Aquatic Macroinvertebrate Occurrences and Population Trends in Constructed and Natural Vernal Pools in Folsom, California

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Abstract. Macroinvertebrate populations from constructed and natural vernal pools on the same land forms and in close proximity, were compared quantitatively to determine colonization and temporal trends. Population trends in the natural pools were used to establish the functional success criteria for constructed pools. Success was evaluated by the quantitative and qualitative similarities of the constructed pool invertebrate populations to those of the natural pools. Most constructed pool invertebrate populations were found to mirror existing populations of vernal pool "obligate" species in natural vernal pools within two years. A combination of factors (i.e., over abundance of *Glyceria* sp., ponding depth, amount of organic matter in pool) may have contributed to the deviation of invertebrate populations in a few constructed vernal pools from those in natural pools. Quantitative and qualitative monitoring will continue for seven more years.

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Introduction

Determination of success in pools constructed to replace natural pools has generally been limited to a few parameters such as hydrologic and botanical criteria. In recent years, the suitability of created pools as special-status shrimp habitat has become an additional consideration. In studies of a vernal pool mitigation project in Folsom, California, macroinvertebrate population composition and abundance were compared using statistical methods in both natural pools and constructed pools to provide indications of the constructed pools suitability as replacement habitat. Because these constructed pools are mitigation for impacted vernal pools, they need to demonstrate that they are functioning ecologically like naturally occurring vernal pools to be considered adequate compensation. The data presented here are the results of the first two years of a nine year monitoring and management study.

Study Site

The study area is located in Folsom, Sacramento County, California. The entire project area is 246.9 hectares, and supports 21.1 hectares of vernal pools in three specific areas referred to as Sites 1, 2, and 3. During the summer of 1994, Jones & Stokes Associates, Inc. designed and managed the construction of 37 vernal pools amongst the natural pools as part of a mitigation plan. Both the constructed and natural pools occur on Redding gravelly loam soils (Soil Conservation Service, 1993). The pools have a clay bottom with a subsurface duripan. The site occurs on the Red Bluff geologic formation on Old Terrace landform. Site 1 is located on flat open uplands dominated by annual grasses. Site 2 occurs on a 100 year flood plain on the north side of Willow Creek. Site 3 is located on a narrow strip of land running east-west, bordered on the south side by a subdivision and on the north by Humbug Creek.

The entire project site contains 273 natural vernal pools, with the majority occurring in Site 1. The pools vary from small, shallow pools (<6 m^2, ponding 15-30 days) to large pools (>10 m^2) that pond water for extended periods (i.e., 60-100 days).

The emphasis of the mitigation plan was to construct special-status shrimp habitat, and to emulate the natural variability of the existing pools. To best accomplish this, the pools were constructed slightly deeper than the habitat they were replacing. A total of 37 pools were constructed; 17 pools at Site 1, seven pools at Site 2, and 13 pools at Site 3.

The inoculum for the constructed pools came primarily from disturbed natural pools occurring at the same site.

Methods

Macroinvertebrate (invertebrates > 2 mm in size) populations were sampled from each of the constructed pools, and from nine natural pools per site, considered here as control pools. The control pools were selected based on similarity in size, ponding depth, and ponding duration to the constructed pools. Both constructed and natural pools were quantitatively sampled using a fine mesh dip net with an aperture opening of 0.0451

m^2. This net was pulled through 1.5 horizontal meters of the pool. Each sweep sampled 0.0677 m^3 of the pool. The contents of the net were placed in a 500 ml Nalgene sample container and preserved in 90% ethanol for 24 hours. The sample preservative was then drained and replaced with fresh 90% ethanol.

Each pool was sampled three times (early, mid, and late) per wet season during the years 1995 and 1996. The timing of each sampling event was determined by the ecological succession stage. The first sampling (early) occurred approximately two weeks after initial inundation, the second sampling (mid) occurred when the first floating hydrophytes (i.e.; *Ranunculus bonariensis* var. *trisepalus*, *Callitriche marginata)* appeared, and the third sampling (late) occurred during the early stages of drying and subsequent collapse of the aquatic component of the vernal pool community. These stages were selected as sampling periods rather than temporal increments due to variability in temperature and rainfall, that prolongs or shortens the stages of the ponding cycle.

In the laboratory, the invertebrates were sorted and enumerated in clear Pyrex trays. Specimens collected from each sample were identified to the lowest justifiable taxon using a Olympus SZ-ST40 zoom stereo scope, and the appropriate taxonomic references (Arnett, 1968; Bohart and Washino, 1978; Edmunds et al., 1976; Gordon, 1977; McAlpine et al., 1981; Menke, 1979; Merritt and Cummins, 1996; Meyer and Durso, 1993; Pennak, 1978; Usinger, 1956; Wiggins, 1977) in order to establish diversity, taxa richness, and abundance, and to develop community indexes. A total of 85 separate taxa were collected from all pools.

Invertebrate biomass was estimated using volumetric displacement. The macroinvertebrate specimens from all samples were dried at room temperature on size 613 qualitative filter paper for 15 minutes and then placed in a 25 ml graduated cylinder with 15 ml of 15°C deionized water. The volumetric displacement was determined and recorded.

All data were entered into a Lotus 123 spreadsheet format (Appendix 1). Analytical summaries of the data are presented below and in Figures 1 through 6. The data presented in Appendix 1 and Figures 1 through 6 are averages for the natural and constructed pools for each site due to the large number of pools sampled.

Results

Invertebrate Density

Invertebrate density is the number of individual invertebrates per cubic meter. The highest densities for Sites 1 and 2 were during the mid-season samplings, averaging 310 individuals per cubic meter in natural pools, which constructed pools emulated by the second year. Site 3 however, had natural pools averaging 220 individuals per cubic meter, with constructed pools averaging slightly higher in the mid-season samples. The 1996 late season samples from Site 3 had constructed pool densities nearly twice those of all other constructed and natural pools (Figure 1).

The pools ponded for the first time in the 1994-95 wet season. Because the pools were newly constructed, the bottom had not yet compacted and there was no layer of thatch. No substrate was available for most colonizing invertebrate species and the water was very turbid. At the time of the 1995 early collection, the only habitats suitable to colonization were the littoral open water (by planktonic filter feeders), and the neuston (water surface) by scavengers. Opportunistic species (i.e., *Chironomus*

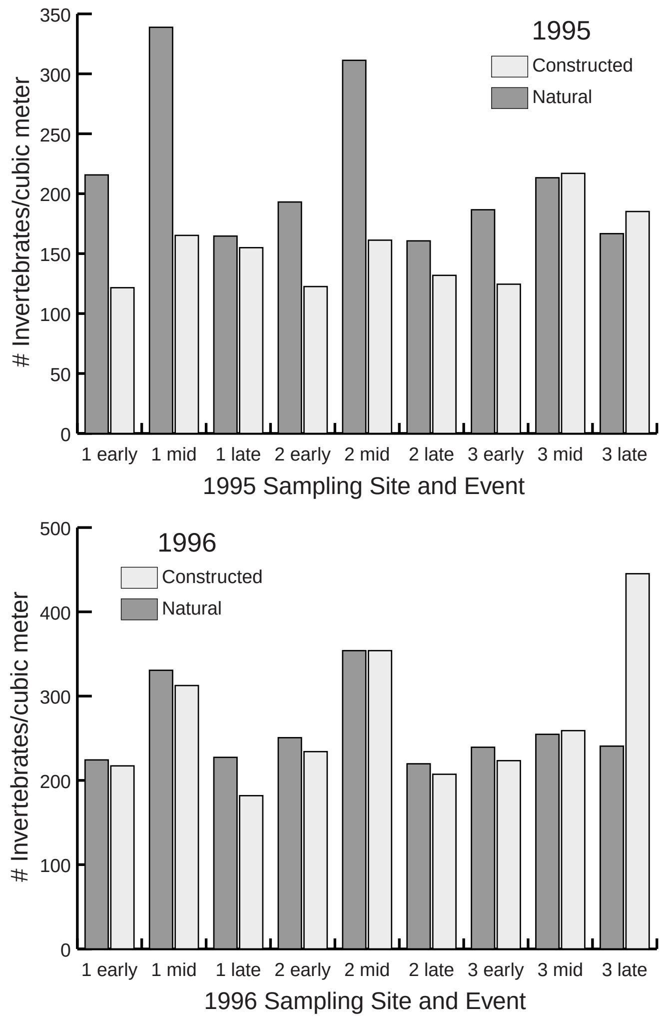

Figure 1. Average densities of macroinvertebrates (individuals/m^3) in natural and constructed vernal pools at three sites in Folsom, California. Samples were collected in three periods (early, mid and late) in 1995 and 1996. Constructed pools sampled: Site 1, n = 7; Site 2, n = 7; Site 3, n = 13. Natural pools sampled: all sites, n = 9.

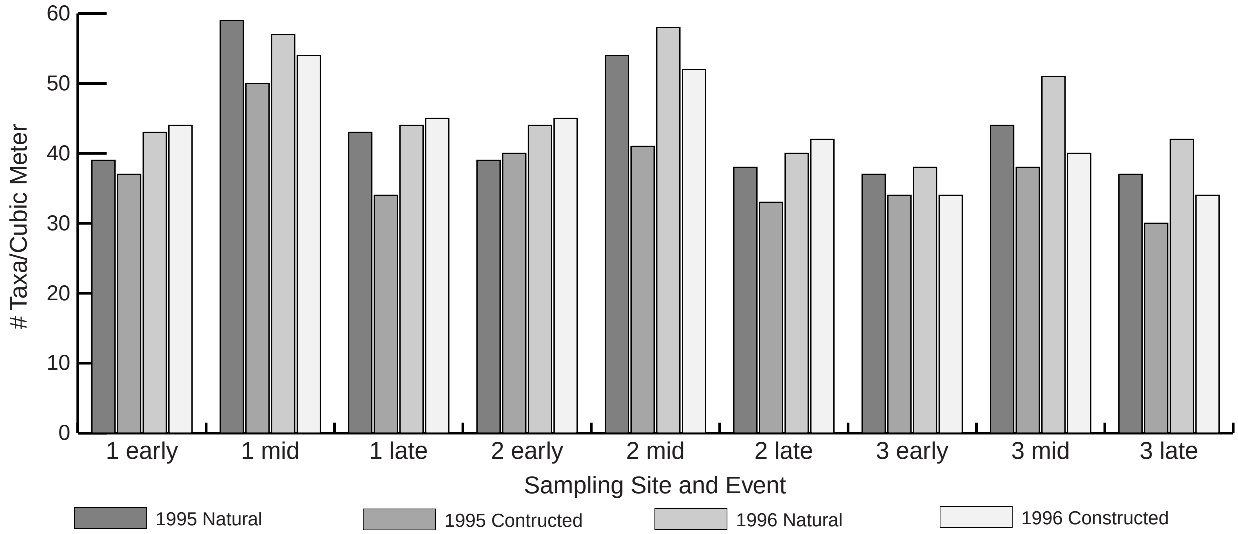

Figure 2. Average richness of macroinvertebrate taxa (individuals/m3) in constructed and natural vernal pools at three sites in Folsom, California.

midges) were generally able to survive in these conditions. Many vagile (capable of flying from one pool to another) predators and grazers (e.g., Corixidae and Dytiscidae) were found as well.

Taxa Richness

Taxa richness is the total number of individual taxa and is used as a means of determining the overall health of an aquatic habitat (Plafkin et al., 1989). In general, the higher the water quality, habitat suitability, and variety, the higher the taxa richness. Taxa richness was highest during the mid season sampling event (Figure 2). The Site 3 constructed pools had the lowest taxa richness of all the sites. The constructed pools of Sites 1 and 2 developed taxa richness comparable to their corresponding reference pools by the 1996 sampling season.

Mosquito/Chironomus Abundance

By measuring the abundance of invertebrate families least sensitive to changes in water quality and habitat suitability, the relative extent of habitat affected can be examined. Mosquitoes and Chironomid midges of the genus *Chironomus* are generally considered opportunistic and tend to be resistant to adverse environmental conditions, and the ratio of these taxa to all other groups increases with decreasing water quality (Plafkin, et al., 1989). Opportunists are species that are not dependent on a specific trophic function (i.e., filter feeders, predators) but can feed, and sustain themselves in many trophic regimes, and also are not limited to vernal pool habitats.

The proportion of the Mosquitoes and *Chironomus* midges was highest in the constructed pools during the 1995 sampling season (Figure 3a). Site 3 had the greatest ratio of Mosquitoes and *Chironomus* midges, reaching 28 times that of the constructed pools of Sites 1 and 2 by the end of 1995. In 1996, the abundance was fairly even across the samples from both natural and constructed pools in Sites 1 and 2, with Mosquitoes and *Chironomus* midges always below 2% of the total invertebrate population. However, Mosquitoes and *Chironomus* midges at Site 3 constructed pools accounted for nearly 40% of the invertebrate composition during the early and mid-season collecting events, and 78% of invertebrate composition during the late season sampling event (Figure 3b).

Community Similarity and Community Loss Indices

Jaccard Coefficient of Community Similarity and Community Loss indices (EPA, 1989) were used to determine similarities between the samples.

$$\text{Jaccard Coefficient of Community Similarity} = \frac{\text{\# taxa common to both samples}}{\text{\# taxa common to both samples} + \text{\# taxa in comparison and not in reference sample} + \text{\# taxa in reference and not in comparison sample}}$$

$$\text{Community Loss} = \frac{\text{\# taxa in reference sample} - \text{\# taxa common to both samples}}{\text{\# taxa in comparison sample}}$$

The Jaccard Coefficient of Community Similarity estimates the degree of similarity between samples based on presence or absence of taxa. The coefficient values range from 0 to 1.0. The higher the coefficient, the greater the similarity between the samples. Sites 1 and 2 constructed pools all had similarity coefficients between 0.8 and 0.9 by 1996 (Figure 4). Site 3 constructed pools similarity coefficients were between 0.5 and 0.6

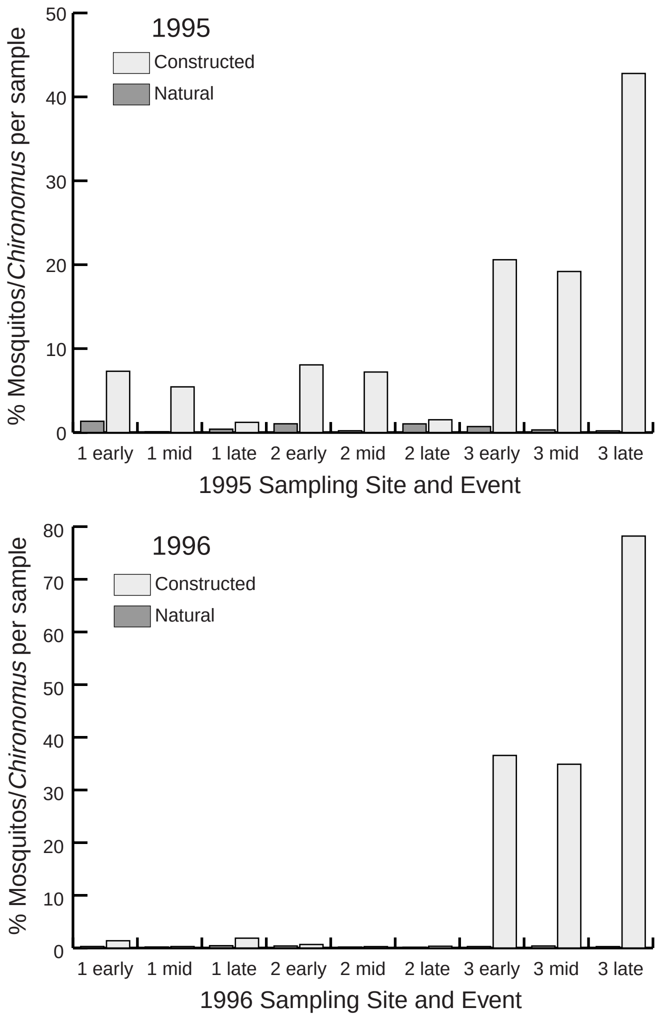

FIGURE 3. Average Mosquito and *Chironomus* sp. abundance in constructed and natural pools for 1995 and 1996. Expressed as a percentage of the number of invertebrates in a sample.

during the mid and late season sampling events for 1995 and 1996.

The Community Loss index estimates the loss of taxa between comparison samples and reference samples. The index identifies the differences in sample composition. The higher the index value, the greater the dissimilarity between the comparison sample and the reference sample. In the 1995 early season sampling, loss index for Sites 1 and 2 averaged below 0.08, while the Site 3 average indices were 0.15, therefore the comparisons demonstrated very low degrees of dissimilarity (Figure 5). The 1995 mid-season loss indices for Sites 1 and 2 averaged 0.37 (an 82% increase), while Site 3 had an average index of 0.03 (an 80% decrease). By the late season sampling event the average indices for Sites 1 and 2 had dropped to 0.29. Site 3, however, jumped to an average of 0.4.

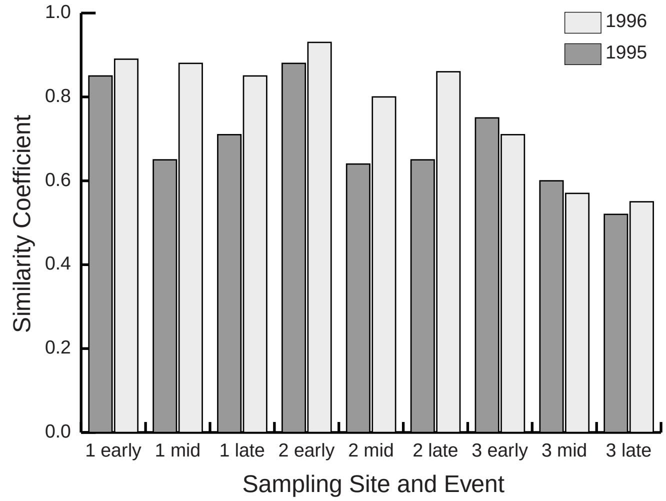

FIGURE 4. Average Jaccard Similarity Coefficient per site and sampling event. Represents the average similarity of a constructed pool to three corresponding reference natural pools.

By 1996, Sites 1 and 2 had an average dissimilarity index of 0.06. Site 3 averaged 0.45 by the late season sampling event, an 86% higher degree of dissimilarity over the Site 1 and 2 constructed pools.

Productivity

The productivity is defined as the grams of living invertebrates per cubic meter within the study area. In 1995, the highest productivity occurred in the natural pools, averaging twice the mass of the constructed pools (Figure 6). In 1996, the constructed pools of Sites 1 and 2 averaged 6% less productivity than the

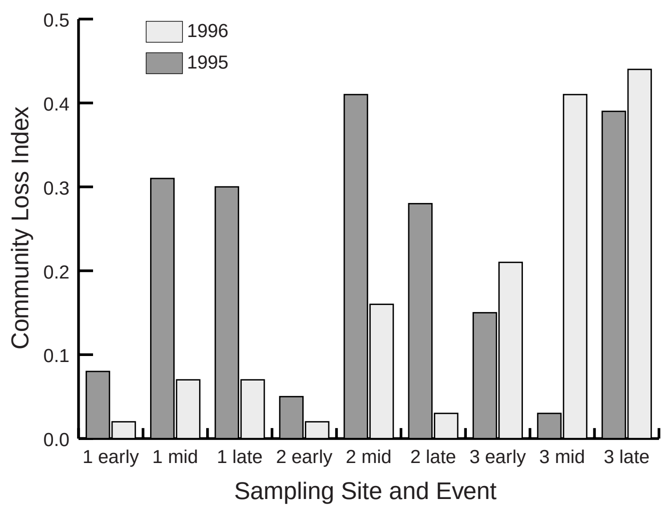

FIGURE 5. Average Community Loss Index. Represents the average taxa dissimilarity of constructed vernal pools to three corresponding reference natural vernal pools.

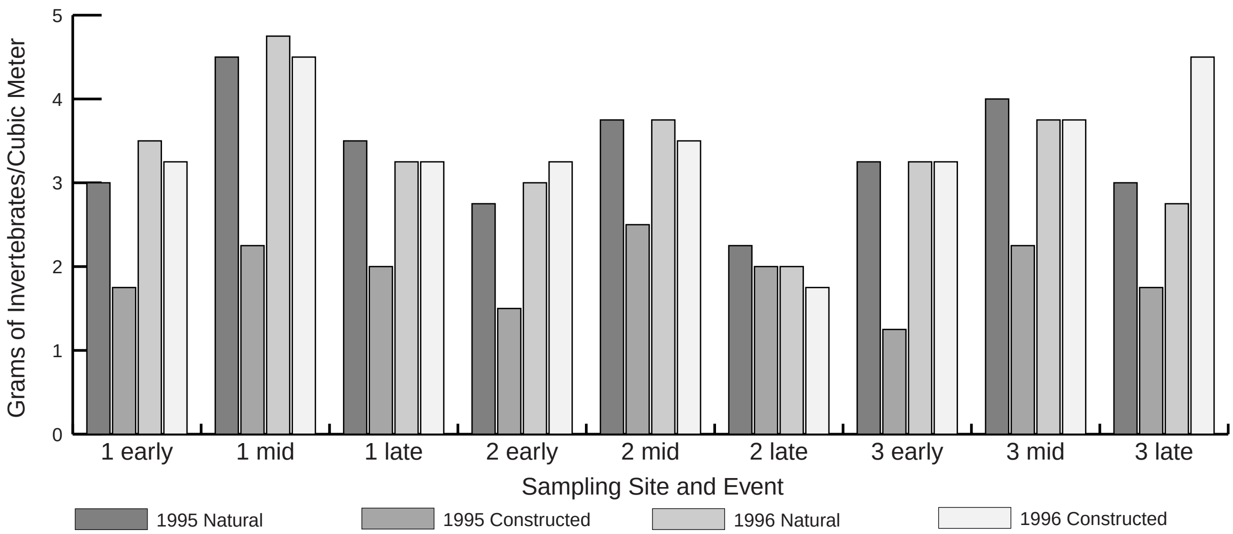

FIGURE 6. Average macroinvertebrate productivity (g/m^3) in constructed and natural vernal pools at three sites in Folsom, California.

natural pools. Site 3 constructed pools mirrored the productivity of the natural pools during the early and mid-season sampling events. The 1996 late season sampling at Site 3 showed the constructed pools had 37% higher productivity than the corresponding natural pools.

CONCLUSIONS

The pools constructed in Sites 1 and 2, and one such pool at Site 3, eventually emulated their corresponding natural pools in overall invertebrate richness, opportunist abundance, densities, statistical similarity, and productivity. Initial invertebrate colonization was low, perhaps due to the simplicity of the habitat. As vegetation developed during the first year, the habitat became more complex. By the end of the second year, the invertebrate populations of these constructed pool reflected the populations of their corresponding natural pools (standard deviation of the mean of 805.78; variance of 649,275.99; standard error of 268.59; precision of 16%, expected ranges are 10%-40% [Merritt and Cummins, 1996]).

Site 3 also had low initial colonization, again perhaps due to lack of habitat diversity, as was the situation at Sites 1 and 2; however, the colonization problems at Site 3 were compounded by other factors. Natural pools and the pools at Sites 1 and 2 had gently sloping sides. The pools in Site 3 were constructed with very steep sides and had little shallow water habitat. In addition, *Glyceria declinata* was the dominate plant in 12 of the 13 constructed pools at Site 3. This plant inhabits ephemeral wetlands, including vernal pools, and prefers deep water in disturbed areas. *Glyceria declinata* was introduced from Europe some time in the 1950's, and became a rice paddy weed (Munz, 1968). The newly constructed pools in Site 3 provided abundant disturbed habitat with low surface area-to-volume ratios (Table 1). *Glyceria declinata* accounted for 30% to 50% of vegetative cover in Site 3 constructed pools by the end of the first sampling season, and 75% to 100% of vegetative cover at the end of the second season.

Dense *Glyceria declinata* cover provides good habitat for opportunistic species. The long leaves of the aquatic stage lay flat across the surface of the water, increasing the surface area of menisci in the pool. This affords opportunists, such as mosquito larvae, hiding places from predators. Many invertebrate predators (i.e., backswimmers or predaceous diving beetles) will hunt by swimming just below the water surface. By lying in the meniscus of a leaf, mosquito larvae elevate themselves above the surface of the water, and out of the line of sight of a predator.

The newly inundated soils within constructed wetlands also play a role in attracting opportunistic species. Gerhardt (1959) demonstrated that soil fermentation (i.e., soil changing from aerobic to anaerobic conditions) produces reduced organic compounds, like acetic and butyric acid, and CO_2, which are released into the water, and are attractants to opportunistic in-

TABLE 1. Correlations table.

Site	Dominant Plant	Average Depth	Ponding Duration	Surface Area/ Volume Ratio
1. Constructed	Varied	37.9 cm	89 days	Avg. = 2.72
2. Constructed	Varied	39.6 cm	88 days	Avg. = 2.71
3. Constructed	*Glyceria* sp.	50.2 cm	121 days	Avg. = 2.01
All Natural	Varied	37.1 cm	76 days	Avg. = 2.74

vertebrate species. Generally these organic compounds can be taken up by algae, but with the dense cover of floating *Glyceria declinata* leaves, sunlight is reduced to a level to low to sustain algal growth. Some of these materials are oxidized in the water, thus removing oxygen from the pool. Most vernal pool invertebrate species are gill breathers, and may suffocate in low dissolved oxygen. Low dissolved oxygen dissuades most nomadic species from ovipositing, unless their larvae are atmospheric breathers, such as mosquitoes, or if the larvae harbor large quantities of hemoglobin such as *Chironomus* sp.

I believe these factors all played a part in determining which invertebrates occupied the constructed vernal pools at Site 3, and with opportunistic invertebrates as symptomatic of undesired functions (due to the scarcity of opportunists in the natural pools), the various features of the Site 3 constructed pools described above should be thought of as correlative, and not causative.

These data represent the findings of the first two years of a nine year monitoring plan. Within two years the constructed pools approximated the same invertebrate functions as the natural habitat. It is apparent that the pools with diversified habitats are the most successful. It is also apparent that no one factor can be singled out to explain why a pool may function in a certain way. The vast majority of constructed pools at these sites cannot be distinguished floristically or faunally from the existing natural pools, and are even used by waterfowl, waders, and amphibians, as are the natural pools. With this in mind, a multivariate monitoring approach (i.e.; flora, hydrology, soils, invertebrates, vertebrates, etc.) to constructed habitats, and the utilization of data developed from such monitoring in management decisions, will help the success of constructed habitats in the long term.

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APPENDIX 1. Average density of macroinvertebrates (#/m[3]).

					1995 Early Season Sampling Averages					
					Site 1		Site 2		Site3	
Phylum	Class	Order	Family	Species	Natural	Const.	Natural	Const.	Natural	Const.
Platyhelminthes	Turbellaria			Sp. 1	30.00	29.00	29.00	4.43	25.67	21.94
				Sp. 2	7.67	1.41	8.67	1.43	9.33	7.53
				Sp. 3	0.33	0.06	0.67	0.14	0.33	
Nematamorpha				Gordius sp.						
Annelida	Oligocheata			Sp. 1						
Tardigrada			Macrobitidae							
Arthropoda	Crustacea	Branchiopoda	Triopsidae	Lepidurus packardi						
			Linderiellidae	Linderiella occidentalis	8.00	6.94	6.33	4.88	1.67	
			Branchinectidae	Branchinecta lynchi	16.33	6.53	9.00	6.14		
			Caenistheriidae	Cyzicus californicus						
			Macrothicidae	Sp. 1	5.67	0.47	5.67	1.43	6.00	
				Macrothrix sp.	7.33	6.35	9.00	8.94	7.67	5.35
			Chydoridae	Alona sp.	2.67	2.41	1.67	2.43	2.33	3.41
				Oxyurella sp. (?)	1.33	1.24	1.33	0.88	1.33	1.24
			Daphniidae	Simocephalus sp.	15.67	8.94	23.67	21.00	24.67	8.53
		Copepoda		Sp. 1	5.00	17.94	6.30	2.43	8.00	
				Sp.2	2.67	0.24	1.60	1.00	2.67	0.24
				Diaptomus sp.	11.33	5.41	9.67	9.59	16.33	14.24
		Ostracoda		Sp.1	7.67	0.24	6.60	8.43	10.33	0.41
				Sp. 2	0.67	0.94	0.67	8.94	3.67	0.94
				Sp. 3		0.41		0.94		0.35
	Arachnida		Tetragnathidae	Tetragnatha sp.						
			Eylaidae	Eylais sp.	2.00	0.24	1.33	0.94	2.33	0.35
	Insecta	Collembola	Poduridae	Podurus aquatica	24.67	2.41	18.00	1.43	11.33	1.94
		Ephemeroptera	Baetidae	Callibaetis sp.						
		Odonata	Coenagrionidae	Coenagrion resolutum						
			Libellulidae	Belonia saturata						
				Libellula sp.						
				Aeshna interrupta nevadaensis						
		Hemiptera	Gerridae	Gerris remigis						
			Corixidae	Corisella decolor	6.33	1.94	4.33	2.94	7.67	6.35
				Corisella inscripta	7.33	2.06	7.67	6.43	7.67	2.94
				Hespercorixa laevigata	3.67	1.94	2.60	1.94	4.67	2.06
				Hespercorixa vulgaris	1.33		0.33	0.43	1.33	
				Siagara vallis						
			Notonectidae	Notonecta undulata						
				Notonecta unifasciata						
				Buenoa scimitra	4.67	0.94	3.00	0.43	3.67	3.35
		Trichoptera	Limnephilidae	Limnephilis aretto						
		Coleoptera	Haliplidae	Apteriliplus parvulus	5.67		5.33		4.67	
				Peltodytes simplex						
				Haliplus gracilus						
			Dytiscidae	Hydroporus hirtellus	1.33	0.94	0.67	0.94	1.00	0.94
				Laccophilus sp.	2.33	1.35	2.33	1.43	2.33	2.35
				Agabinus sculpterellus						
				Agabus linellus						
				Agabus approximatus						
				Colymbetes sp.						
				Rhantus binotatus						
				Hydrotrupes palpalis	5.33	1.06	5.33	1.06	3.67	2.94
				Dytiscus marginicollis	0.33					
			Gyrinidae	Gyrinus punctellus						
				Gyrinus consobrinus						
			Hydrophilidae	Helophorus sp.						
				Berosus fraternus	6.00	1.41	5.30	3.94	4.60	3.35
				Tropisternus laterallis	1.00	0.41	1.33	1.43	1.33	0.94
				Tropisternus californicus	1.00	0.35	1.00	0.35	0.67	0.94
				Paracymus subcupresus						
				Helochares normatus						
			Hydraenidae	Hydraena vandykei	0.33		1.00			
				Octhebius holmbergi						
			Scarabaeidae	Aphodius alternatus	1.33	0.65	0.67	0.43	1.00	0.06
			Heteroceridae	Microaugyles mundulus						
			Curculionidae	Sp. 1						
				Sp. 2						
		Diptera	Tipulidae	Tipula sp.	0.67	0.06	0.33	0.06	1.00	0.06
				Molophilus sp.			0.33			0.06
				Ormosia sp.						
			Dixidae	Dixella sp.						
			Culicidae	Anopholes freeborni						
				Aedes clivus		0.94		0.94		1.94
				Culex stigmatosoma						
				Culex tarsalis						
				Culex pipiens						
				Culiseta inornata	0.33	1.65	0.33	1.65	0.67	9.94
				Culiseta incidens	2.33	1.35	1.00	2.35	0.33	7.35
			Chironomidae	Chironomus sp.	0.33	4.94	0.67	4.94	0.33	6.41
				Corynoneura sp.	8.67	1.65	5.33	1.65	2.67	1.35
			Tabanidae	Tabanus punctifer						
			Dolichopodidae	Medetera sp. ?						
			Scathophagidae	Orthacheata sp.						
Mollusca	Gastropoda		Physidae	Physatella sp.	2.67	3.41	2.33	2.43	2.33	2.35
			Lymnaeidae	Lymnaea sp.	3.67	3.35	2.67	1.35	1.33	2.35
Totals					215.67	121.58	193.07	122.53	186.60	124.50

APPENDIX 1. (Continued.)

					1995 Mid Season Sampling Averages					
					Site 1		Site 2		Site 3	
Phylum	Class	Order	Family	Species	Natural	Const.	Natural	Const.	Natural	Const.
Platyhelminthes	Turbellaria			Sp. 1	21.67	13.94	22.33	11.41	19.67	28.35
				Sp. 2	21.33	6.35	15.67	5.41	9.33	9.41
				Sp. 3		0.35				
Nematamorpha				Gordius sp.	3.00		0.30			
Annelida	Oligocheata			Sp. 1	1.33		0.67			
Tardigrada			Macrobitidae		2.67		0.67			
Arthropoda	Crustacea	Branchiopoda	Triopsidae	Lepidurus packardi	0.67	6.41				
			Linderiellidae	Linderiella occidentalis	3.33	5.41	3.67	5.94	0.67	
			Branchinectidae	Branchinecta lynchi	23.67	11.35	21.33	9.35		
			Caenistheriidae	Cyzicus californicus						
			Macrothicidae	Sp. 1	5.30					
				Macrothrix sp.	8.67	6.41	9.33	5.35	10.33	
			Chydoridae	Alona sp.	4.30	0.35	4.67	0.41	4.33	1.41
				Oxyurella sp. (?)	1.33		2.67		1.67	3.94
			Daphniidae	Simocephalus sp.	58.67	23.35	51.33	24.94	35.67	7.94
		Copepoda		Sp. 1	12.30	10.41	8.33	12.41	7.33	0.24
				Sp.2	4.67	0.41	6.33	0.35	2.33	0.94
				Diaptomus sp.	42.67	8.94	43.33	9.35	19.67	18.94
		Ostracoda		Sp.1	7.67	6.24	5.67	6.41	7.33	21.94
				Sp. 2	0.67	4.94	0.67	5.41	2.33	17.41
				Sp. 3	0.30	3.41	0.67	3.35		11.06
	Arachnida		Tetragnathidae	Tetragnatha sp.						
			Eylaidae	Eylais sp.	4.33	0.24	3.30		1.67	
	Insecta	Collembola	Poduridae	Podurus aquatica						
		Ephemeroptera	Baetidae	Callibaetis sp.						
		Odonata	Coenagrionidae	Coenagrion resolutum						
			Libellulidae	Belonia saturata						
				Libellula sp.						
				Aeshna interrupta nevadaensis						
		Hemiptera	Gerridae	Gerris remigis	0.30		0.33			
			Corixidae	Corisella decolor	2.30	1.41	0.33	0.35		3.35
				Corisella inscripta	2.30	1.24	0.67	2.35	4.67	1.94
				Hespercorixa laevigata	4.67	0.94	7.33	1.94	5.33	1.94
				Hespercorixa vulgaris	3.00	0.24	2.67	1.35	2.33	0.94
				Siagara vallis	1.30		1.67		1.33	0.06
			Notonectidae	Notonecta undulata	0.30	1.24	0.33	1.35	0.33	5.35
				Notonecta unifasciata	0.30	0.94	0.33	1.94	0.67	3.41
				Buenoa scimitra	8.67	7.94	11.67	6.41	12.33	3.94
		Trichoptera	Limnephilidae	Limnephilis aretto	1.30		1.67		2.67	
		Coleoptera	Haliplidae	Apteriliplus parvulus	5.30		2.67		3.67	
				Peltodytes simplex	1.30					
				Haliplus gracilus			0.33	0.06	0.33	
			Dytiscidae	Hydroporus hirtellus	3.67	0.24	0.67	1.94	2.33	0.41
				Laccophilus sp.	7.67	3.35	2.33	3.94	4.67	2.94
				Agabinus sculpterellus	2.30	0.24	5.67	0.35		
				Agabus linellus						
				Agabus approximatus	3.67	0.06	5.33	2.41	4.67	1.94
				Colymbetes sp.						
				Rhantus binotatus	0.33	0.35	1.67	0.41	2.33	3.35
				Hydrotrupes palpalis	5.33	0.94	4.33		3.67	4.94
				Dytiscus marginicollis	2.67		2.67			
			Gyrinidae	Gyrinus punctellus	0.33	0.94				
				Gyrinus consobrinus			0.33	0.06	0.33	
			Hydrophilidae	Helophorus sp.	0.67		0.33		1.30	
				Berosus fraternus	4.67	3.94	7.67	4.06	3.67	2.94
				Tropisternus laterallis	4.33	4.41	4.67	3.35	2.67	1.35
				Tropisternus californicus	5.33	2.24	3.67	2.41	2.33	2.35
				Paracymus subcupresus	4.67	2.24	7.33	2.24	4.33	1.94
				Helochares normatus	1.30	0.35	2.33		0.67	
			Hydraenidae	Hydraena vandykei	0.33	0.35				
				Octhebius holmbergi	0.30					
			Scarabaeidae	Aphodius alternatus	1.33	0.94		0.06		
			Heteroceridae	Microaugyles mundulus						
			Curculionidae	Sp. 1						
				Sp. 2						
		Diptera	Tipulidae	Tipula sp.		0.06				
				Molophilus sp.	0.33		0.33		0.33	
				Ormosia sp.	0.33		0.67		0.67	
			Dixidae	Dixella sp.	0.33	0.35	0.33	0.06	0.33	
			Culicidae	Anopholes freeborni		0.35		0.41		
				Aedes clivus						
				Culex stigmatosoma				1.41		2.94
				Culex tarsalis		2.41		4.41		9.94
				Culex pipiens		2.94	0.33			13.35
				Culiseta inornata						
				Culiseta incidens		0.35				1.06
			Chironomidae	Chironomus sp.	0.33	2.94	0.33	5.41	0.67	14.35
				Corynoneura sp.	16.67	1.65	17.67	1.06	12.33	1.94
			Tabanidae	Tabanus punctifer		0.35				0.06
			Dolichopodidae	Medetera sp. ?	3.67	3.94	5.33	2.94	3.33	2.35
			Scathophagidae	Orthacheata sp.	1.67		2.33		2.67	
Mollusca	Gastropoda		Physidae	Physatella sp.	2.67	3.41	1.33	4.41	2.33	3.35
			Lymnaeidae	Lymnaea sp.	4.33	3.41	2.67	4.06	1.67	2.94
Totals					338.82	165.21	311.26	161.24	213.29	216.95

APPENDIX 1. (Continued.)

					1995 Late Season Sampling Averages					
					Site 1		Site 2		Site 3	
Phylum	Class	Order	Family	Species	Natural	Const.	Natural	Const.	Natural	Const.
Platyhelminthes	Turbellaria			Sp. 1	0.67	0.94	0.67	0.43	0.67	7.23
				Sp. 2						
				Sp. 3						
Nematamorpha				Gordius sp.						
Annelida	Oligocheata			Sp. 1						
Tardigrada			Macrobitidae		0.33		0.33			
Arthropoda	Crustacea	Branchiopoda	Triopsidae	Lepidurus packardi	3.67	2.53				
			Linderiellidae	Linderiella occidentalis	6.33	5.94				
			Branchinectidae	Branchinecta lynchi					0.33	
			Caenistheriidae	Cyzicus californicus	9.67	8.47	17.67	18.41	11.67	0.23
			Macrothicidae	Sp. 1						
				Macrothrix sp.						
			Chydoridae	Alona sp.						
				Oxyurella sp. (?)						
			Daphniidae	Simocephalus sp.	28.33	27.41	27.67	23.57	31.67	0.85
		Copepoda		Sp. 1						
				Sp.2	6.67	8.06	5.67	2.71	7.67	
				Diaptomus sp.	8.33	4.41	9.67	8.28	8.67	
		Ostracoda		Sp.1	18.33	21.41	13.33	13.57	17.67	33.46
				Sp. 2	24.67	34.94	27.67	21.86	26.67	9.92
				Sp. 3						
	Arachnida		Tetragnathidae	Tetragnatha sp.	0.67	0.41	0.33	0.28	0.33	0.23
			Eylaidae	Eylais sp.	0.67					
	Insecta	Collembola	Poduridae	Podurus aquatica						
		Ephemeroptera	Baetidae	Callibaetis sp.	2.67		5.67		4.33	
		Odonata	Coenagrionidae	Coenagrion resolutum	3.67	5.94	2.33	2.71	4.33	4.54
			Libellulidae	Belonia saturata	0.33	6.41	0.33	0.14	1.33	
				Libellula sp.	0.67	0.06	0.33	0.28	0.67	0.15
				Aeshna interrupta nevadaensis	0.33			0.71		1.38
		Hemiptera	Gerridae	Gerris remigis	0.33	0.94	0.33	0.57	0.33	
			Corixidae	Corisella decolor						
				Corisella inscripta						
				Hespercorixa laevigata						
				Hespercorixa vulgaris						
				Siagara vallis	1.67	1.94	2.33	2.41	2.33	0.69
			Notonectidae	Notonecta undulata	0.67	1.41	1.33	1.41	1.33	8.54
				Notonecta unifasciata	2.67	0.94	1.67	1.71	1.67	6.08
				Buenoa scimitra	2.33	0.94	1.67	2.41	1.33	0.15
		Trichoptera	Limnephilidae	Limnephilis aretto	3.33		4.67		5.33	
		Coleoptera	Haliplidae	Apteriliplus parvulus	4.67		4.33		2.67	
				Peltodytes simplex						
				Haliplus gracilus						
			Dytiscidae	Hydroporus hirtellus						
				Laccophilus sp.						
				Agabinus sculpterellus	4.67	3.41	5.33	5.28	3.67	2.08
				Agabus linellus	5.33	3.35	4.67	4.57	6.33	10.08
				Agabus approximatus	8.67	2.06	8.33	5.14	7.67	9.31
				Colymbetes sp.	1.33	0.35	1.33	1.71	2.33	0.62
				Rhantus binotatus	1.33	2.06	1.67	2.71	1.67	0.46
				Hydrotrupes palpalis						
				Dytiscus marginicollis	0.33		0.33		0.67	
			Gyrinidae	Gyrinus punctellus		0.35				
				Gyrinus consobrinus	0.33		0.33			
			Hydrophilidae	Helophorus sp.	0.33	1.41	0.33	1.14	0.67	
				Berosus fraternus						
				Tropisternus laterallis		0.06	1.33	0.43		
				Tropisternus californicus				0.43	0.33	2.38
				Paracymus subcupresus	3.67	3.35	3.33	3.29	4.33	0.23
				Helochares normatus	0.33	0.06		0.57		
			Hydraenidae	Hydraena vandykei						
				Octhebius holmbergi						
			Scarabaeidae	Aphodius alternatus						
			Heteroceridae	Microaugyles mundulus	0.33		0.33		0.33	
			Curculionidae	Sp. 1	0.33		0.33		0.67	
				Sp. 2	0.67		0.67		0.67	
		Diptera	Tipulidae	Tipula sp.						1.08
				Molophilus sp.						
				Ormosia sp.						
			Dixidae	Dixella sp.	0.33	0.06	0.33	0.86	0.67	3.46
			Culicidae	Anopholes freeborni						7.62
				Aedes clivus						
				Culex stigmatosoma						14.69
				Culex tarsalis	0.33	0.94		0.29		29.92
				Culex pipiens	0.33	0.94	0.33		0.33	20.54
				Culiseta inornata						
				Culiseta incidens						
			Chironomidae	Chironomus sp.				0.14		6.46
				Corynoneura sp.	1.67	0.65	1.33	1.57	2.33	
			Tabanidae	Tabanus punctifer						0.92
			Dolichopodidae	Medetera sp. ?						
			Scathophagidae	Orthacheata sp.	1.33	1.41	1.67	1.14	1.67	1.38
Mollusca	Gastropoda		Physidae	Physatella sp.	1.33	1.41	0.67	1.14	1.33	0.46
			Lymnaeidae	Lymnaea sp.						
Totals					164.65	154.97	160.64	131.87	166.67	185.14

APPENDIX 1. (Continued.)

Phylum	Class	Order	Family	Species	1996 Early Season Sampling Averages Site 1 Natural	Site 1 Const.	Site 2 Natural	Site 2 Const.	Site 3 Natural	Site 3 Const.
Platyhelminthes	Turbellaria			Sp. 1	31.33	32.41	27.33	26.11	24.33	11.23
				Sp. 2	11.33	7.41	9.33	8.43	11.33	4.92
				Sp. 3	0.67	0.94	0.67	0.88	0.33	
Nematamorpha				Gordius sp.	0.33	0.06	0.67	0.43		
Annelida	Oligocheata			Sp. 1	0.33	0.06	0.33	0.57		
Tardigrada			Macrobitidae							
Arthropoda	Crustacea	Branchiopoda	Triopsidae	Lepidurus packardi						
			Linderiellidae	Linderiella occidentalis	2.33	3.41	3.33	5.47	2.33	
			Branchinectidae	Branchinecta lynchi	10.33	9.35	7.67	7.12		
			Caenistheriidae	Cyzicus californicus						
			Macrothicidae	Sp. 1	6.00	7.24	4.67	3.57	3.33	
				Macrothrix sp.	9.33	11.41	8.67	8.94	8.67	0.08
			Chydoridae	Alona sp.	3.67	3.35	2.33	2.88	2.67	0.31
				Oxyurella sp. (?)	2.33	1.94	3.67	2.43	1.67	0.15
			Daphniidae	Simocephalus sp.	17.00	18.41	34.67	35.88	29.33	1.15
		Copepoda		Sp. 1	3.67	4.35	7.67	6.94	11.33	
				Sp.2	1.67	0.06	0.67	0.94	2.33	0.92
				Diaptomus sp.	15.67	16.24	18.67	21.43	34.67	1.62
		Ostracoda		Sp.1	10.33	8.94	5.33	3.88	12.33	33.38
				Sp. 2	2.33	2.06	0.67	0.57	4.67	25.15
				Sp. 3		0.41		0.57		
	Arachnida		Tetragnathidae	Tetragnatha sp.						
			Eylaidae	Eylais sp.	2.67	1.41	4.33	3.94	3.67	0.15
	Insecta	Collembola	Poduridae	Podurus aquatica	22.67	31.35	39.33	31.88	23.33	
		Ephemeroptera	Baetidae	Callibaetis sp.						
		Odonata	Coenagrionidae	Coenagrion resolutum						
			Libellulidae	Belonia saturata						
				Libellula sp.						
				Aeshna interrupta nevadaensis						
		Hemiptera	Gerridae	Gerris remigis						
			Corixidae	Corisella decolor	2.67	3.06	6.33	5.94	8.33	5.38
				Corisella inscripta	7.33	4.35	8.33	7.43	8.67	5.61
				Hespercorixa laevigata	4.67	2.94	1.67	1.94	3.67	6.15
				Hespercorixa vulgaris	2.33	3.35	1.33	1.88	3.33	0.15
				Siagara vallis						
			Notonectidae	Notonecta undulata						2.08
				Notonecta unifasciata			0.33	0.88		2.38
				Buenoa scimitra	6.30	5.94	5.33	4.43	4.33	0.92
		Trichoptera	Limnephilidae	Limnephilis aretto						
		Coleoptera	Haliplidae	Apteriliplus parvulus	4.33		11.67		2.33	
				Peltodytes simplex						
				Haliplus gracilus						
			Dytiscidae	Hydroporus hirtellus	2.33	3.06	1.33	1.88	1.33	2.62
				Laccophilus sp.	2.67	3.35	2.67	2.43	2.67	0.07
				Agabinus sculpterellus						
				Agabus linellus						
				Agabus approximatus						
				Colymbetes sp.						
				Rhantus binotatus						
				Hydrotrupes palpalis	6.67	3.35	6.67	7.71	6.67	8.31
				Dytiscus marginicollis	1.33	0.94	0.33	0.43	0.33	
			Gyrinidae	Gyrinus punctellus	0.33					
				Gyrinus consobrinus						
			Hydrophilidae	Helophorus sp.						
				Berosus fraternus	7.33	6.41	6.33	5.71	5.33	6.38
				Tropisternus laterallis	2.33	4.06	4.67	6.88	2.33	7.23
				Tropisternus californicus	0.67	1.41	0.67	0.71	0.33	8.54
				Paracymus subcupresus						
				Helochares normatus						
			Hydraenidae	Hydraena vandykei	0.67	0.06	0.33	0.71	0.67	
				Octhebius holmbergi	1.33	0.06	1.67	0.88		
			Scarabaeidae	Aphodius alternatus	1.67	1.41	0.67	0.43	2.33	0.23
			Heteroceridae	Microaugyles mundulus						
			Curculionidae	Sp. 1						
				Sp. 2						
		Diptera	Tipulidae	Tipula sp.	1.33	0.94	1.33	0.71	0.33	0.38
				Molophilus sp.	1.33	1.06			0.67	0.23
				Ormosia sp.						
			Dixidae	Dixella sp.			0.33	0.71		
			Culicidae	Anopholes freeborni						
				Aedes clivus	0.33	0.94	0.33	0.43	0.33	23.38
				Culex stigmatosoma						
				Culex tarsalis						
				Culex pipiens						
				Culiseta inornata	0.33	1.65	0.33	0.43		29.92
				Culiseta incidens		0.35		0.43		15.23
			Chironomidae	Chironomus sp.		0.06	0.33	0.71	0.33	13.15
				Corynoneura sp.	4.33	1.35	4.67	3.43	4.67	0.92
			Tabanidae	Tabanus punctifer						
			Dolichopodidae	Medetera sp. ?						
			Scathophagidae	Orthacheata sp.						
Mollusca	Gastropoda		Physidae	Physatella sp.	3.33	3.35	2.67	2.43	1.67	3.69
			Lymnaeidae	Lymnaea sp.	4.33	2.94	0.33	1.71	2.33	1.38
Totals					224.27	217.20	250.66	234.12	239.31	223.42

APPENDIX 1. (Continued.)

					1996 Mid Season Sampling Averages					
					Site 1		Site 2		Site 3	
Phylum	Class	Order	Family	Species	Natural	Const.	Natural	Const.	Natural	Const.
Platyhelminthes	Turbellaria			Sp. 1	24.67	23.11	23.33	21.29	18.67	20.54
				Sp. 2	18.33	17.35	17.33	21.48	10.33	3.31
				Sp. 3	0.33	0.41				
Nematamorpha				Gordius sp.				0.14		
Annelida	Oligocheata			Sp. 1						
Tardigrada			Macrobitidae							
Arthropoda	Crustacea	Branchiopoda	Triopsidae	Lepidurus packardi	7.67	6.94				
			Linderiellidae	Linderiella occidentalis	5.33	5.41	6.67	2.57		
			Branchinectidae	Branchinecta lynchi	21.33	22.35	24.33	8.86		
			Caenistheriidae	Cyzicus californicus						
			Macrothicidae	Sp. 1	4.33	3.94	0.33	0.14		
				Macrothrix sp.	5.67	4.11	11.33	10.58	11.33	
			Chydoridae	Alona sp.	4.67	4.35	5.67	4.14	4.67	
				Oxyurella sp. (?)	1.67	1.41	2.67	2.57	1.33	
			Daphniidae	Simocephalus sp.	58.67	57.94	59.67	55.57	44.67	0.85
		Copepoda		Sp. 1	5.33	6.65	5.33	4.14	7.33	
				Sp.2	3.33	3.41	0.33	1.14	3.33	3.31
				Diaptomus sp.	42.67	45.41	64.67	72.71	23.67	0.69
		Ostracoda		Sp.1	4.33	7.35		2.85	8.33	64.15
				Sp. 2	0.33	0.35			1.67	17.69
				Sp. 3	0.33	0.94	3.67	1.57		11.84
	Arachnida		Tetragnathidae	Tetragnatha sp.			0.33	0.14	0.33	0.84
			Eylaidae	Eylais sp.	3.33	2.94	1.33	0.14		
	Insecta	Collembola	Poduridae	Podurus aquatica						
		Ephemeroptera	Baetidae	Callibaetis sp.			0.33	0.14	16.67	
		Odonata	Coenagrionidae	Coenagrion resolutum	0.33	0.41	2.67	2.58	9.67	
			Libellulidae	Belonia saturata			1.33	1.41	4.33	
				Libellula sp.					2.33	
				Aeshna interrupta nevadaensis					0.33	
		Hemiptera	Gerridae	Gerris remigis	0.33		0.33	0.41	0.33	0.23
			Corixidae	Corisella decolor	4.67	6.35	2.33	2.58	4.33	1.31
				Corisella inscripta	2.33	1.24				
				Hespercorixa laevigata	5.33	4.94	6.33	6.85	3.67	4.15
				Hespercorixa vulgaris	3.33	2.94	4.67	4.14	0.33	1.38
				Siagara vallis	1.67	1.41	2.33	2.14	1.33	1.85
			Notonectidae	Notonecta undulata	3.67	2.35	0.67	0.14	4.33	8.38
				Notonecta unifasciata	1.67	1.06	0.67	1.58	3.67	0.92
				Buenoa scimitra	19.33	16.35	17.67	18.14	4.67	2.00
		Trichoptera	Limnephilidae	Limnephilis aretto	3.67		2.67	1.14	3.67	
		Coleoptera	Haliplidae	Apteriliplus parvulus	2.33		3.33		1.33	
				Peltodytes simplex			0.33			
				Haliplus gracilus						
			Dytiscidae	Hydroporus hirtellus	1.67	1.35	1.33	1.85		
				Laccophilus sp.	4.67	4.06	3.33	4.85	0.33	
				Agabinus sculpterellus	3.33	4.41	6.67	4.00	1.33	2.46
				Agabus linellus	1.33	2.35	2.67	4.43	3.67	1.46
				Agabus approximatus		1.41	3.67	2.14	4.67	1.38
				Colymbetes sp.	2.33	0.41	0.33	1.58	2.67	1.62
				Rhantus binotatus	0.33	0.06	2.67	0.58	2.33	0.85
				Hydrotrupes palpalis	4.67	3.94	3.33			
				Dytiscus marginicollis	1.67		2.33		0.33	
			Gyrinidae	Gyrinus punctellus					0.33	
				Gyrinus consobrinus	0.33	0.41	0.33			
			Hydrophilidae	Helophorus sp.	2.67	2.35	0.67			
				Berosus fraternus	3.67	1.41	4.67	4.42	2.33	0.38
				Tropisternus laterallis	1.33	0.94	3.67	3.14	1.67	0.92
				Tropisternus californicus	1.33	0.35	3.67	2.42	1.67	0.77
				Paracymus subcupresus	2.33	1.94	8.33	2.85	5.67	
				Helochares normatus	0.33	0.35	1.33	0.41	0.67	
			Hydraenidae	Hydraena vandykei	0.67	0.35	0.33	0.41	0.33	
				Octhebius holmbergi						
			Scarabaeidae	Aphodius alternatus			1.33			
			Heteroceridae	Microaugyles mundulus						
			Curculionidae	Sp. 1						
				Sp. 2						
		Diptera	Tipulidae	Tipula sp.	0.33	0.35	0.33	0.41		1.38
				Molophilus sp.	0.67		0.67		0.33	0.92
				Ormosia sp.	0.33	0.41	0.33	0.41	0.67	0.08
			Dixidae	Dixella sp.	0.67	1.35	0.33	1.29		1.31
			Culicidae	Anopholes freeborni						0.85
				Aedes clivus						
				Culex stigmatosoma						6.85
				Culex tarsalis	0.33	0.41		0.41	0.33	34.38
				Culex pipiens		0.06	0.33			25.31
				Culiseta inornata						
				Culiseta incidens						
			Chironomidae	Chironomus sp.	0.33	0.41	0.33	0.41	0.67	23.00
				Corynoneura sp.	21.33	19.41	18.33	11.57	14.33	0.38
			Tabanidae	Tabanus punctifer						0.84
			Dolichopodidae	Medetera sp. ?	4.33	3.94	4.67	4.28	2.33	0.31
			Scathophagidae	Orthacheata sp.	1.67	2.35	2.33	2.41	4.67	2.92
Mollusca	Gastropoda		Physidae	Physatella sp.	2.33	3.94	1.33	1.57	4.33	4.85
			Lymnaeidae	Lymnaea sp.	4.67	2.41	1.67	1.86	2.33	2.38
Totals					330.63	312.55	353.96	308.99	254.64	259.04

APPENDIX 1. (Concluded.)

					1996 Late Season Sampling Averages					
					Site 1		Site 2		Site 3	
Phylum	Class	Order	Family	Species	Natural	Const.	Natural	Const.	Natural	Const.
Platyhelminthes	Turbellaria			Sp. 1	3.67	3.94	0.67	0.86	1.67	6.08
				Sp. 2			0.33		0.33	2.62
				Sp. 3						
Nematamorpha				Gordius sp.						
Annelida	Oligocheata			Sp. 1						
Tardigrada			Macrobitidae						0.33	
Arthropoda	Crustacea	Branchiopoda	Triopsidae	Lepidurus packardi	15.33	14.35				
			Linderiellidae	Linderiella occidentalis						
			Branchinectidae	Branchinecta lynchi						
			Caenistheriidae	Cyzicus californicus	28.67	29.94	24.33	23.43	34.33	0.08
			Macrothicidae	Sp. 1	3.33	2.52				
				Macrothrix sp.	1.33	1.41				
			Chydoridae	Alona sp.						
				Oxyurella sp. (?)						
			Daphniidae	Simocephalus sp.	46.67	16.53	56.33	54.86	54.67	0.31
		Copepoda		Sp. 1	0.33	0.41				
				Sp.2			6.67	4.00	3.67	
				Diaptomus sp.	12.67	12.35	11.67	10.43	17.33	
		Ostracoda		Sp.1	15.67	13.35	12.33	13.29	17.67	13.69
				Sp. 2	13.33	13.52	27.67	35.29	22.33	9.31
				Sp. 3						
	Arachnida		Tetragnathidae	Tetragnatha sp.	0.67	0.41	0.33	0.43	0.33	0.69
			Eylaidae	Eylais sp.						
	Insecta	Collembola	Poduridae	Podurus aquatica						
		Ephemeroptera	Baetidae	Callibaetis sp.	4.67	2.18	7.67		3.67	
		Odonata	Coenagrionidae	Coenagrion resolutum	3.67	2.76	6.67	7.71	5.33	0.31
			Libellulidae	Belonia saturata	1.33	1.59	0.33	0.14	6.67	
				Libellula sp.	0.67	0.41	0.67	0.86	0.67	0.69
				Aeshna interrupta nevadaensis			0.67	0.71	0.67	
		Hemiptera	Gerridae	Gerris remigis	0.67	0.94	0.33	0.43	0.33	
			Corixidae	Corisella decolor						
				Corisella inscripta						
				Hespercorixa laevigata	2.33	2.94	1.33	0.14		
				Hespercorixa vulgaris	2.67	3.41	0.33	0.14		
				Siagara vallis	5.67	1.94	3.33	2.43	4.33	2.62
			Notonectidae	Notonecta undulata	4.67	4.41	4.67	3.71	8.33	6.69
				Notonecta unifasciata	3.67	4.35	3.67	3.85	6.67	14.92
				Buenoa scimitra	4.33	3.94	6.33	5.71	1.33	0.31
		Trichoptera	Limnephilidae	Limnephilis aretto	4.33	4.94	4.67	4.14	2.33	
		Coleoptera	Haliplidae	Apteriliplus parvulus	1.33				1.33	
				Peltodytes simplex						
				Haliplus gracilus						
			Dytiscidae	Hydroporus hirtellus						
				Laccophilus sp.						
				Agabinus sculpterellus	6.67	5.94	7.33	7.29	4.67	7.23
				Agabus linellus	5.67	4.35	4.67	3.86	9.67	4.92
				Agabus approximatus	8.67	9.35	5.67	5.14	6.33	3.54
				Colymbetes sp.	2.33	1.29	2.33	1.86	3.33	5.69
				Rhantus binotatus	1.33	2.47	2.67	2.14	4.33	6.85
				Hydrotrupes palpalis						
				Dytiscus marginicollis			0.33	0.29	0.67	
			Gyrinidae	Gyrinus punctellus	0.33	0.35			0.67	
				Gyrinus consobrinus						0.31
			Hydrophilidae	Helophorus sp.			0.33	0.29		
				Berosus fraternus		0.41				
				Tropisternus lateralis		0.41		0.14		
				Tropisternus californicus	1.33				0.33	1.92
				Paracymus subcupresus	6.67	6.94	4.67	3.14	5.33	0.53
				Helochares normatus	0.33	0.06				
			Hydraenidae	Hydraena vandykei	0.33			0.14		
				Octhebius holmbergi	0.33					
			Scarabaeidae	Aphodius alternatus						
			Heteroceridae	Microaugyles mundulus	0.67	0.41	0.67	0.14	0.33	
			Curculionidae	Sp. 1	0.33	0.28	0.33	0.14	0.67	
				Sp. 2	0.67	0.94	0.67	0.14	0.67	
		Diptera	Tipulidae	Tipula sp.						1.23
				Molophilus sp.						
				Ormosia sp.	0.33	0.53	0.67	0.43	0.33	0.69
			Dixidae	Dixella sp.	0.67	0.06	0.67	0.86	1.67	1.08
			Culicidae	Anopholes freeborni						10.54
				Aedes clivus						
				Culex stigmatosoma						72.15
				Culex tarsalis	0.33	0.94		0.43		112.85
				Culex pipiens	0.33	0.94	0.33	0.14	0.33	137.23
				Culiseta inornata						
				Culiseta incidens						
			Chironomidae	Chironomus sp.	0.33	1.53		0.14	0.33	15.46
				Corynoneura sp.	6.67	0.65	2.67	3.29	4.33	0.38
			Tabanidae	Tabanus punctifer		0.06				1.31
			Dolichopodidae	Medetera sp. ?			2.33	2.71		0.92
			Scathophagidae	Orthacheata sp.			1.67	1.86	1.67	1.62
Mollusca	Gastropoda		Physidae	Physatella sp.	1.33	1.41	0.67	0.14	0.33	0.46
			Lymnaeidae	Lymnaea sp.					0.33	
Totals					227.33	181.86	219.68	207.26	240.64	445.23