DRAFT REPORT

Macroinvertebrate and Zooplankton Communities of the Willard Spur Wetlands: Results of 2013 Sampling

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1. Summary

The results of macroinvertebrate and zooplankton sampling in the Willard Spur in 2013 are described. This third year of sampling emphasized a subset of the open-water, mid-channel sites that were sampled in previous years. Samples collected in 2013 were taken each month between March and November, except in August and September when low water to completely dry conditions were present. Low water levels affected the condition and abundance of submerged vegetation by mid-summer, which in turn affected the macroinvertebrate and zooplankton communities present.

The composition of the macroinvertebrate communities in 2013 was similar to that found in 2012, and overall diversity was ~~was~~ the same as that found in 2012 at the three sampling sites. From March through May, midges (Chironomidae) were the dominant taxon. As the aquatic vegetation developed in June and July, phytophilous macroinvertebrates increased in abundance, and the communities became more diverse. Few individuals were collected in October and November when water levels increased sufficiently to allow sampling. Abundance of macroinvertebrates was similar in 2013 compared to 2012 for the sampling period as whole, but seasonal differences were present. Sample counts were higher in spring 2013 compared to spring 2012, but fewer individuals were present in fall 2013 compared to fall 2012. As in 2012, key metrics (percentage of PMI taxa and Simpson's Index) increased from spring to summer and then declined rapidly by fall. Overall, the macroinvertebrate communities in the Willard Spur demonstrated a high degree of resiliency after the low water conditions in 2012.

Zooplankton community composition in the Willard Spur in 2013 was similar to that present in 2012. Diversity was slightly less than previous years, although the reduced sampling effort likely contributed to the lower number of species. As in previous years, copepods dominated in early spring and fall, whereas cladocerans dominated as the submerged vegetation developed.

2. Introduction & General Methods

This report summarizes the results of 2013 sampling of the macroinvertebrate and zooplankton communities present in the Willard Spur wetlands as part of the development of water quality standards pursuant to the operation of the newly-constructed Perry/Willard Regional Wastewater Treatment Plant. The status of the macroinvertebrate community is given in the first section, and the final section describes the composition and seasonal changes in the zooplankton community.

Sampling was conducted at 4 sites: Inside the Willard Bay Tailrace (STORET 5984643), WS-3 (5984670), WS-6 (5984700), and WS-8 (5984720). Sampling began in late March 2013 and continued monthly through November. Samples typically were collected the third week of each month. In August, only the Tailrace site was sampled; none of the main channel sites could be sampled in August and September due to low water levels. Habitat conditions in the Willard Spur during the 2013 sampling period were similar to conditions in 2012 due to below-normal spring runoff, resulting in rapidly declining water levels and decreasing stands of submerged aquatic vegetation by mid-summer.

Macroinvertebrate and zooplankton samples were collected from the Willard Spur by Utah Division of Water Quality personnel. Macroinvertebrates were collected with a D-net sampler (0.5-mm mesh) according to the DWQ SOP. Zooplankton were collected with a tow net (0.25-mm mesh) according to DWQ SOP. Samples were preserved in the field in ethanol. Processing of samples followed DWQ SOPs. Data collected for macroinvertebrates included counts of individuals by taxon, biomass, and derived community metrics (Simpson's Index and %PMI; Gray 2011, 2012). Zooplankton data included counts of individual taxa that were used to determine percentage composition of the community.

Occasional references are made to the results of other DWQ studies at impounded wetlands along the Great Salt Lake in previous years (e.g., Gray 2009-2011). Macroinvertebrate and zooplankton samples from those studies were collected and processed using the same DWQ SOPs as the Willard Spur samples.

3. Macroinvertebrates

Community Composition and Abundance

The list of macroinvertebrate taxa collected at all sites in the Willard Spur during 2013 is given in Table 3.1. Except for the corixid *Sigara*, all of the taxa present in 2013 in the Willard Spur had been collected in previous years. *Sigara* was present only as a single individual; this corixid has been recorded from other wetlands in the Bear River drainage (unpublished data from 2012 DWQ impounded wetlands survey). At the three main channel sites sampled in 2013, 21 taxa were recorded during the entire sampling period. This total compares with the 19 taxa found at these sites in 2012. The only common taxon not collected in 2013 was the snail *Gyraulus*. The tailrace site continued to have low diversity with only 6 taxa present in 2013 (5 taxa were present in 2012).

Overall community composition for the entire sampling period at the main channel sites is given in Figure 3.1a. Chironomids (mainly *Chironomus* and Tanypodinae) comprised nearly three-fourths of all macroinvertebrates collected. Compared to the community present in 2012 at main channel sites (Gray 2013), chironomids comprised a greater proportion of the community with relatively fewer snails and corixids. Seasonally, spring samples showed the typical dominance by chironomids (Figure 3.1b). In June and July, the community was more diverse with chironomids, corixids, and mayflies in about equal relative abundance (Figure 3.1c). Corixids and chironomids comprised the relatively few individuals collected in October and November. As in 2012, the tailrace community was almost entirely composed of chironomids in relatively small numbers.

At sites WS-3 and WS-6 in June, mayflies and corixids were dominant due to early recruitment. In July, odonates (mainly damselflies) and amphipods increased in relative abundance. At these two sites, the overall composition and pattern of change in the macroinvertebrate communities were similar to those observed in 2012. At site WS-8, the more rapid decline in water levels and poor growth and condition of the SAV resulted in less recruitment of odonates and mayflies and a continued dominance by chironomids through June and July.

The overall abundance of macroinvertebrates was lower in 2013 than in 2012. Mean counts per sample (ln-transformed) at the main channel sites for the entire sampling period were 478 individuals/sample in 2013 vs. 986 individuals/sample in 2012. This difference was due to lower densities in late summer-fall samples in 2013 as water levels declined earlier than in 2012. Sample counts were higher in spring in 2013 compared to 2012 and resulted from greater numbers of Tanypodinae chironomids (perhaps due to less "flushing" of detritus and organisms during the 2013 spring runoff; see Gray 2012). Sample counts in June and July were the same in both years (Fig. 3.2).

Snail populations also showed significant change in 2013 compared to 2012. *Gyraulus* was abundant at site WS-3 and common at site WS-6 during summer 2012, but it was absent in 2013. *Physa* snails also were more abundant all three main channel sites in summer 2012 compared to 2013. The reduced numbers of snails in 2013 likely resulted from the lack of recruitment. Snails in the Willard Spur were found to have an initial peak in reproduction in July; recruitment from peripheral sites occurred first and contributed individuals to the mid-channel sites (Gray 2013). The more rapid decline in water levels in 2013 likely reduced this recruitment, resulting in lower numbers of snails in mid-channel.

Macroinvertebrate Community Metrics

The proportion of individuals comprised of phytophilous macroinvertebrates (%PMI) and Simpson's Index (SI) have been useful in describing changes in macroinvertebrate communities, particularly in relation to changes in habitats relative to the condition and quantity of submerged aquatic vegetation (Gray 2013). The discussion below emphasizes trends in these metrics for the 2013 samples at the main channel sites.

Field observations indicated that filamentous algae quickly increased in abundance in May at all of the main Spur sites (WS-3, 6, & 8). Although some growth of SAV occurred in June, by July it was being overgrown by algae at sites WS-3 and WS-6 and was highly degraded at WS-8.

Values of the %PMI and SI metrics at the open-water sites followed a general trend observed in 2012 (Figs. 3.3 and 3.4). Both metrics increased from spring through mid-summer as the SAV developed and a more diverse community became present, and both metrics then decreased as water levels dropped and the SAV senesced during late summer and fall. For the %PMI metric, the overall higher values in June 2013 compared to June 2012 were the result of higher densities of the corixid *Hesperocorixa.* At site WS-8, the more rapid decline in water levels and poor growth and condition of the SAV resulted in less recruitment of PMI taxa (particularly odonates and mayflies) and a continued dominance by chironomids through June and July (Figs. 3.5 and 3.6).

4. Zooplankton Communities

A list of taxa, distributions, and peak abundance for zooplankters collected in the Willard Spur is given in Table 4.1. The zooplankton communities in the Willard Spur in 2013 were similar in composition to the communities found in 2012 (Fig 4.1). At the main channel sites, *Daphnia* was the most common cladoceran during the spring runoff inflows from March through May. As the SAV developed in June at sites WS-3 and WS-6, the two cladocerans associated with aquatic vegetation, *Simocephalus* and *Scaphaloberis*, became dominant along with typical chydorids (e.g., *Chydorus*, *Pleuroxus*; Figs. 4.2 and 4.3). This composition continued into July at site WS-6. Although *Scaphaloberis* was present at site WS-3 in July, the overall composition of the cladoceran community reflected large numbers of *Moina.* Although *Moina* typically is associated with highly degraded conditions (similar to what occurred in the upper Spur in autumn 2012), its high numbers at WS-3 in July was more likely the result of individuals drifting in from the tailrace rather than a significant decline in habitat conditions (more than 5,000 *Moina* were collected in the July sample from the Tailrace site compared to a sample count of 200 *Moina* at WS-3) . Zooplankton at site WS-8 during June and July were mostly chydorids and *Macrothrix* (a benthic detritivore), reflecting the low water levels and poor growth of SAV. *Bosmina* dominated the cladoceran community at all of the main channel sites during the fall months. *Bosmina* typically is uncommon in the freshwater GSL wetlands, but it can be abundant in in the Great Salt Lake proper (Wurtsbaugh and Marcarelli 2004).

As in previous years, *Eucyclops* and *Diacyclops* copepods were common to abundant throughout the main Spur sites during the sampling period. Rotifers were rare except in the fall samples, and diaptomid copepods were rare.

5. Literature Cited

Gray, L. J. 2009. Macroinvertebrates of the wetlands of the Great Salt Lake: 2007. Report to the Utah Department of Environmental Quality, Division of Water Quality.

Gray, L. J. 2010. Macroinvertebrate and Zooplankton Communities in the Impounded Wetlands of the Great Salt Lake: November 2009. Report to the Utah Department of Environmental Quality, Division of Water Quality.

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Gray, L. J. 2012. Macroinvertebrates of the Willard Spur Wetlands: Literature Review and Results of Sampling in 2011. Prepared for the Willard Spur Steering Committee and Science Panel and the Utah Department of Environmental Quality, Division of Water Quality, Salt Lake City, Utah. (30 September 2012)

Gray, L. J. 2013. Macroinvertebrate and Zooplankton Communities of the Willard Spur Wetlands: Results of 2012 Sampling. Prepared for the Willard Spur Steering Committee and Science Panel and the Utah Department of Environmental Quality, Division of Water Quality, Salt Lake City, Utah. (28 February 2013)

Wurtsbaugh, W., and A. M. Marcarelli. 2004. Phytoplankton and Zooplankton in Farmington Bay and the Great Salt Lake, Utah (2003). Report to Central Davis Sewer Improvement District, Kaysville, UT.

Table 3.1. List of macroinvertebrate taxa collected in the Willard Spur, 2013. Feeding Groups: gatherer-collector (GC), scraper (SC), shredder (SH), and predator (PR)

1. Aquatic Insects: Order	**Family**	**Genus**	**Species**	**Feeding Group**
Ephemeroptera	Baetidae	*Callibaetis*	sp.	GC
Ephemeroptera	Caenidae	*Caenis*	*amica*	GC
Trichoptera	Leptoceridae	*Ylodes*	sp.	SH
Odonata	Coenagrionidae	*Ischnura* (+ *Enallagma*)	spp.	PR
Odonata	Libellulidae	*Erythemis*	sp.	PR
Hemiptera	Corixidae	*Corisella*	spp.	PR
Hemiptera	Corixidae	*Hesperocorixa*	sp.	PR
Hemiptera	Corixidae	*Sigara*	sp.	PR
Hemiptera	Notonectidae	*Notonecta*	sp.	PR
Diptera	Ephydridae	*Ephydra*	sp.	GC
Diptera	Chironomidae	*Chironomus*	sp.	GC
Diptera	Chironomidae	tribe Tanytarsini	sp.	GC
Diptera	Chironomidae	subfamily Tanypodinae	sp.	PR
Diptera	Chironomidae	subfamily Orthocladiinae	sp.	GC
Coleoptera	Dytiscidae	(early instar larvae)	sp.	PR
Coleoptera	Dytiscidae	*Stictotarsus*	sp.	PR
Coleoptera	Hydrophilidae	*Enochrus*	sp.	CG
Coleoptera	Hydrophilidae	*Tropisternus*	sp.	CG
Coleoptera	Chrysomelidae	(undetermined)	sp.	SH
Other Invertebrates				
2. Crustacea: Amphipoda	Hyalellidae	*Hyalella*	*azteca*	GC
3. Mollusca: Gastropoda	Physidae	*Physa (Physella)*	sp.	SC
4. Annelida (Oligochaeta)	Naididae	(undetermined)	sp.	GC

Table 4.1. Species of zooplankton collected in the Willard Spur, 2013. Occurrence refers distribution of the species, either by sampling site or throughout the Spur (i.e., "widespread"). Common/uncommon/rare designations based on relative abundance in samples. "Peak" refers to the sampling period of greatest relative abundance at main channel sites.

Cladocera			
Family	**Species**	**2013 Occurrence**	**2013 Peak**
Daphniidae	*Daphnia dentifera* (Sars)	widespread; common	Apr-May
Daphniidae	*Simocephalus vetulus* (O.F.M.)	widespread; common	June
Daphniidae	*Scapholeberis* sp.	widespread; common	July
Daphniidae	*Ceriodaphnia quadrangula* (O.F.M.)	widespread; rare	June
Chydoridae	*Pleuroxus aduncus* (Jurine)	widespread; common	Jun-Jul
Chydoridae	*Alona* sp.	WS-3 only; common	June
Chydoridae	*Chydorus sphaericus* (O.F.M.)	mainly WS-3; common	June
Chydoridae	*Leydigia* sp.	WS-6 only; rare	July
Moinidae	*Moina macrocarpa* Straus	widespread; common	July
Bosminidae	*Bosmina longirostris* (O.F.M.)	widespread; common	Oct
Macrothricidae	*Macrothrix rosea* (Jurine)	widespread; common	July
Copepoda			
Family	**Species**		
Cyclopidae	*Eucyclops agilis (Koch)*	widespread; common	April
Cyclopidae	*Diacyclops thomasi (Forbes)*	widespread; common	July
Diaptomidae	*Leptodiaptomus connexus Light*	widespread; rare	Nov
Rotifera			
Family	**Species**		
Asplanchnidae	*Asplanchna sp.*	widespread; uncommon	Nov
Brachionidae	*Brachionus plicatilis* (O.F.M.)	widespread; common	Nov

Figure 3.1a. Composition of the macroinvertebrate community in the Willard Spur, March-November 2013 (combined data from sites WS-3, WS-6, and WS-8 for entire sampling period).

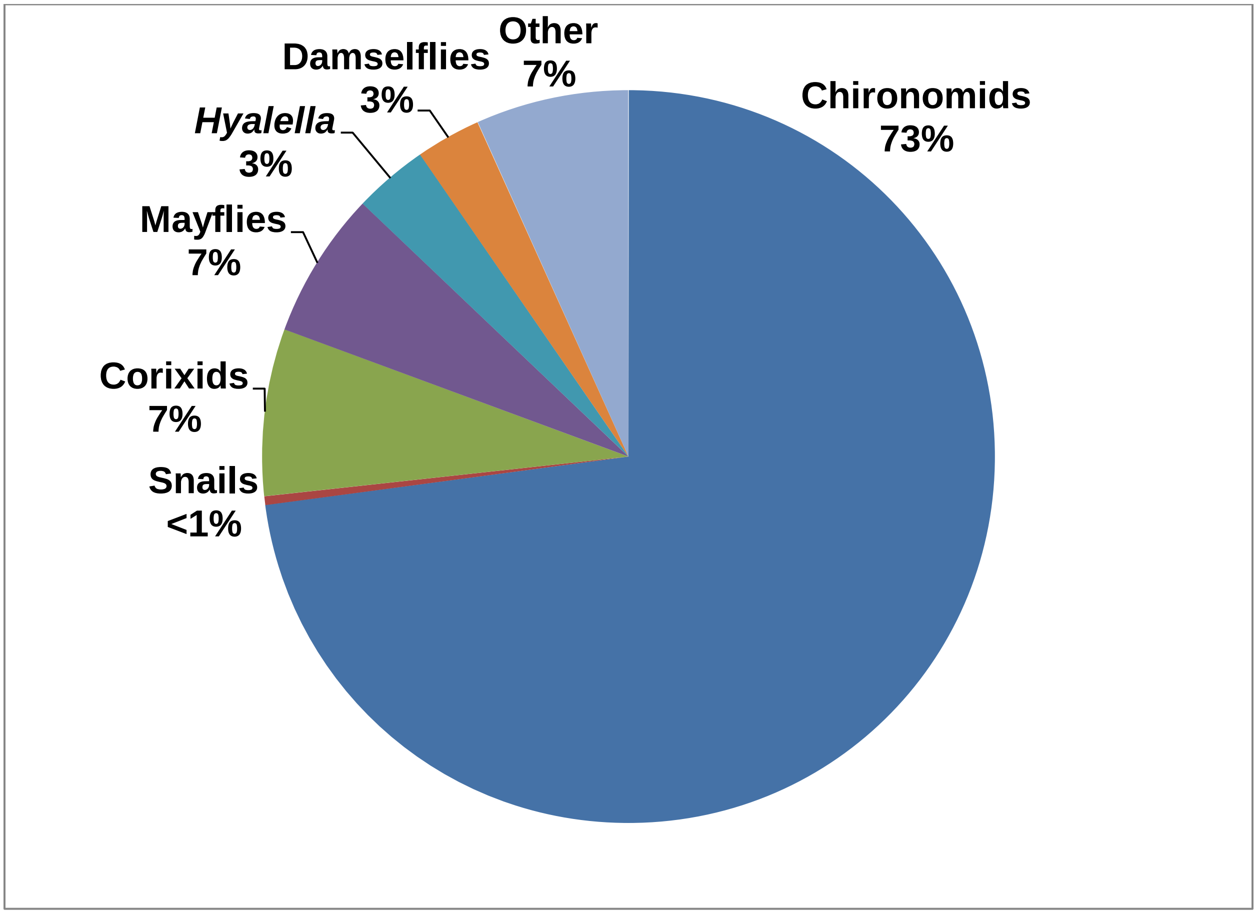

Figure 3.1b. Composition of the macroinvertebrate community in the Willard Spur, March-May 2013 (combined data from sites WS-3, WS-6, and WS-8).

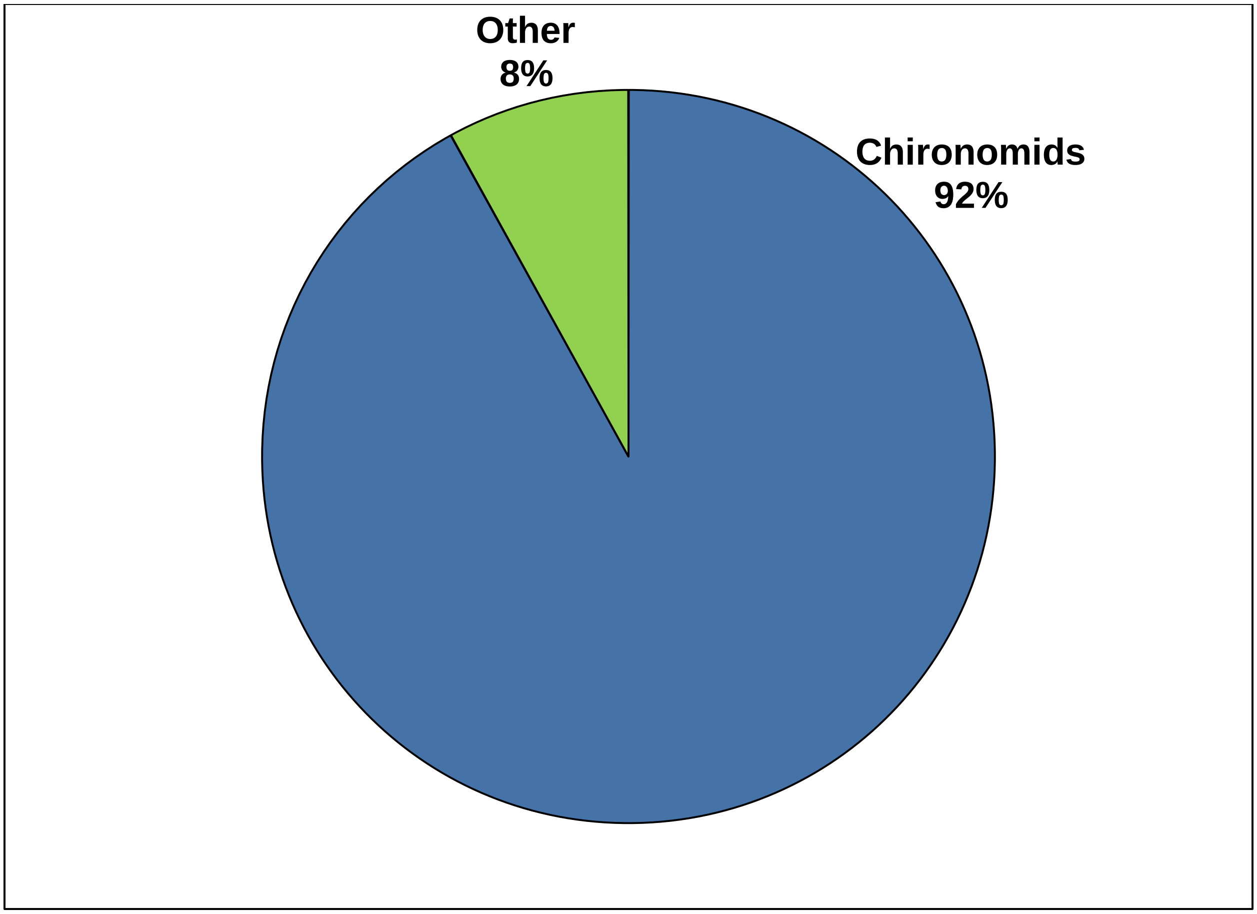

Figure 3.1c. Composition of the macroinvertebrate community in the Willard Spur, June-July 2013 (combined data from sites WS-3, WS-6, and WS-8).

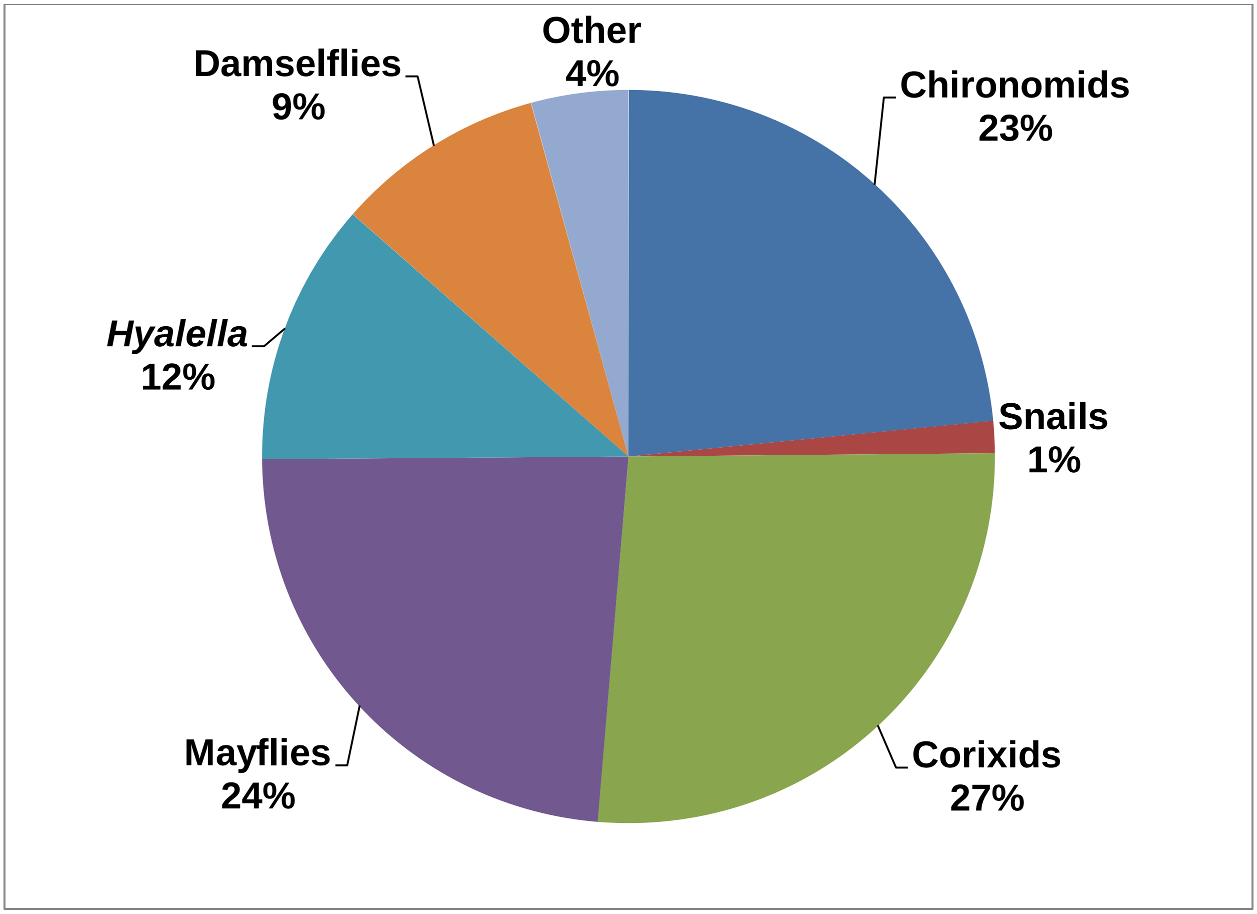

Figure 3.2. Seasonal abundance of macroinvertebrates in the Willard Spur, 2012 and 2013 (combined data from sites WS-3, WS-6, and WS-8; means of ln-tranformed counts).

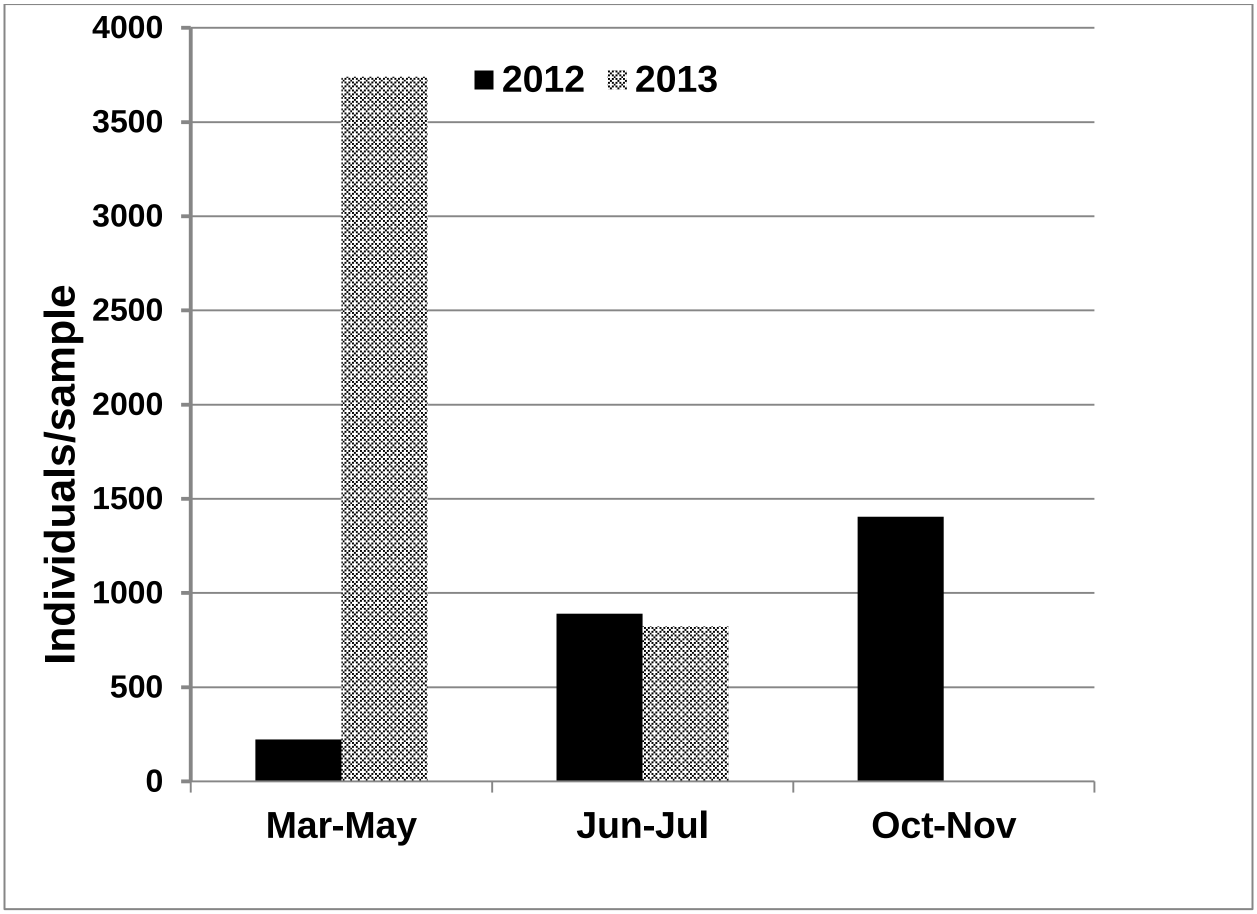

Figure 3.3. Values of the %PMI metric in the Willard Spur, March-November 2013 (means of values from sites WS-3, WS-6, and WS-8 on each date).

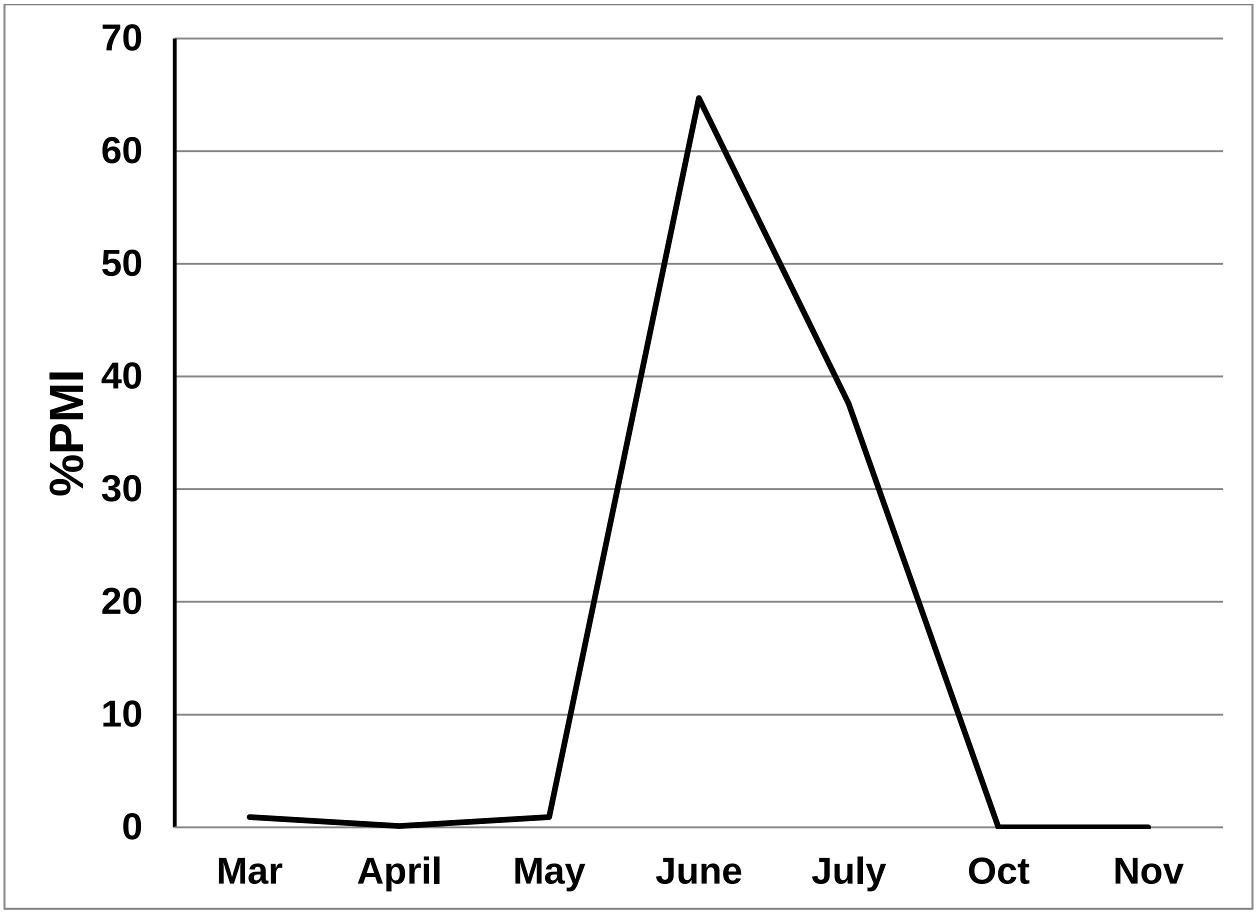

Figure 3.4. Values of the Simpson's Index metric in the Willard Spur, March-November 2013 (means of values from sites WS-3, WS-6, and WS-8 on each date).

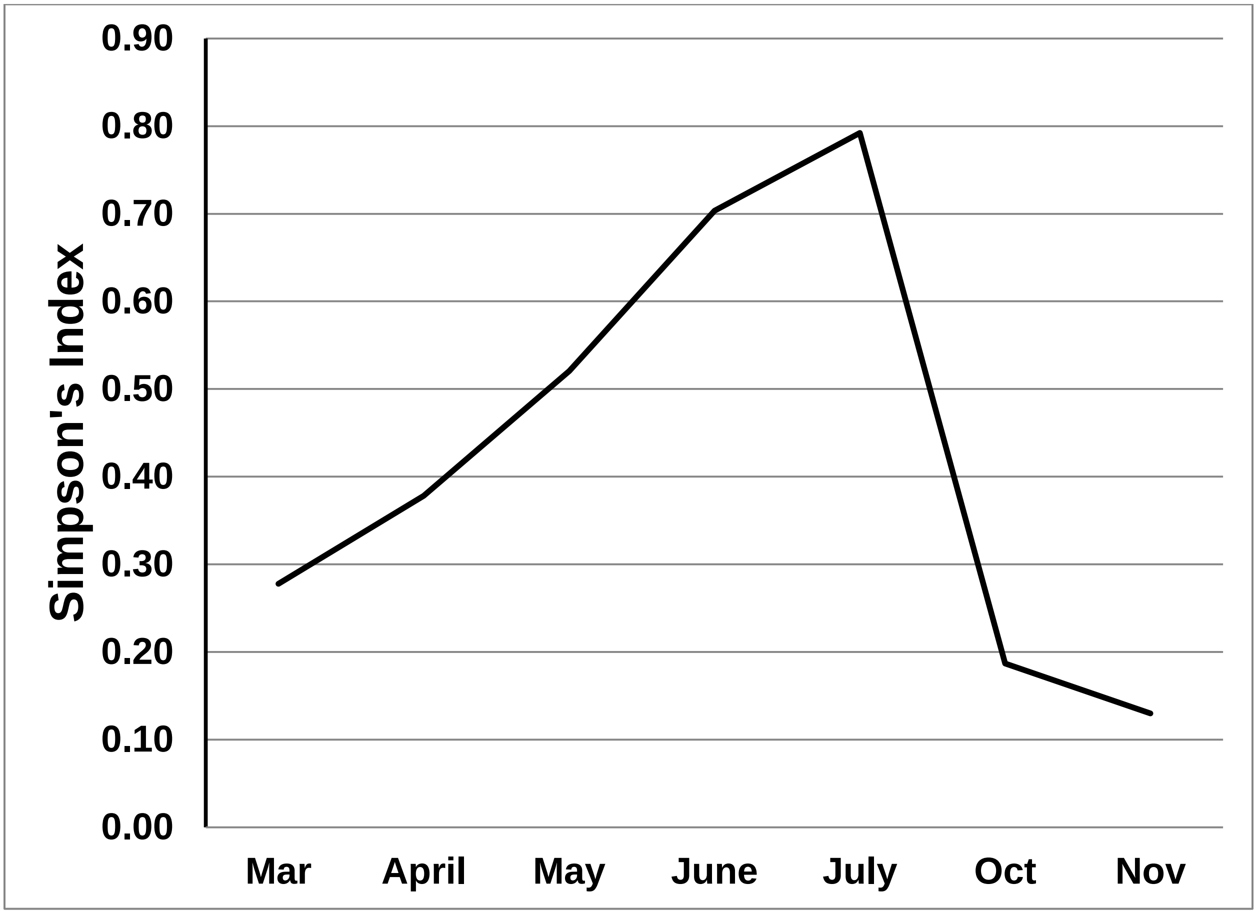

Figure 3.5. Values of the %PMI metric at each site by date in the Willard Spur, 2013.

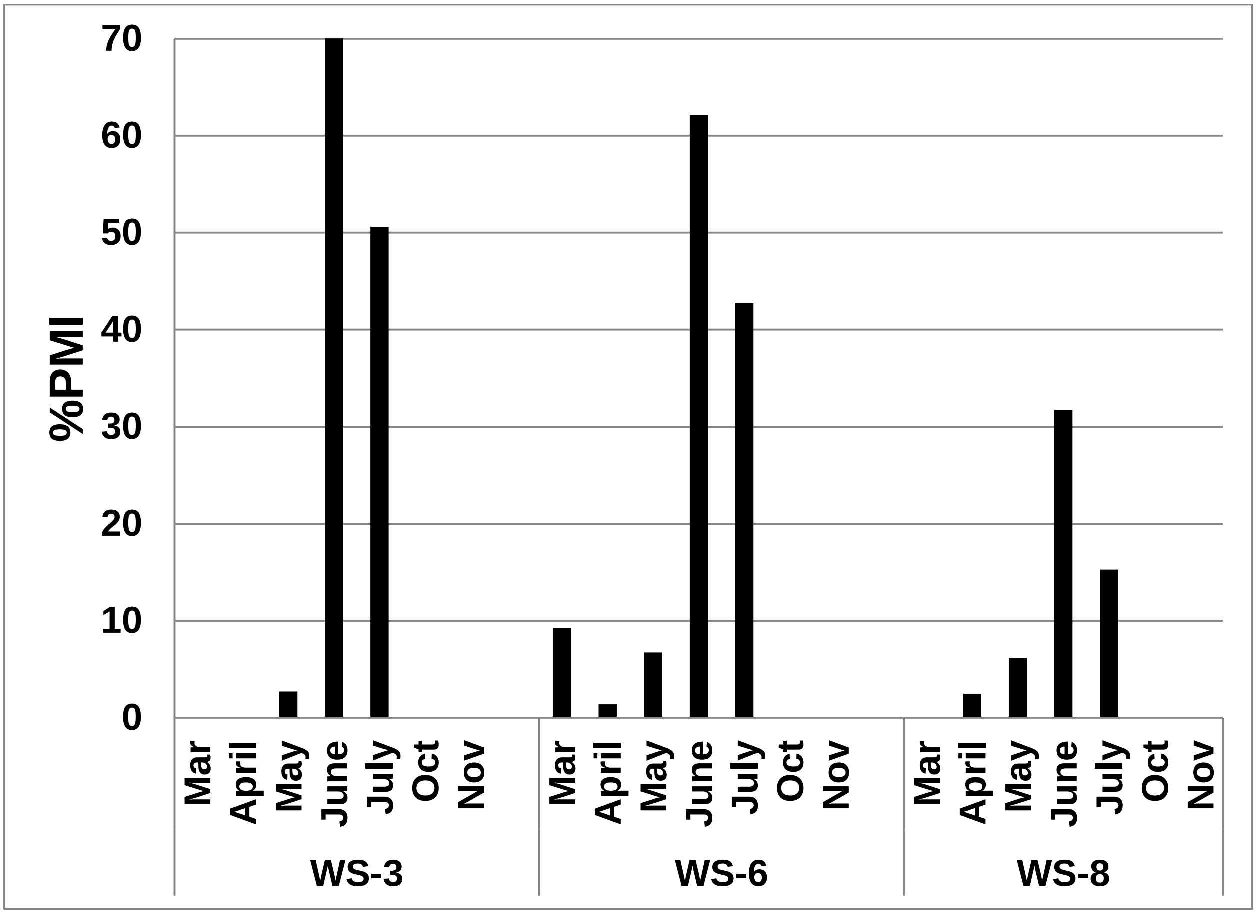

Figure 3.6. Values of the Simpson's Index metric at each site by date in the Willard Spur, 2013. (Note: Too few individuals were collected at WS-3 in October and November to calculate a valid value of the metric. Samples from WS-8 in October and November had no individuals present.)

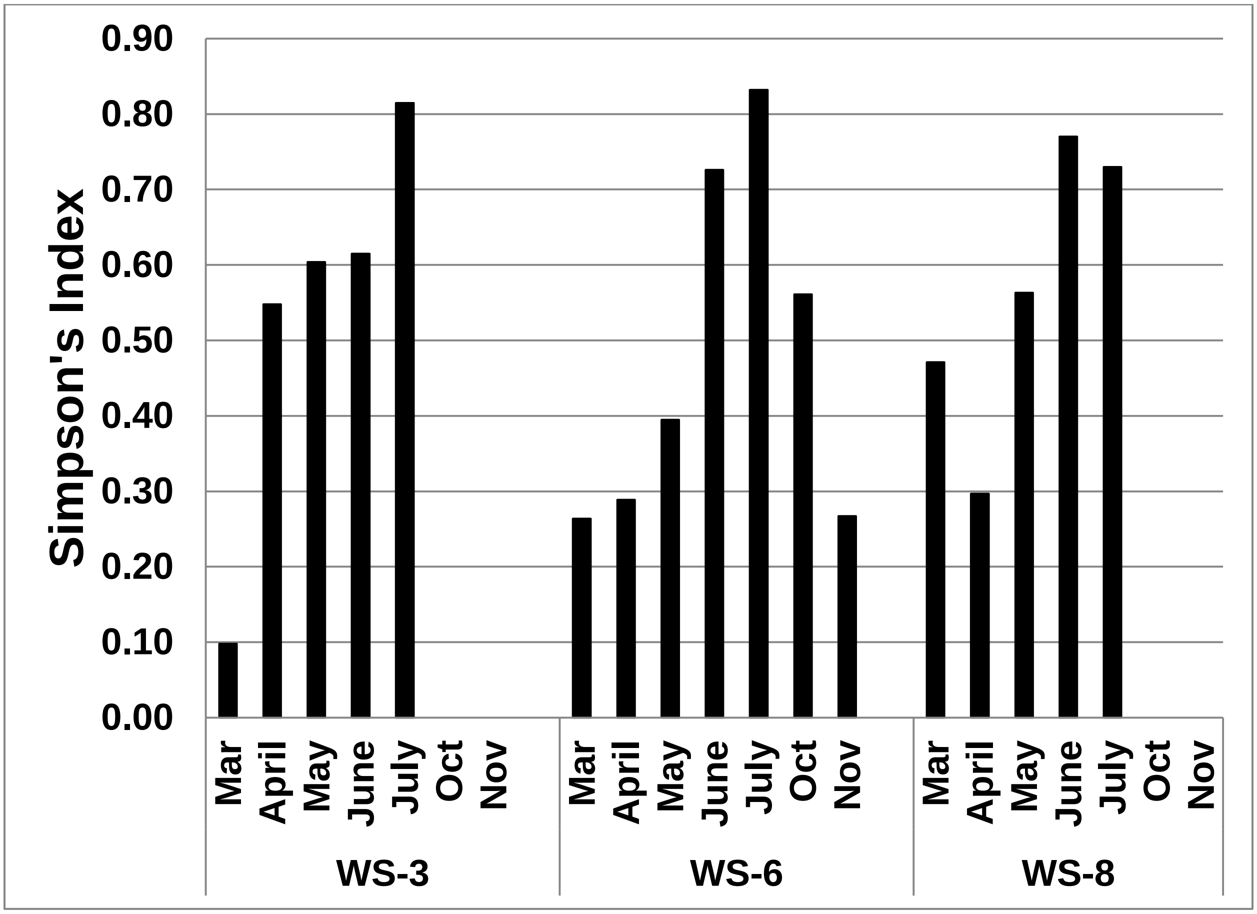

Figure 4.1. Composition of the zooplankton community in the Willard Spur, March-November 2013 (combined data from sites WS-3, WS-6, and WS-8). "Annual" refers to an overall percentage based on total counts for the entire sampling period.

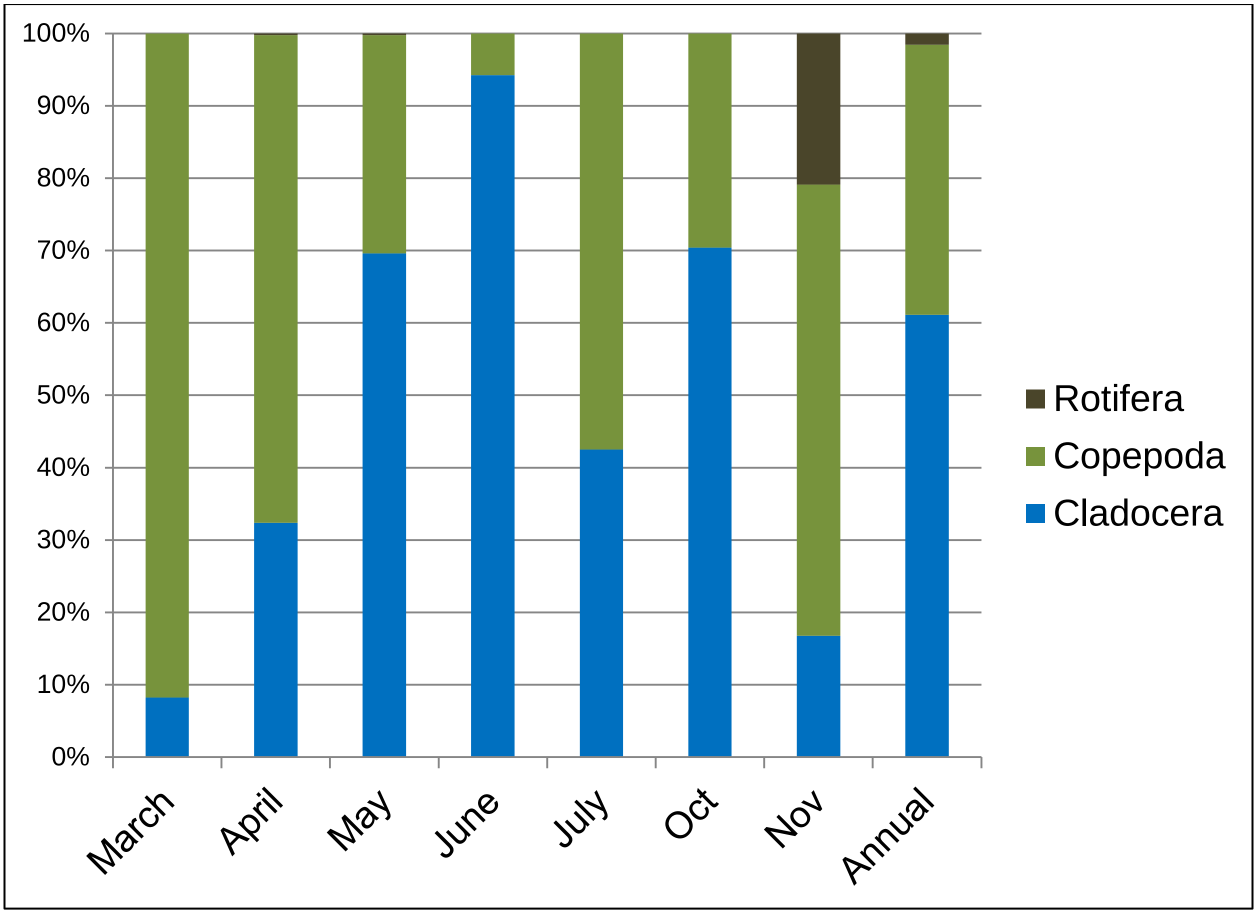

Figure 4.2. Composition of Cladocera in the Willard Spur, March-November 2013 (combined data from sites WS-3, WS-6, and WS-8).

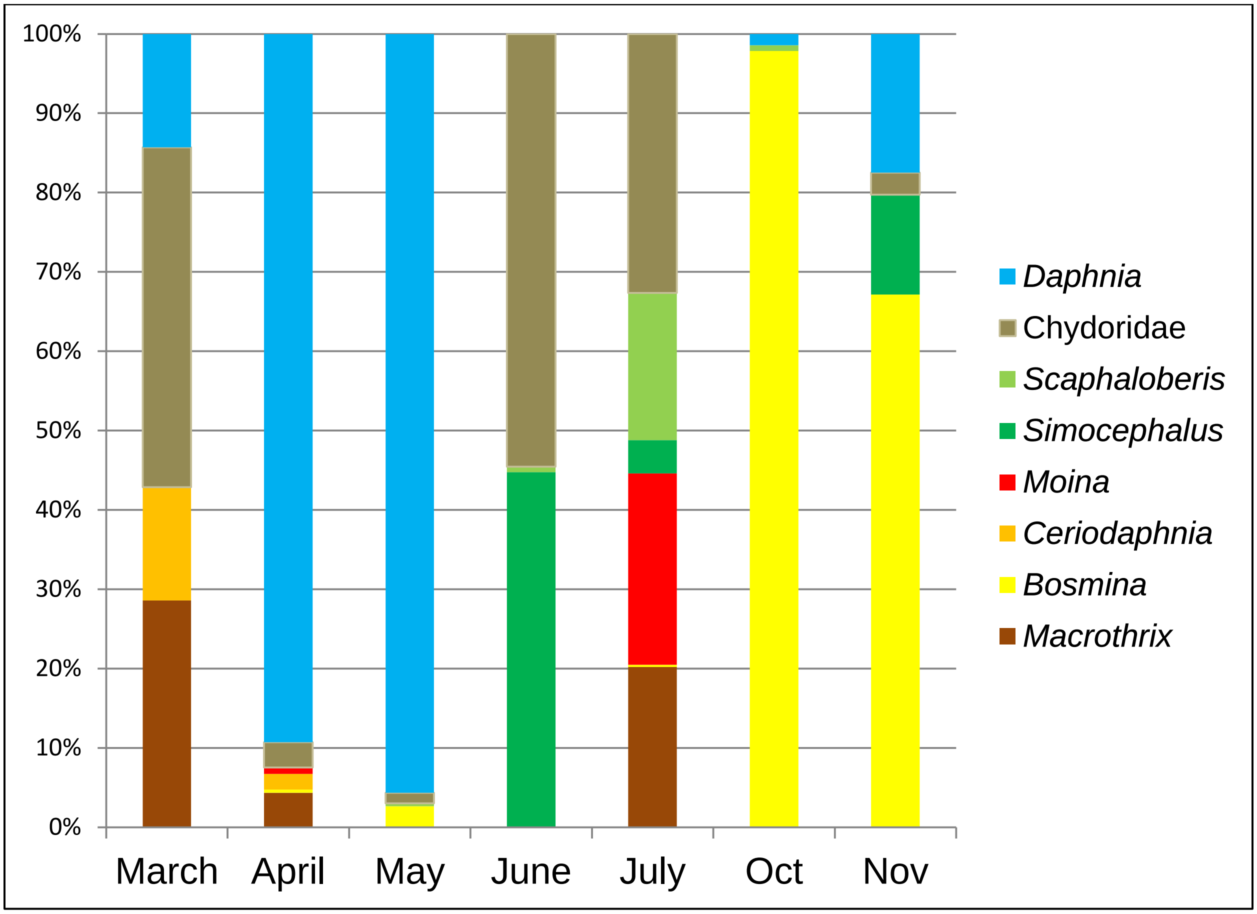

Figure 4.3. Composition of Cladocera at individual sampling sites in the Willard Spur, March-November 2013.