Como Lake Macroinvertebrate Survey, May – September 2007
Final Report

Activity trap before submersion

Submerged activity trap

submitted 17 June 2009 to
The Capital Regions Watershed District
By Joan McKearnan

Introduction

Como Lake is a hypereutrophic 29-ha lake in the Capitol Regions Watershed District. In recent years, Como Lake has garnered much attention to manage its nutrient levels and algal standing crop (Noonan 1998, Capitol Regions Watershed District 2002). The lake is shallow with a median depth of 1.5 m and maximum depth of 4.9 m. The lake's polymictic stratification allows phosphorus from sediments to mix into the water adding to the nutrient load. A "top-down" biomanipulation was performed in 1985 by removal of omnivorus rough fish and restocking with sunfish, largemouth bass, and walleye. More recent management techniques includes storm water management with rain gardens, attempts to control the goose population, shoreline stabilization efforts, and macrophyte harvesting.

One area of the Como Lake ecology that has gained little attention are the macroinvertebrates. Macroinvertebrates occupy most microhabitats within a lake, but generally are considered benthic or planktonic, though, some are both. Some function as important recyclers of nutrients (Water on the Web 2004). Few studies have been conducted on Como's macroinvertebrates - one of the most recent was a masters thesis project conducted by a University of Minnesota student, Moriya Rufer, which focused on chironomids in various metropolitan lakes (Rufer 2006).

The Environmental Committee of St. Paul Neighborhood District 10 has been conducting a Natural Resource Inventory of Como Lake and surrounding public areas. The first phase of the inventory focused on birds and trees in Como Park and North Dale Recreation Center (McKearnan 2007). This phase studied the macroinvertebrate fauna of Como Lake. Our objectives for this study were:

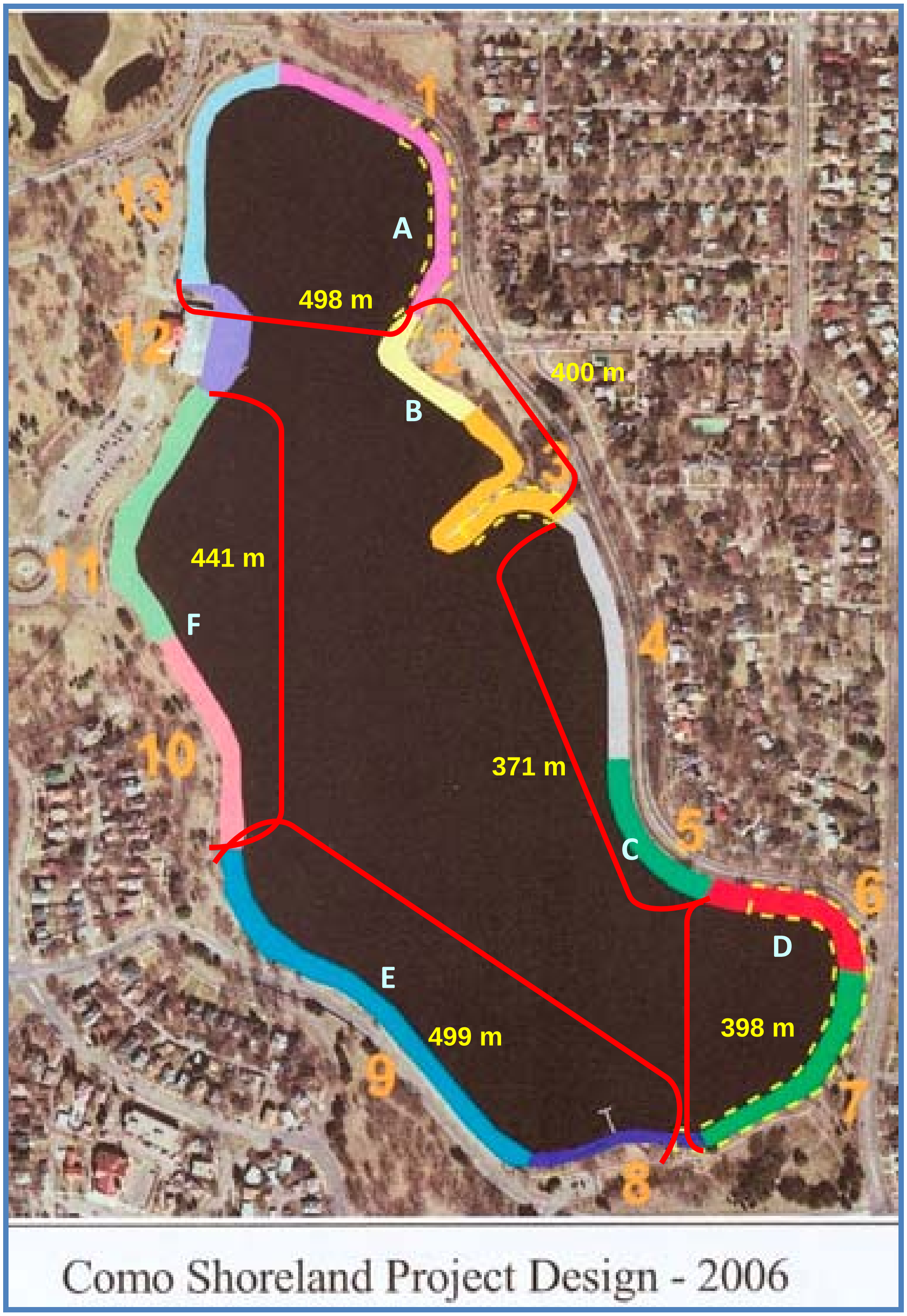
1) survey both benthic and planktonic macroinvertebrates at several sites in Como Lake,
2) relate the invertebrate community to various habitat and management features in the lake, and,
3) help to educate people about this little known component of lake ecology.

Methods

Site selection – Six sites were selected using the The Como Lake Shoreline Task Force's 13 management sections (Figure 1). Each section has had various management techniques – aquatic vegetation plantings, biologs, creation of native plant buffers, etc. – to stabilize and improve the aesthetic look of the lake's shoreline (D. M. Robinson, pers. comm.). Starting with the sections north of the pavilion (Section 13 and 1) a site was randomly selected within 5 m of the shore with the conditions that it be accessible, less than 1m deep, and relatively representative of the major habitat of the sections. Then for each two adjacent sections (2 &3, 4 & 5, 6 & 7, 8 & 9, 10 & 11), five other sites were randomly selected in a similar manner. Section 12 by the pavilion will not be surveyed because of the high level of disturbance that occurs there in the summer. This is also where Moriya Rufer sampled and so data for the chironomid community has already been collected here (Rufer 2006).

Site descriptions – Site A was next to a large inlet pipe with overhanging trees and an artificial rocky bank with biologs (Table 1). There was very little emergent vegetation, but some algal mats were found during two samples. Site B was on the south side of the point where the East Parking Lot lies. Bulrush (*Schoenoplectus* sp.) had been planted at this site a few years before and sometimes the submerged vegetation was quite thick. The shoreline was grassy with some forbs and a path within a few meters. Site C was amongst a cattail (*Typha* sp.) patch with a mostly herbaceous shoreline and some scattered trees (before the 11 August 2007 storm).The substrate here was mucky compared to the other sites which were mostly firm. Site D was only a few meters away and had a similar shoreline, except it was near an inlet pipe. There was more bulrush amongst the cattails and a firm bottom. Site E had a steep slope with biologs and a few trees, shrubs and forbs on the banks. The aquatic portion had very little emergent vegetation. Submerged vegetation was sparse to moderate here throughout the summer. Site F was amongst cattails with moderate amounts of floating duckweed (*Lemna* sp.) in the water and herbaceous vegetation with some shrubs on its shoreline.

Figure 1. Como Lake and Shoreline Task Force Management Sections. Sample Sites are indicated with letters A-F and the length of the combined Management Sections from which sampling sites were selected are provided.



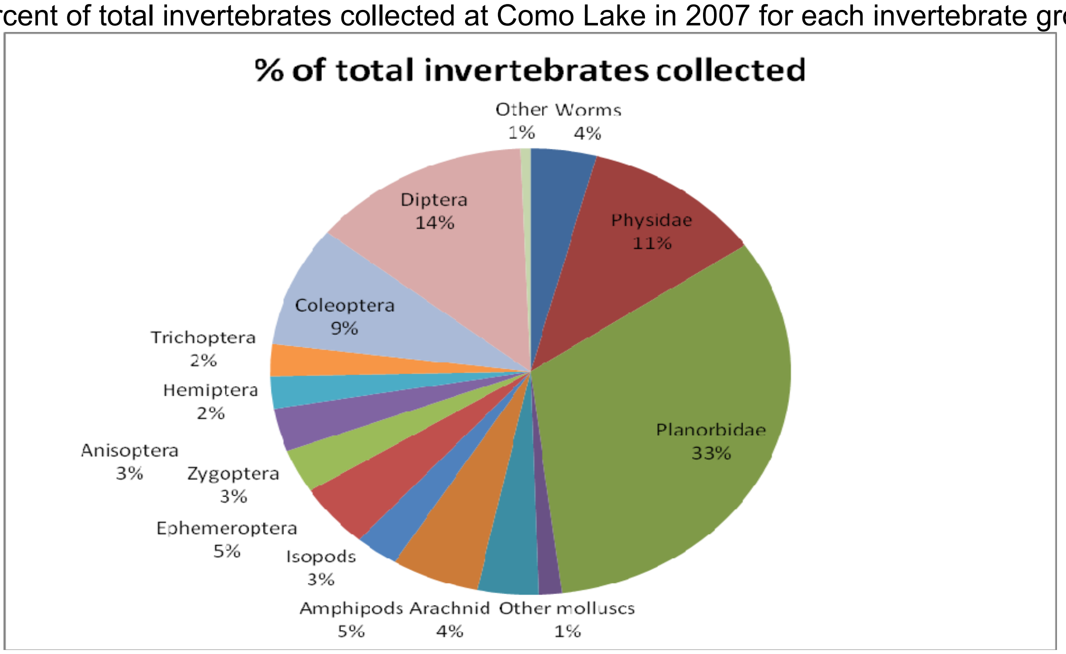
Macroinvertebrate sampling – Both dip-netting and activity traps were used to collect invertebrates, as recommended by Helgen (*2002*) and the U.S. Environmental Protection Agency (2002). Dip-netting can capture benthic and swimming invertebrates and those clinging to vegetation. It tends to collect the greatest diversity of invertebrates. We performed 2 sweeps at each site and then used a screen and sieve (mesh size 200 µm) to separate the invertebrates from vegetation. Activity traps were used to sample swimming invertebrates and those active at night. Two were placed at each site within 48 hours prior to collecting the traps. Samples were collected once a month between May and September in 2007.

Macroinvertebrate identification – Samples were sorted again in the laboratory into different taxa for identification. Most of the identification was conducted by student interns and their supervisor at The St. Paul Parks and Recreation Department and a student worker at Anoka Ramsey Community College (see acknowledgments). Twenty-five percent of the organisms' identifications were verified by Leonard Ferrington's Lab at the University of Minnesota. Resources used in identification included: Merritt et al.(2008), McCafferty (1983) and Bouchard (2004) and the Volunteer Stream Monitoring Interactive Verification Program (VSM-IVP) website (Rufer and Ferrington 2006). Most insect taxa were identified to family level; non-insects to family level or above. Some of the student interns at St. Paul Parks attempted to further identify specimens to genus and even species and these identifications are presented in Tables 3-7, however, these identifications have not been verified and were not used in analysis of diversity. Diversity was defined as the number of taxa collected indetified at family level or above.

Results

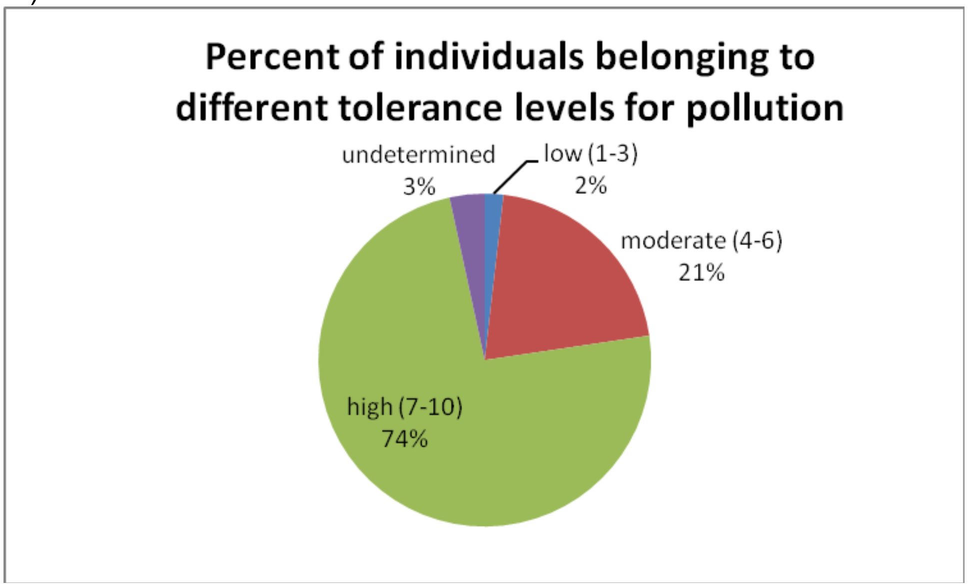
Abundance of different groups - A total of 2207 individuals from 68 macroinvertebrate taxa were collected and identified in all 60 samples (2 trapping methods x 6 sites x 5 months) (Table 1). The largest group of macroinvertebrates was snails from 2 major families (Planorbidae [ramshorn snails] and Physidae [bladder snails]) with representatives from 3 other families (Fig. 2, Table 1). Dipterans (flies) constituted the largest number of insects collected, primarily as a result of the 134 chironomid (non-biting midges) larvae collected in September. Haliplid (crawling water) beetles make up the second most common insect family. Both adults and larvae were observed and occurred more commonly at the beginning and end of the season. Amphipods (scuds) were the most abundant non-insect arthropod order and were most common in June and July.

Fig. 2. Percent of total invertebrates collected at Como Lake in 2007 for each invertebrate group



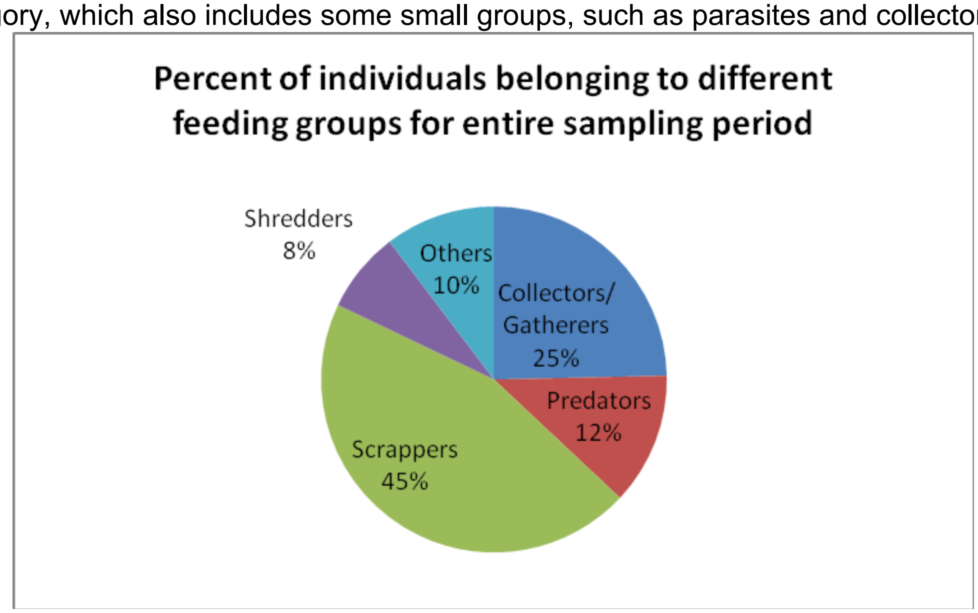
Only 1.8% of the invertebrates had a low tolerance for pollution (Fig. 3, Table 2). Almost 21% of the specimens have a moderate tolerance of pollution and a large majority (73.8%) had high tolerance for pollution. The tolerance of approximately 3% of the invertebrates was undetermined.

Fig. 3. The percent of individuals belong to different tolerance levels to organic pollution, according to Bouchard (2004).



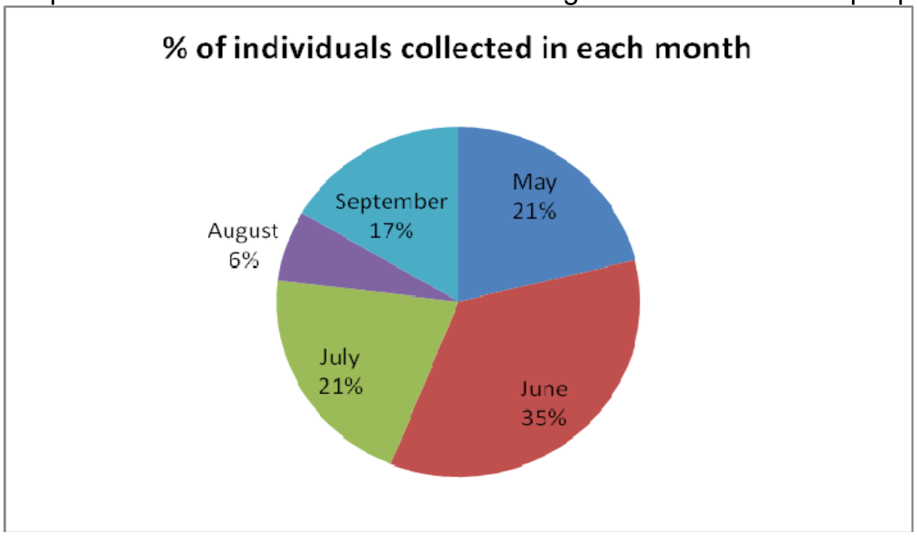
The functional feeding group distribution showed that at least 12% of the invertebrates collected were predators, including Odonates and Hemipterans. The largest functional feeding group was the scrapers (45%) which are almost all snails (Table 2). Collectors/Gatherers, such as oligochaetes, turbellarians and some dipterans, comprised one-quarter of the community.

Fig. 4. The percent of individuals belong to different functional feeding groups, according to Bouchard (2004). For some taxa, multiple feeding groups were determined and those taxa were assigned to the "Other" category, which also includes some small groups, such as parasites and collector/filterers.



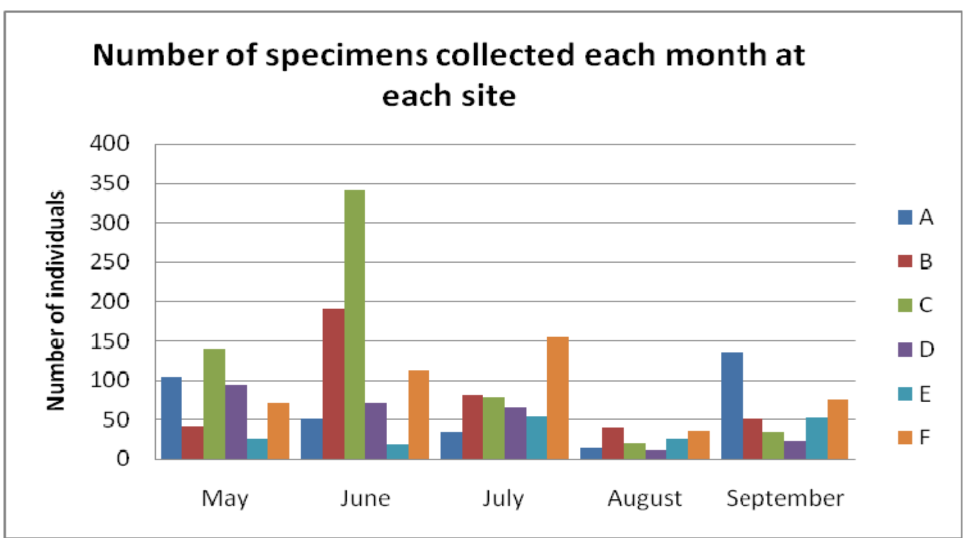
Comparison of different sampling periods - The number of invertebrates differed throughout the sampling period. June had the highest number of individuals but only the second highest in diversity (Table 1, Fig. 5). Its decrease in ranking of diversity is a result of having the largest (55%) percentage of snails found in the sample. However, when looking at the number of non-insect taxa, June had the highest number of taxa (15), including Turbellarians and Hydrobiid snails which were not found in other samples. July samples had the highest taxa richness with 40 different taxa collected. August samples had the fewest number of individuals and the lowest diversity of taxa.

Fig. 5. Percent of specimens collected at Como Lake during each of the five sample periods in 2007.



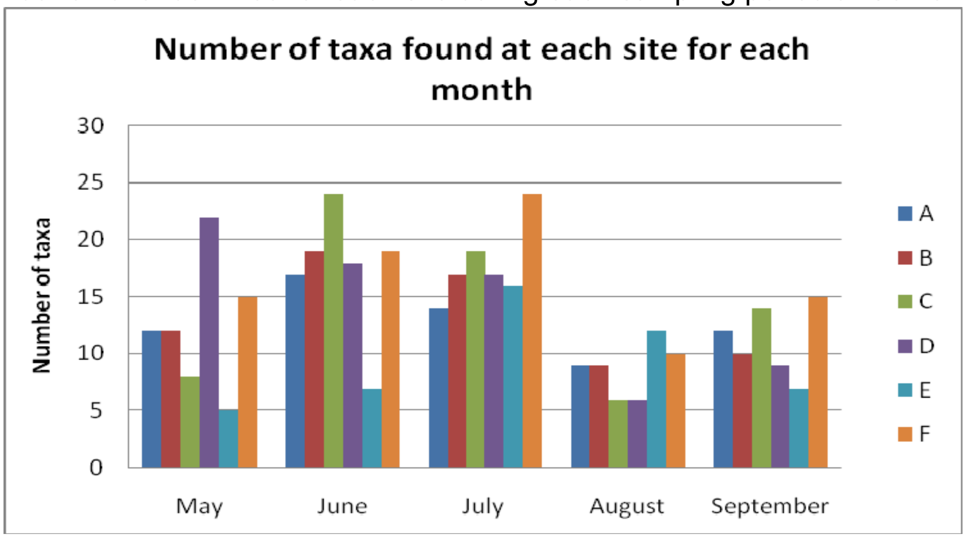
Comparison of different sites - The sites differed in the number of individuals found during each sampling period (Fig. 6). In the early months, Site C had the most number of specimens because there were 101 Planorbid snails found in May and 219 in June (Table 2). In May, if the number of snails is removed then Site F, then Site D would have the most number of individuals, 67 and 59 respectively. In June, even if snails are removed Site C would have the most number of invertebrates collected (62)(Table 3). In July, Site F had the most number of specimens, even with snails removed (Table 4). In August, numbers were low with little difference between sites, but Site B had the most number of specimens (Table 5). Site A had the most number of specimens in September because of a large number of chironomids (Table 6). Site E was the least productive site earlier in the summer and Site D later in the summer.

Fig. 6. Number of specimens collected at each of the different sites for each sampling period at Como Lake, 2007



The number of individuals collected did not always correlate well with the number of taxa identified during each sampling period. Even though, Site C had the most number of specimens in May, Site D was the most diverse (Fig. 7). However in June, Site C was also the most diverse and populated as well as Site F in July. In August, Site E had highest taxa richness. In September,while Site A had the most number of individuals, it was third in diversity, next to sites F and C. Site E was on average, the least diverse eventhough, it had the highest diversity in August. Site A would be considered the second least diverse.

Fig. 7. Number of taxa identified for each site during each sampling period at Como Lake, 2007



When comparing all individuals and taxa found at each site throughout the sampling period, Site C had the most individuals, with 604 individuals collected. Site F had the next highest abundance with 443 indivudals and Site E had the lowest abundance with 174 individuals collected (Fig. 8). Site F had the highest diversity with 39 taxa looking at the family level or above. Site C came in second with 35 species, and all sites had 30 or more taxa except for Site E, which had only 23 taxa (Fig. 9).

Fig. 8. The percent of individuals collected at each site over all the individuals collected during the entire sampling period, Como Lake 2007.

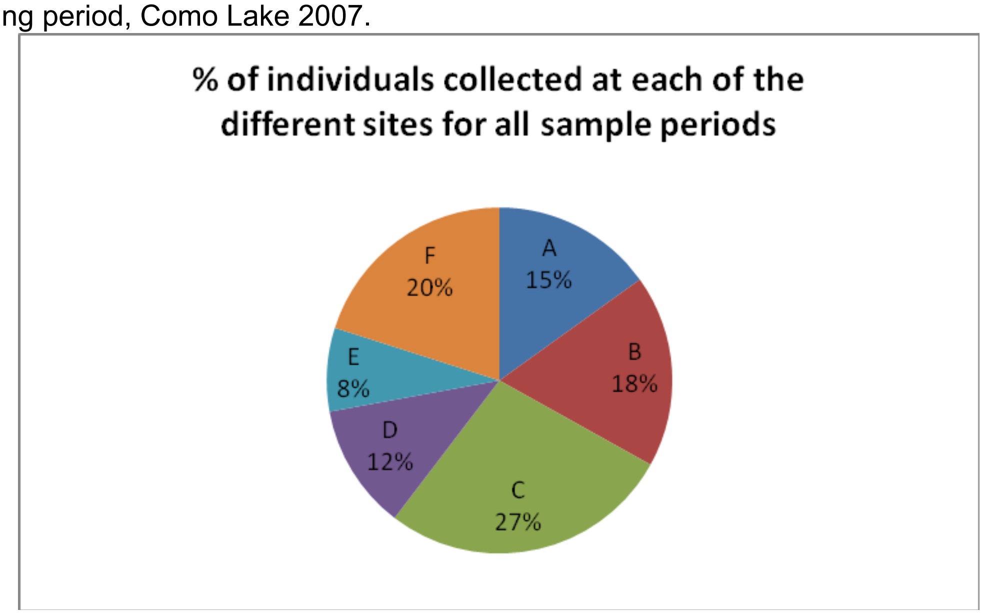
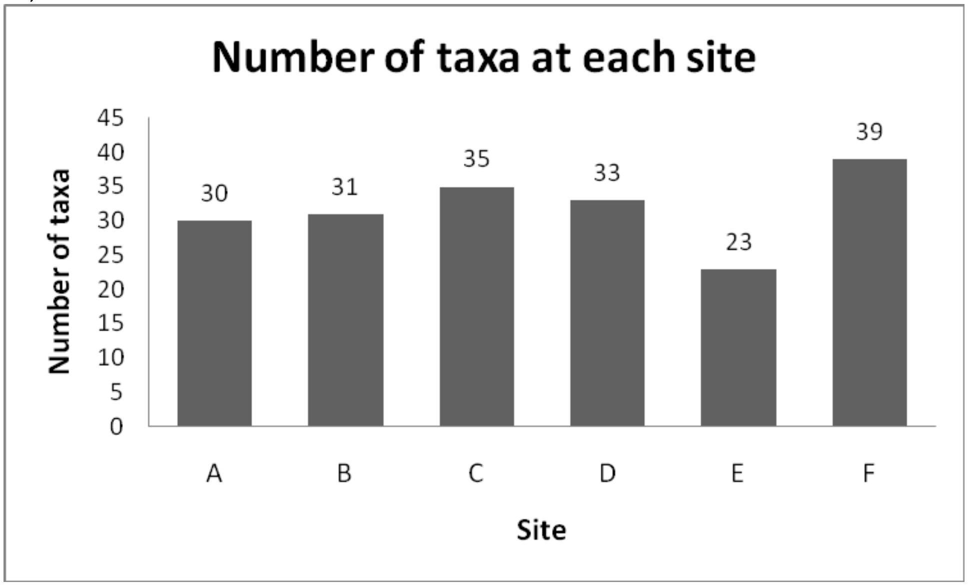


Fig. 9. The combined number of taxa (family level or above) collected at each site for the entire sampling period, Como Lake 2007



Relationship of Invertebrates with their Habitat

Only one habitat variable from Table 1 seemed to be related to the number of individuals and taxa diversity. The amount of submerged vegetation correlates with the number of specimens found during each sample size, but was not quite significant (Spearman's r =0.632, p = 0.053). The relationship between the amount of submerged vegetation and the number of taxa is clearer (Spearman's r = 0.535, p = 0.003). In both cases, where there is more submerged vegetation there is a tendency to have more individuals and more diversity (Figs. 10 and 11). The amount of emergent vegetation was not correlated to abundance or diversity. Sites C and F which generally had higher abundance and diversity then other sites had in common softer substrates. Sites with biologs (A and E) had lower diversity than other sites, but further study would have to confirm there are not other factors in play.

Fig. 10. The number of individuals found for the different amount of submerged vegetation recorded during a sampling period at Como Lake, 2007.

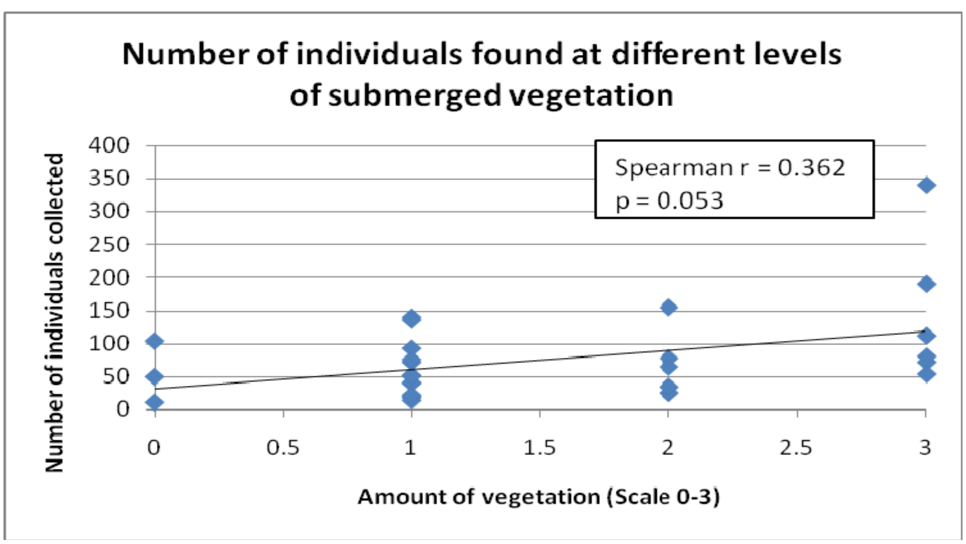
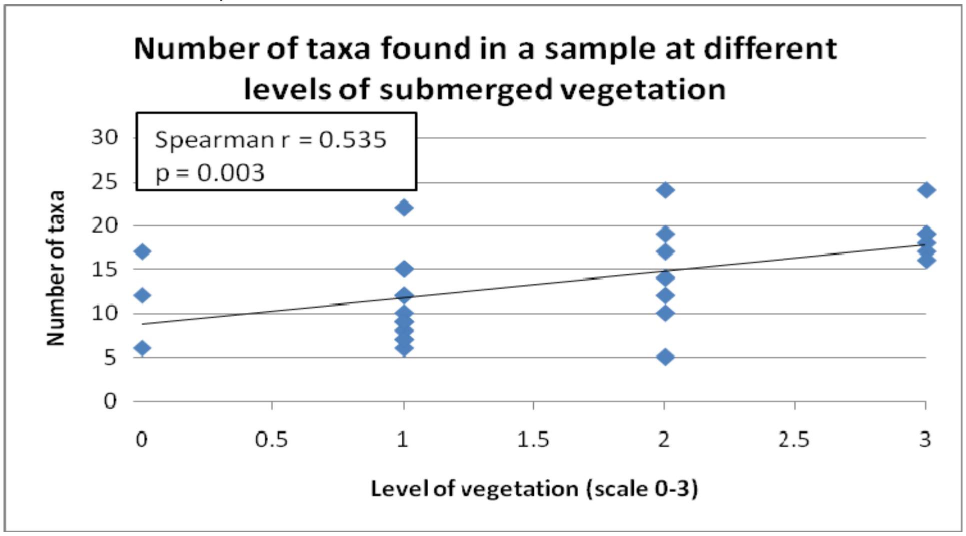


Fig. 11. The number of taxa found for the different amount of submerged vegetation recorded during a sampling period at Como Lake, 2007.



<u>Discussion</u>

Objective 1) Survey both benthic and planktonic macroinvertebrates at several sites in Como Lake.

With 68 macroinvertebrate taxa at the family level or greater, Como Lake could be considered relatively diverse. Helgen (2004) ranked large depressional lakes with >51 taxa to have high biotic integrity, but when one looks at the 3 most abundant taxa (Planorbid and Physid snails and chironomids), they constitute 55% of the sample which Helgen categorized as moderate integrity in her comparison of 44 wetlands.

Though a variety of organisms were found in Como Lake, very few were intolerant of organic pollution, indicating that the lake suffers from some organic pollution, especially when 75% of individuals are considered to have a high tolerance. Helgen (2002) considered a depressional wetland to have low biotic integrity when more than 69% of the sample was comprised of tolerant taxa.

The functional feeding group distribution showed that at least 12% of the invertebrates collected were predators, including Odonates and Hemipterans. The largest functional feeding group was the scrapers (45%) with the majority consisting of snails. In comparison, the Vermont Agency of Natural Resources (VANR) found 12-39% of their macroinvertebrate samples in a lake taken during spring, summer and fall (Burnham et al. 1998).

Objective 2) relate the invertebrate community to various habitat and management features in the lake

Shoreline management appears to have little effect on the macroinvertebrates. The two sites with biologs were not as productive as other sites and there did not appear to be other shoreline features associated with macroinvertebrate abundance or diversity. Emergent vegetation (cattails and bulrush) might have some effect, as sites B, C and D were either moderately or highly diverse or had abundant populations, while sites A and E lacked emergent vegetation and these sites had low diversity and abundance, However, Site F, the second most abundant lacked emergent vegetation.

Submergent vegetation was correlated with taxa richness and almost significant correlation with abundance. However, this submergent vegetation was mostly algal mats, considered to be undesirable as a sign of eutrophication in the lake.

Objective 3) help to educate people about this little known component of lake ecology.
Thirteen students or recent graduates (see Acknowledgments) helped with sorting in the field, most having no experience with aquatic macroinvertebrates and were able to see the variety of organisms belonging to this important assemblage. An additional 40 or so students were exposed to these invertebrates in the laboratory as I brought samples for 2 biology classes at Como Park High School. Identification was conducted by 10 college interns for St. Paul Parks and Recreation and 1 student worker at Anoka Ramsey Community College. In addition, some of the people walking around Como Lake inquired about the project and one class of young naturalists watched some of the sorting in the field.

<u>Conclusion</u>

This sampling effort will provide a good baseline for future studies. While the indicators are somewhat mixed about the health of the community, it appears that there is room for improvement to promote a macroinvertebrate assemblage of more predators and pollution-intolerant taxa. Control of nutrient input into Como Lake should contribute to increasing the biotic integrity of this lake.

If sampling was to continue at Como Lake, but with a more limited effort, then it appears the best time and places to sample would be in June at Site C and then either Site B and/or F. July could also be productive, especially at sites C and F, where samples would be likely to find diversity and abundance. August would be the month to be least likely to produce a good variety of organisms as well as good numbers of specimens.

<u>Acknowledgments</u>
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Literature Cited

Berner, L. and M.L. Pesacador. 1988. *The Mayflies of Florida.* University of Florida Press

Bouchard, R. W. Jr. 2004. Guide to Aquatic Invertebrates of the Upper Midwest: identification for students, citizen monitors, and aquatic resource professionals. University of Minnesota. St. Paul.

Burnham, D.G., J.H. Kellog, S.L. Fiske. 1998. An Inventory and Assessment of the Aquatic Resources of Wallingford Pond, Wallingford, Vermont. Vermont Agency of Natural Resources. Department of Environmental Conservation. URL: http://www.anr.state.vt.us/dec/waterq/bass/docs/bs_wallingfordpond.pdf

Capitol Regions Watershed District. 2002. Como Lake Strategic Management Plan.

Helgen, J. 2002. An invertebrate Index of Biological Integrity (IBI) for large depressional wetlands. Minnesota Pollution Control Agency.

McCafferty, W. P. 1983. Aquatic Entomology: the fishermen's and ecologists' illustrated guide to insects and their relatives. Jones and Bartlett Publishers, Inc. Boston.

McKearnan, J. E. 2007. Como Park Habitat Analysis. Report submitted to St. Paul Audubon Society.

Merritt, R.W., K.C. Cummins and M. B. Berg. 2008. An *Introduction to the Aquatic Insects of North America, 4th ed.* Kendall/Hunt Publishing Co., Dubuque, IA

Noonan, T. A. 1998. Como Lake, Minnesota: the long-term response of a shallow urban lake to biomanipulation. J. Lake and Reservoir Manage. 14(1):92-109.

Rufer, M. M. 2006. Chironomid communities as water quality indicators in Twin Cities metro area lakes. summary of M.S. Thesis research at URL: http://www.entomology.umn.edu/midge/MR_thesis.htm

Rufer, M. M. and L. C. Ferrington, Jr. 2006. Volunteer Stream Monitoring Interactive Verification Program. URL: http://www.entomology.umn.edu/midge/VSMIVP.htm

U.S. EPA. 2002. Methods for evaluating wetland conditions: developing an invertebrate index of biological integrity for wetlands. Office of Water, U.S. Environmental Protection Agency, Washington, D.C. EPA-822-R-02-019

Water on the Web. 2004. Lake ecology. University of Minnesota-Duluth, Duluth, MN 55812. URL: http://waterontheweb.org/under/lakeecology/index.html