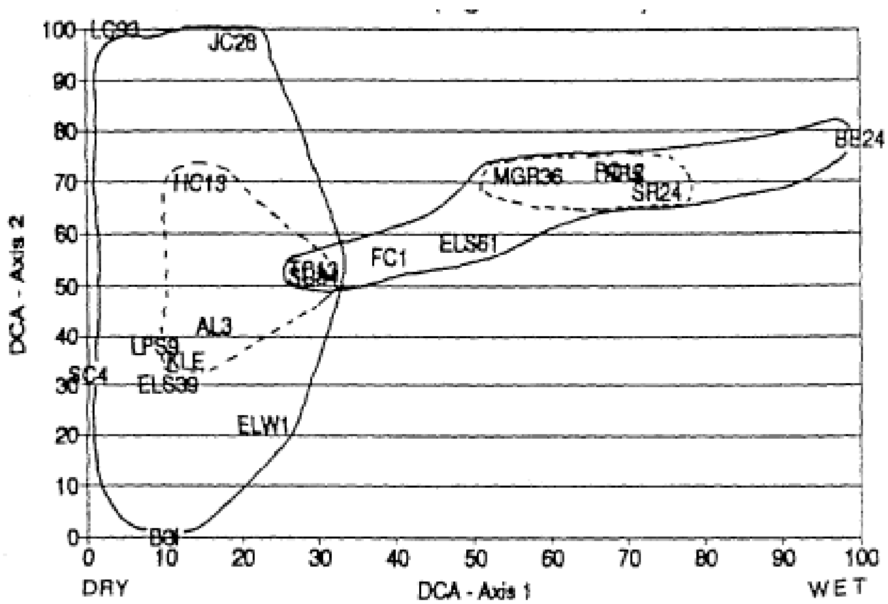

Figure 4-2. Terrestrial, aquatic and semi-aquatic taxa DCA analysis results.

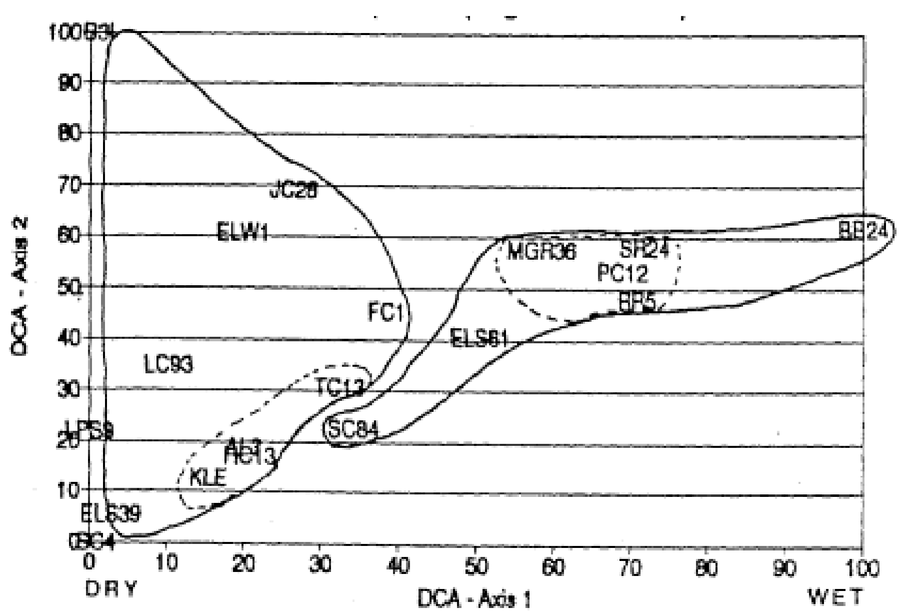

Figure 4-3. Aquatic and semi-aquatic taxa DCA analysis results.

On axis 2, communities of intermittent wetlands showed considerable separation from flooded wetlands indicating that seasonally flooded habitats were more variable in community structure than those with permanent standing water. As in the case for non-urbanized, wet sites, the four non-urbanized summer dry site insect communities clustered more closely together than the communities in moderately and highly urbanized site.

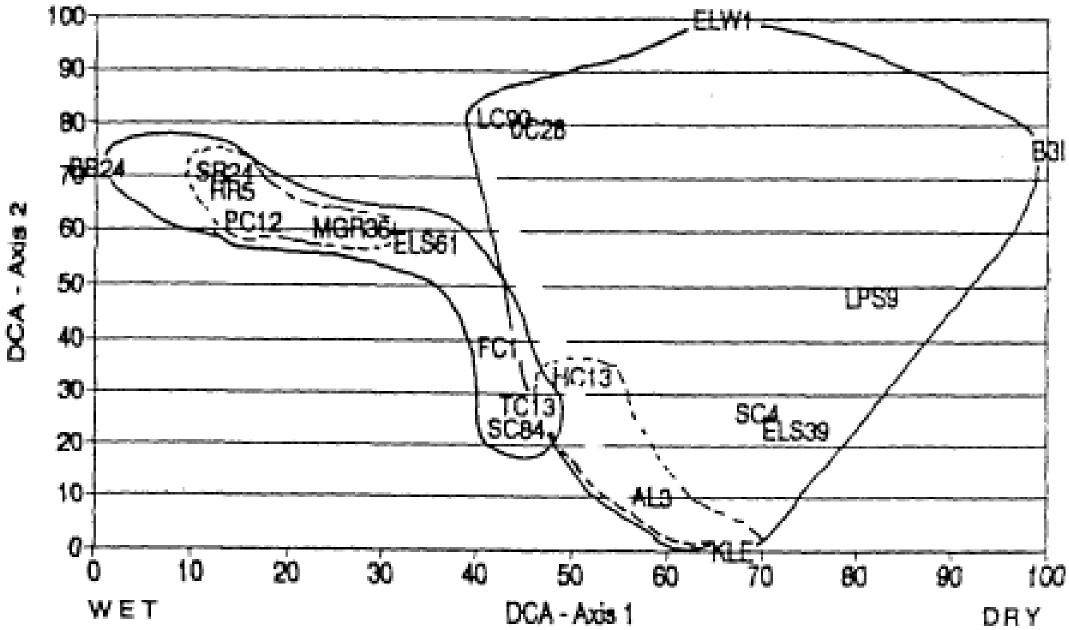

Figure 4-3. Midge taxa DCA analysis results.

CONCLUSION

Several studies have reported on invertebrates of lotic and lentic habitats. This paper is the most comprehensive to date on the distribution and abundance of emerging macroinvertebrates of palustrine wetlands in the Northwest. We feel confident that we have good descriptions of wetland emergent macroinvertebrates using the traps and conditions described from replicate captures among 19 wetlands during three years of survey between 1988 and 1995. Our descriptive statistical analysis of the high numbers of macroinvertebrates captured combined with estimates of variability among traps indicates that emergent trapping provides a good census of emerging aquatic insects in wetlands. Capture data further suggest that robust statistical comparisons of emergence data are possible by combining the three replicates at each site (Richter et. al. 1991). Nevertheless, increasing the number of replicates would be desirable and would provide additional power to our findings.

Our study is especially valuable in describing the chironomid midge communities. In North America, this group is represented by more species than all other orders of insects combined (McCafferty 1983). We identified 80 taxa in 1989 alone, including new species and extended the range extended extensions of several other taxa. Nearly half of the encountered taxa have not been previously reported in wetlands (Wrubeski 1987).

We identified 17 out of a total of 35 North American dipteran families associated with aquatic or semi-aquatic environments (McCafferty 1983) including several families not mentioned as found in marginal areas of shallow bodies of water including lakes, ponds, pools, marshes and bogs.

Non-dipteran aquatic and semi-aquatic insects identified within our survey were, for the most part, identified elsewhere in similar wetland ecosystems. The three taxa of dragonflies (Odonata) and *Callibaetis* (Ephemeroptera) are commonly found in Canadian marshes (Rosenberg and Danks 1987), whereas *Paraleptophlebia* is common in ephemeral streams of the Pacific Northwest. Plecoptera taxa found are also the ones typically inhabiting small perennial or temporary streams.

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APPENDIX 4-1. TABLES OF ARTHROPOD YIELD.

Table 4-2. Annual arthropod yield (per M2) from 19 wetlands in King County, Washington. Measured with three emergence traps (0.25 M2 area) at each wetland site run continuously for "insect year" 1988* (9/15/88 - 9/30/89, 1993 (4/10/93 - 4/9/94) & 1995 (1/1/95 - 10/30/95).

Wetland	Year	TOTAL TERR. ARTHROPODS	TOTAL AQUATIC AND SEMI-AQUATIC TAXA	Ephemeroptera	Odonata	Plecoptera	Trichoptera	Diptera	Brachycera	Nematocera	Non-Chironomid Nematocera	Chironomidae
	1989	41	4408	0	0	0	9	4399	2428	1971	724	1247
AL3	1993	9	2134	0	0	0	0	2134	184	1950	584	1366
	1995	31	1323	1	0	0	36	1286	225	1061	354	708
	1989	589	3037	0	0	0	1	3035	888	2147	634	1513
B3I	1993	222	2360	0	0	0	0	2360	1107	1253	616	637
	1995	277	735	0	0	0	0	735	168	567	460	108
	1989	56439	8858	3	24	1	132	8698	267	8431	203	8228
BBC24	1993	172	7515	0	0	0	0	7515	136	7379	145	7234
	1995	289	3020	1	0	0	15	3004	94	2910	93	2816
	1989	1972	7337	0	0	0	9	7328	1016	6312	3552	2760
ELS39	1993	122	4229	0	0	0	0	4229	404	3825	1970	1855
	1995	509	3204	0	0	0	5	3199	304	2895	2299	596
	1989	25935	20828	19	1	0	27	20781	5488	15293	3368	11925
ELS61	1993	597	10844	0	0	0	0	10844	3779	7065	2902	4163
	1995	452	1612	0	0	7	5	1600	133	1467	484	983
	1989	336	1238	0	0	0	0	1238	583	656	485	171
ELW1	1993	73	339	0	0	0	0	339	55	284	269	15
	1995	90	256	0	0	0	0	256	140	116	105	11
	1989	1531	4736	0	0	0	1	4734	1575	3160	461	2699
FC1	1993	115	6767	0	0	0	0	6767	73	6694	301	6393
	1995	113	2899	0	0	0	5	2894	15	2879	35	2844
	1989	308	8753	0	0	5	40	8708	2169	6538	3525	3013
HC13	1993	113	2272	0	0	0	0	2272	44	2228	270	1958
	1995	69	1522	0	0	1	21	1500	33	1467	435	1032
	1989	97	1134	105	0	32	3	994	69	925	169	756
JC28	1993	8	2900	0	0	0	0	2900	7	2893	53	2840
	1995	28	702	206	0	7	24	465	28	437	134	303
	1989	5076	9691	232	0	1576	61	7821	2925	4896	2580	2316
LCR93	1993	45	6234	0	0	0	0	6234	128	6106	193	5913
	1995	217	21501	0	0	0	0	21501	880	20621	1605	19016
	1989	2836	5126	0	0	0	3	5124	1160	3964	3313	651
LPS9	1993	153	1076	0	0	0	1	1075	432	643	504	139
	1995	62	2964	8	2	0	231	2723	86	2637	382	2255
	1989	8067	7365	7	0	0	35	7324	2884	4440	1072	3368
MGR36	1993	243	6699	0	0	0	1	6698	39	6659	226	6433
	1995	294	1606	0	0	3	23	1580	234	1346	944	402
	1989	74	8870	0	0	0	7	8863	2984	5879	1127	4752
NFIC12	1993	282	13047	0	0	0	0	13047	368	12679	1340	11340
	1995	169	2256	5	0	101	9	2141	952	1189	877	313
	1989	575	5892	11	0	0	36	5845	484	5361	440	4921
PC12	1993	119	5683	0	0	0	0	5683	288	5395	437	4958
	1995	149	3159	0	0	0	13	3146	902	2244	313	1931
	1989	945	8621	3	0	0	28	8591	884	7707	500	7207
RR5	1993	60	2413	0	0	0	1	2412	35	2377	132	2245
	1995	127	2067	0	0	42	5	2020	307	1713	1676	38
	1989	308	2952	0	0	5	12	2935	887	2048	1232	816
SC4	1993	104	2186	0	0	0	0	2186	626	1560	678	882
	1995	84	1696	0	0	0	12	1684	189	1495	367	1128
	1989	115	3692	3	0	0	0	3689	1377	2312	449	1863
SC84	1993	25	1106	0	0	0	0	1106	20	1086	181	904
	1995	45	642	0	0	0	1	641	6	635	77	558
	1989	2590	5598	24	0	0	27	5547	467	5080	815	4265
SR24	1993	37	2506	0	0	0	0	2506	12	2494	82	2412
	1995	29	662	0	0	0	1	661	76	585	96	489
	1989	85	4658	0	0	0	1	4656	1043	3614	407	3207
TC13	1993	36	2116	0	0	0	0	2116	9	2107	104	2003
	1995											

Table 4-3. Annual terrestrial arthropod yield (per M^2) from 19 wetlands in King County, Washington. Measured with three emergence traps (0.025 M^2 area) at each wetland, run continuously for "insect year", 1989* (9/15/88-9/31/89), 1993 (4/10/93-4/9/94) and 1995 (1/1/95-10/30/95).

			INSECTA														
Wetland	Year	**Arachnida**	Collembola	Thysanoptera	Psocoptera	Hemiptera	Homoptera	Non Aphididae	Aphididae	Neuroptera	Coleoptera	Lepidoptera	Hymenoptera	Other Hymenoptera	Parasitoid	Formicidae	TOTAL TERR. ARTHROPODS
AL3	1989	7	3	0	11	0	3	0	1	0	11	2	5	0	5	0	41
	1993	3	0	0	0	0	0	0	0	0	0	1	5	0	5	0	9
	1995	1	4	1	8	0	0	0	0	0	1	1	13	0	13	0	31
B3I	1989	35	124	13	41	9	124	0	113	9	11	7	216	0	212	4	589
	1993	4	1	4	20	1	110	5	105	3	12	7	60	7	51	3	222
	1995	3	37	1	20	0	165	1	163	0	0	0	51	0	51	0	277
BBC24	1989	33	179	17	144	0	55823	0	55797	7	56	7	173	1	171	1	56439
	1993	5	20	0	3	0	3	1	1	1	88	3	49	0	49	0	172
	1995	14	68	1	17	0	3	2	1	0	119	8	59	0	59	0	289
ELS39	1989	67	1043	33	4	1	281	0	133	0	40	8	495	4	505	5	1972
	1993	5	13	1	7	1	36	9	27	0	1	1	56	0	55	1	122
	1995	11	144	0	77	0	140	8	132	0	40	3	94	2	92	0	509
ELS61	1989	19	223	7	68	3	25155	0	25213	4	143	5	309	12	325	0	25935
	1993	12	72	4	0	3	210	13	197	0	37	24	235	1	234	0	597
	1995	13	337	4	4	0	31	23	8	0	11	9	44	1	43	0	452
ELW1	1989	19	131	0	47	12	44	0	17	0	1	1	81	1	79	1	336
	1993	13	4	0	24	0	3	1	1	0	8	0	21	0	21	0	73
	1995	8	36	3	15	1	1	1	0	0	11	1	15	1	13	0	90
FC1	1989	73	768	41	0	0	457	3	316	1	15	0	175	0	172	3	1531
	1993	20	7	5	9	0	48	25	23	0	8	0	17	0	17	0	115
	1995	9	11	5	70	0	1	1	0	0	3	1	12	0	12	0	113
HC13	1989	31	23	1	27	11	35	0	13	1	13	1	165	1	161	3	308
	1993	9	3	4	4	0	68	0	68	0	16	0	9	0	9	0	113
	1995	5	3	1	39	1	1	0	1	0	3	0	16	0	16	0	69
JC28	1989	11	32	1	20	4	7	0	5	0	1	0	21	0	21	0	97
	1993	1	1	0	0	0	0	0	0	3	0	0	3	0	3	0	8
	1995	3	7	1	11	1	1	1	0	0	3	1	0	0	0	0	28
LCR93	1989	88	21	57	129	15	4219	0	4055	3	101	1	441	0	439	3	74
	1993	11	0	5	1	0	8	3	5	0	9	0	11	0	11	0	282
	1995	16	19	0	0	0	100	0	100	2	9	1	69	1	68	0	169
LPS9	1989	57	197	15	4	5	2140	1	2084	5	55	1	388	8	380	0	5076
	1993	20	15	0	0	1	18	5	13	0	5	0	94	5	89	0	45
	1995	4	13	2	3	6	0	0	0	0	6	0	28	0	28	0	217
MGR36	1989	49	85	36	41	5	7645	0	7607	5	51	1	147	0	145	1	2868
	1993	43	5	4	5	1	4	1	3	0	7	0	174	0	174	0	153
	1995	23	132	11	0	0	9	4	5	0	15	8	97	0	94	3	62
NFIC12	1989	7	8	5	11	0	11	0	9	0	3	3	27	3	24	0	8067
	1993	4	11	4	16	5	7	1	5	1	3	0	231	4	227	0	243
	1995	12	5	1	68	1	16	11	5	0	17	1	47	0	47	0	294
PC12	1989	25	213	13	7	0	169	0	25	0	39	6	103	0	134	1	575
	1993	32	13	8	0	0	11	4	7	0	16	1	37	0	36	1	119
	1995	3	11	1	3	0	55	55	0	0	7	24	47	3	44	0	149
RR5	1989	21	137	15	39	3	219	3	75	0	261	23	228	1	213	13	945
	1993	1	3	3	1	0	4	1	3	0	19	3	27	0	27	0	60
	1995	21	41	0	1	0	0	0	0	0	17	3	43	0	43	0	127
SC4	1989	64	53	7	1	13	19	1	3	0	40	3	108	4	97	13	308
	1993	1	28	3	3	1	15	14	1	1	7	15	30	1	29	0	104
	1995	8	12	0	35	0	23	23	0	0	0	0	7	0	7	0	84
SC84	1989	12	11	5	3	0	24	0	1	0	1	0	59	7	43	9	115
	1993	4	0	0	10	2	2	2	0	0	0	0	7	0	7	0	25
	1995	5	15	0	4	0	10	10	0	0	5	0	5	0	5	0	45
SR24	1989	3	31	15	3	0	2375	16	2207	0	9	0	155	1	152	1	2590
	1993	5	0	1	3	0	9	5	3	0	12	0	7	0	7	0	37
	1995	3	8	1	7	0	0	0	0	0	5	0	5	0	5	0	29
TC13	1989	11	17	8	3	0	1	0	1	0	7	0	39	0	39	0	85
	1993	9	3	7	1	0	3	1	1	0	4	0	9	0	9	0	36
	1995																

Table 4-4. Annual aquatic/semi-aquatic insect yield (per M^2) from 19 wetlands in King County, Washington. Measured with three emergence traps (0.025 M^2 area) at each wetland site, run continuously for "insect year" 1989* (9/15/88 - 9/31/89), 1993 (4/10/93 - 4/9/94).

		TAXON																					
Wetland	Year	Ephemeroptera	Odonata	Plecoptera	Trichoptera	Total Diptera/ Nematocera	Nematocera/ Chironomidae	Nematocera/ Non Chironomidae	Anisopodidae	Bibionidae	Cecidomyiidae	Ceratopogonidae	Chaoboridae	Culicidae	Dixidae	Misc. Nematocera	Mycetophilidae	Psychodidae	Scatopsidae	Sciaridae	Simuliidae	Tipulidae	Trichoceridae
	1989	0	0	0	9	724			0	0	159	53	5	3	100	0	52	120	0	137	0	95	0
AL3	1993	0	0	0	0	1950	584	1366	0	0	13	130	19	75	9	0	57	185	0	15	0	81	0
	1995	1	0	0	36	1061	354	708	0	0	5	25	72	13	19	0	4	21	0	9	0	185	0
	1989	0	0	0	1	624			1	0	407	71	0	1	1	1	8	32	4	13	0	84	0
B3I	1993	0	0	0	0	1253	616	637	1	0	246	1	0	0	5	0	76	16	0	21	0	249	0
	1995	0	0	0	0	567	460	108	0	0	301	3	0	0	0	0	9	5	0	19	0	122	0
	1989	3	24	1	132	203			0	0	11	121	11	1	33	15	0	1	0	9	0	0	0
BBC24	1993	0	0	0	0	7379	145	7234	0	0	3	25	35	39	28	0	0	8	0	5	0	3	0
	1995	1	0	0	15	2910	93	2816	0	0	5	15	33	8	7	0	4	9	0	11	0	1	0
	1989	0	0	0	9	3552			0	2	226	16	0	0	2	2	106	14	0	3152	0	32	0
ELS39	1993	0	0	0	0	3825	1970	1855	0	0	108	152	39	208	59	0	23	839	31	463	0	51	0
	1995	0	0	0	5	2895	2299	596	0	0	139	24	6	13	1	0	94	109	0	1906	0	7	0
	1989	19	1	0	27	3368			0	0	24	819	12	25	7	8	504	1449	1	336	0	183	0
ELS61	1993	0	0	0	0	7065	2902	4163	0	0	68	1886	0	37	20	0	218	315	0	153	0	205	0
	1995	0	0	7	5	1467	484	983	0	0	4	243	0	23	1	0	68	27	0	21	0	97	0
	1989	0	0	0	0	485			0	0	35	223	0	1	0	3	16	16	0	77	0	115	0
ELW1	1993	0	0	0	0	284	269	15	0	0	177	0	0	0	0	0	27	1	0	23	0	41	0
	1995	0	0	0	0	116	105	11	0	0	25	0	0	0	0	0	5	4	0	61	0	9	0
	1989	0	0	0	1	461			1	0	32	48	0	53	116	11	40	120	1	5	0	33	0
FC1	1993	0	0	0	0	6694	301	6393	0	0	1	29	0	33	181	0	0	52	0	3	0	1	0
	1995	0	0	0	5	2879	35	2844	0	0	3	3	0	0	18	0	0	3	0	8	0	1	0
	1989	0	0	5	40	3520			3	0	104	116	0	1	7	8	39	2421	0	509	4	308	0
HC13	1993	0	0	0	0	2228	270	1958	0	0	1	7	80	83	72	0	8	11	0	1	0	8	0
	1995	0	0	1	21	1467	435	1032	0	0	4	20	106	39	55	0	188	13	0	4	0	7	0
	1989	105	0	32	3	169			0	0	1	65	0	0	7	11	3	55	0	11	0	16	1
JC28	1993	0	0	0	0	2893	53	2840	0	0	8	0	0	0	29	0	8	5	0	1	0	1	0
	1995	206	0	7	24	437	134	303	0	0	11	19	0	1	15	0	16	15	0	40	0	19	0
	1989	232	0	1576	61	2579			31	0	241	764	0	0	191	229	177	367	0	129	152	297	0
LCR93	1993	4	0	0	9	6106	193	5913	0	0	11	21	0	1	48	0	31	0	0	3	25	53	0
	1995	0	0	0	0	20621	1605	19016	0	0	90	4	0	0	0	0	734	0	0	722	0	55	0
	1989	0	0	0	3	3313			4	0	1096	68	0	0	7	4	49	75	0	1528	0	483	0
LPS9	1993	0	0	0	1	643	504	139	0	0	130	9	0	0	1	0	82	1	0	266	0	15	0
	1995	8	2	0	231	2637	382	2255	0	0	7	289	0	25	22	0	4	13	0	21	0	0	0
	1989	7	0	0	35	1072			0	0	105	92	0	24	100	35	15	609	1	40	0	51	0
MGR36	1993	0	0	0	1	6659	226	6433	0	0	12	57	8	12	93	0	0	25	0	19	0	0	0
	1995	0	0	3	23	1346	944	402	0	0	57	44	0	0	0	0	41	1	0	497	0	303	0
	1989	0	0	0	7	1127			0	0	352	72	4	15	1	0	21	145	0	489	0	27	0
NFIC12	1993	0	0	0	0	12679	1340	11340	0	0	100	596	43	25	4	0	80	96	0	323	0	73	0
	1995	5	0	101	9	1189	877	313	0	0	138	67	0	0	20	0	67	61	0	448	4	72	0
	1989	14	0	0	36	437			1	0	15	84	0	23	1	24	8	179	1	64	0	37	0
PC12	1993	0	0	0	0	5395	437	4958	0	0	1	42	3	238	22	0	42	25	0	31	0	33	0
	1995	0	0	0	13	2244	313	1931	0	0	25	106	1	1	0	0	28	3	0	124	0	24	0
	1989	3	0	0	28	500			0	0	11	241	7	0	0	16	16	101	0	75	0	33	0
RR5	1993	0	0	0	1	2377	132	2245	0	0	3	114	3	3	0	0	3	0	0	4	0	3	0
	1995	0	0	42	5	1713	1676	38	0	0	91	3	0	161	0	0	55	15	0	1291	0	60	0
	1989	0	0	5	12	1232			0	0	299	3	0	16	0	3	7	117	0	728	0	60	0
SC4	1993	0	0	0	0	1560	678	882	0	0	122	37	0	120	15	0	57	131	0	120	0	75	0
	1995	0	0	0	12	1495	367	1128	0	0	4	5	133	71	112	0	1	28	0	9	0	4	0
	1989	3	0	0	0	449			0	0	65	33	7	1	12	4	9	84	0	79	0	155	0
SC84	1993	0	0	0	0	1086	181	904	0	0	9	0	80	18	61	0	2	10	0	2	0	0	0
	1995	0	0	0	1	635	77	558	0	0	11	6	11	6	3	0	22	10	0	7	0	0	0
	1989	24	0	0	27	815			0	0	107	189	7	19	48	132	163	84	0	27	0	40	0
SR24	1993	0	0	0	0	2494	82	2412	0	0	0	26	32	3	15	0	0	0	0	4	0	2	0
	1995	0	0	0	1	585	96	489	0	0	7	4	41	1	4	0	7	8	0	5	0	19	0
	1989	0	0	0	1	407			0	0	88	84	1	0	5	3	11	73	1	89	0	51	0
TC13	1993	0	0	0	0	2107	104	2003	0	0	7	39	17	8	24	0	0	5	0	4	0	0	0
	1995																						

Table 4-5. Annual aquatic/semi-aquatic insect yield (per M^2) from 19 wetlands in King County, Washington, as measured with 3 emergence traps (0.25 M^2 area) at each wetland site, run continuously between September 1988 and September 1989.

	AQUATIC AND SEMIAQUATIC INSECTS																		
				Non-Urbanized								Moderately Urbanized						Highly Urbanized	
	Perennial					Dry in Summer			Perrenial			Dry in Summer						Perennial	
TAXON	Mgr36	RR5	HC13	SR24	PC12	AL3	NFIC12	TC13	ELW1	BB24	ELS61	LCR93	LPS9	SC4	JC28	SC84	ELS39	B3I	FC1
Ephemeroptera	7	3	0	24	14	0	0	0	0	3	19	232	0	0	105	3	0	0	0
Callibaetis	0	3	0	24	13	0	0	0	0	3	19	0	0	0	0	3	0	0	0
Paraleptophlebia	7	0	0	0	1	0	0	0	0	0	0	232	0	0	105	0	0	0	0
Odonata	0	0	0	0	0	0	0	0	0	24	1	0	0	0	0	0	0	0	0
Ischnura cervula	0	0	0	0	0	0	0	0	0	20	1	0	0	0	0	0	0	0	0
Enallagma boreale	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Coenagrion	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Plecoptera	0	0	5	0	0	0	0	0	0	1	0	1576	0	5	32	0	0	0	0
Capnia nr. oregona	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Paraleuctra? vershina	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malenka	0	0	0	0	0	0	0	0	0	0	0	83	0	0	0	0	0	0	0
Ostracerca dimicki	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	0	0	0	0
Podmosta delicatula	0	0	1	0	0	0	0	0	0	1	0	1325	0	1	1	0	0	0	0
Soyedina interrupta	0	0	0	0	0	0	0	0	0	0	0	137	0	0	31	0	0	0	0
Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Taenionema	0	0	0	0	0	0	0	0	0	0	0	27	0	0	0	0	0	0	0
Trichoptera	35	28	40	27	36	9	7	1	0	132	27	61	3	12	3	0	9	1	1
Unk. Trichoptera	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroptila	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oxyethira	0	1	0	0	0	0	0	0	0	112	0	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1
Lepidostoma cinereum	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Clistoronia	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clostoeca disjuncta	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Glyphopsyche irrorata	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Halesochila taylori	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lenarchus rho	0	4	0	1	1	0	3	0	0	0	3	0	0	0	0	0	0	0	0
Lenarchus vastus	0	12	36	0	5	9	3	0	0	0	0	4	0	0	0	0	4	0	0

Table 4-6. Diversity and richness of aquatic/semi-aquatic arthropod and Chironomidae communities found at 19 wetland sites in King County, Washington.

Diversity and Richness: All Aquatic/Semi-Aquatic Taxa Except Brachycera

																		Highly Urbanized	
			Non-Urbanized							Moderately Urbanized									
	Perennial					Dry in Summer			Perennial			Dry in Summer						Perennial	
Wetland	MGR36	RR5	HC13	SR24	PC12	AL3	NFIC12	TC13	ELW1	BBC24	ELS61	LCR93	LPS9	SC4	JC28	SC84	ELS39	B3I	FC1
Taxa richness	40	52	40	47	52	21	20	27	27	62	47	62	22	29	39	29	21	31	34
Annual adult yield per m2	4433	7732	6585	5082	5407	1852	5884	3614	655	8570	15340	6761	3969	2065	1064	2307	6332	2139	3159
Shannon Diversity Index (log 2	4.27	2.76	3.04	4.13	3.83	3.1	2.27	2.73	3.12	3.72	2.6	4.2	2.48	2.58	3.53	3.19	1.79	3.08	2.98
Pielou Evenness Index	0.803	0.48	0.57	0.74	0.67	0.71	0.53	0.57	0.66	0.624	0.467	0.71	0.56	0.53	0.67	0.66	0.41	0.62	0.59

Diversity and Richness: All Chironomidae Taxa

Wetland	MGR36	RR5	HC13	SR24	PC12	AL3	NFIC12	TC13	ELW1	BBC24	ELS61	LCR93	LPS9	SC4	JC28	SC84	ELS39	B3I	FC1
Taxa richness	28	38	23	34	35	11	8	16	19	42	29	32	11	16	26	19	9	19	22
Annual adult yield per m2	3368	7207	3013	4265	4921	1247	4752	3207	171	8228	11925	2316	651	816	756	1863	2760	1513	2699
Shannon Diversity Index (log 2	3.83	2.4	2.54	3.56	3.44	1.67	1.44	2.18	2.88	3.49	1.7	3.07	1.79	1.4	2.66	2.45	0.87	2.42	2.31
Pielou Evenness Index	0.798	0.46	0.56	0.7	0.67	0.48	0.48	0.54	0.68	0.648	0.35	0.62	0.52	0.35	0.57	0.58	0.28	0.57	0.52

versity and Richness: Chironomidae Taxa without Unidentified Females

Wetland	MGR36	RR5	HC13	SR24	PC12	AL3	NFIC12	TC13	ELW1	BBC24	ELS61	LCR93	LPS9	SC4	JC28	SC84	ELS39	B3I	FC1
Taxa richness	24	34	19	30	31	8	6	13	15	38	26	28	10	13	22	16	7	16	18
Annual adult yield per m2	1726	1989	1062	1905	2993	215	1175	1172	56	4099	3000	861	226	212	379	864	608	777	689
Shannon Diversity Index (log 2	3.71	3.88	3.06	3.61	2.99	1.77	1.2	2.2	3.4	3.85	2.48	3.64	2.58	1.53	2.64	1.94	0.44	2.65	2.67
Pielou Evenness Index	0.809	0.76	0.72	0.74	0.6	0.59	0.46	0.59	0.87	0.734	0.528	0.76	0.78	0.41	0.59	0.49	0.16	0.66	0.64

Table 4-7. Annual adult Chironomidae yield (per M^2) from 19 wetlands in King County, Washington, as measured with 3 emergence traps (0.25 M^2 area) at each wetland site, run continuously between September 1988 and September 1989.

	CHIRONOMIDAE TAXA																	Highly	
	Non-Urbanized								Moderately Urbanized									Urbanized	
	Perennial					Dry in Summer			Perennial			Dry in Summer						Perennial	
TAXON	MGR36	RR5	HC13	SR24	PC12	AL3	NFIC12	TC13	ELW1	BBC24	ELS61	LCR93	LPS9	SC4	JC28	SC84	ELS39	B3I	FC1
Diptera/Chironomidae																			
Boreochlus	145	0	8	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
Total Podonominae	145	0	8	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
Odontomesa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	7	0
Prodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	169	0
Total Prodiamesinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	176	0
Brillia	15	0	0	0	1	0	0	0	9	5	5	9	0	0	7	0	0	73	1
Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Corynoneura	161	40	35	523	83	0	0	1	0	40	11	37	0	0	17	0	0	0	24
Cricotopus	0	0	0	65	24	0	0	0	1	25	0	0	0	0	0	0	0	63	0
Cricotopus bifurcatus	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Doithrix	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4
Limnophyes	103	531	261	36	51	124	849	167	7	12	799	289	67	160	152	63	574	12	133
Mesosmittia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Metriocnemus	0	0	0	17	0	0	0	0	4	1	13	13	21	1	0	0	4	75	3
Nanocladius	0	43	0	0	0	0	0	0	0	8	0	39	0	0	1	0	0	0	0
Orthocladius	0	83	1	36	0	0	0	0	0	21	0	29	0	0	8	3	0	0	0
Parakiefferiella	0	0	0	0	0	0	0	0	1	0	0	3	0	3	0	0	0	0	0
Parametriocnemus	0	188	24	16	3	0	0	7	1	0	1439	29	7	1	11	0	0	1	0
Paraphaenocladius	17	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Poryophaenocladius	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0
Psectrocladius	1	285	0	11	32	0	0	15	0	21	15	0	0	0	0	0	0	0	0
Pseudosmittia	0	29	273	0	0	0	1	385	0	0	71	4	9	7	5	425	8	1	4
Rheocricotopus	0	0	3	0	1	0	0	0	0	0	1	29	43	0	1	1	0	0	0
Smittia	0	0	111	0	0	12	121	0	0	0	9	19	55	17	0	5	4	0	0
Thienemanniella	39	0	0	0	17	0	0	8	0	44	0	7	0	0	0	1	0	0	0
Orthocladiinae m.	3	73	5	5	17	0	0	3	1	0	4	53	19	5	4	0	2	253	0
Orthocladiinae fm.	657	4612	1632	877	512	716	3240	1685	77	119	8429	1083	423	583	325	721	2148	727	1395
Total Orthocladiinae	1004	5884	2345	1587	741	852	4213	2271	105	303	10796	1644	643	779	532	1221	2740	1208	1564
Chironomus decorus gr.	111	64	87	19	13	52	188	229	0	29	16	1	0	8	1	281	4	0	267
Chironomus riparius	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cladopelma viridula	0	20	0	7	1	0	0	0	0	68	0	0	0	0	0	0	0	1	0
Demicryptochironomus nr	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dicrotendipes	0	4	0	8	11	0	0	0	0	47	27	0	0	0	0	3	0	0	0
Endochironomus nigrican	0	5	0	56	24	0	0	0	0	19	71	3	0	0	0	1	0	0	0
Endochironomus subtend	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glyptotendipes	0	1	0	79	5	0	0	0	0	104	0	0	0	0	0	0	0	0	0
Kiefferulus dux	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Microtendipes pedellus va	12	0	0	0	0	0	0	0	0	113	0	0	0	0	0	0	0	0	0
Microtendipes pedellus va	0	28	0	0	0	0	0	0	0	343	0	0	0	0	0	0	0	0	0
Parachironomus monochr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Parachironomus cf. forcep	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parachironomus sp. 1	0	44	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parachironomus sp. 2	0	47	0	15	0	0	0	0	0	7	1	5	0	0	0	0	0	0	0
Paratendipes	0	0	0	0	0	0	0	0	0	0	0	8	0	0	21	0	0	0	0
Paratendipes albimanus	3	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0
Phaenopsectra flavipes	3	7	0	0	17	0	0	0	0	5	0	0	0	0	1	3	0	0	3
Phaenopsectra punctipes	0	0	1	0	0	0	0	0	0	4	3	0	0	0	0	0	0	0	0
Polypedilum illinoense	0	4	0	0	0	0	0	0	11	13	19	0	0	0	0	0	0	0	0
Polypedilum ophioides	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0
Polypedilum cf. simulans	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Polypedilum gr. 1	105	109	95	128	851	16	15	7	4	864	128	28	1	4	13	19	0	0	55
Polypedilum gr. 2	0	71	0	65	61	0	0	1	0	419	72	0	3	0	0	0	0	0	0
Stictochironomus	0	48	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
Xestochironomus	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0
Unk. Chironomini genus	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0
Chironomini m.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomini fm.	253	400	232	540	680	184	336	347	23	1420	381	116	3	17	43	220	4	4	528
Total Chironomini	487	856	463	927	1668	253	539	584	39	3481	717	165	8	29	81	527	8	5	856

Table 4-7 Continued.

TAXON	MGR36	RR5	HC13	SR24	PC12	AL3	NFIC12	TC13	ELW1	BBC24	ELS61	LCR93	LPS9	SC4	JC28	SC84	ELS39	B3I	FC1
Chironomidae cont.																			
Ablabesmyia	57	33	0	335	35	0	0	0	0	275	68	1	0	0	0	0	0	0	11
Apsectrotanypus algens	129	3	0	0	0	0	0	0	0	80	0	15	0	0	117	0	0	0	0
Conchapelopia cf. currani	15	1	0	0	1	0	0	0	0	51	0	0	0	0	0	0	0	3	0
Conchapelopia dusena	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112	8
Djalmabatista	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hayesumyia serata	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Labrundinia	0	0	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0	0
Larsia	0	51	1	36	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Meropelopia nr. american	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0
Natarsia miripes	0	0	0	0	0	0	0	0	0	0	0	111	0	0	3	0	0	0	0
Procladius bellus	0	59	0	8	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Procladius nr. freemani	0	31	0	88	661	0	0	0	0	96	3	0	0	0	0	0	0	0	0
Procladius nr. sublettei	16	1	0	11	11	0	0	0	0	141	0	0	0	0	0	0	0	0	0
Procladius n. sp.?	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paramerina smithae	161	7	0	12	3	0	0	0	0	21	4	19	0	0	3	0	0	0	0
Psectrotanypus dyari	77	1	11	137	656	5	0	345	4	96	28	4	0	0	0	12	0	0	111
Tanypus cf. parastellatus	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zavrelimyia fastuosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Zavrelimyia sinuosa	0	0	0	0	0	0	0	0	0	0	61	0	0	0	0	0	0	0	0
Zavrelimyia thryptica	133	0	5	0	35	4	0	0	0	5	104	9	0	1	4	1	0	0	13
Macropelopiini m.	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Macropelopiini fm.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
Pentaneurini m.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pentaneurini fm.	283	64	13	75	33	4	0	0	1	19	7	113	0	3	3	0	0	7	9
Total Tanypodinae	875	253	32	703	1449	13	0	345	13	859	275	272	0	4	131	13	0	127	156
Micropsectra gr. 1	384	0	75	19	257	0	0	1	1	67	12	21	0	0	0	4	12	0	44
Micropsectra gr. 2	16	19	17	1	84	0	0	3	0	149	16	43	0	0	1	41	0	0	0
Rheotanytarsus	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanytarsus	17	52	0	161	20	0	0	0	0	800	0	29	0	0	3	0	0	0	0
Tanytarsini fm.	407	141	76	827	701	0	0	3	12	2552	108	141	0	1	4	51	0	0	77
Total Tanytarsini	824	212	168	1008	1063	1	0	7	13	3588	136	235	0	1	8	96	12	0	121