2008

Tmdl Bioassessment Sampling Of Benthic Macroinvertebrates For Lake Jesup And Lake Seminary

Gloria Eby
University of Central Florida

TMDL BIOASSESSMENT SAMPLING OF BENTHIC MACROINVERTEBRATES FOR LAKE JESUP AND LAKE SEMINARY

by

GLORIA M. EBY
B.S. University of Central Florida, 2001

A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Science
in the Department of Biology
in the College of Sciences
at the University of Central Florida
Orlando, Florida

Spring Term
2008

ABSTRACT

The objective of this study was to obtain a bioassessment using benthic macroinvertebrates to meet TMDL (Total Maximum Daily Load) criteria for an oligotrophic (Lake Seminary) and an eutrophic (Lake Jesup) freshwater system in Seminole County, Florida. Monthly sampling of the benthic macroinverterbrate communities provided important biological data necessary to construct TMDL protocol and trophic state. Since macroinvertebrates are near the base of the food chain, they not only provide a critical role in the natural flow of energy and cycling of nutrients through the food web, but also provide a good indication of water quality by their presence and abundance. This study suggests that TMDL protocol and reversal trends in eutrophication can be successfully monitored using benthic macroinvertebrate data.

Comparative methodology between the LCI and conventional methods indicate that the LCI is a valid, cost-effective and rapid bioassessment method when compared to the conventional method and that the conventional method is an effective tool when more in depth benthic studies are needed as it shows distinct seasonal patterns and accounts for more of the sensitive, intolerant taxa. Furthermore, this type of biological monitoring and trend analysis aids in the implementation of anthropogenic controls that targets waters for TMDLs in suspect systems. When integrated within a watershed management plan, multi-metric indexing functions as an effective overall indicator of the biological condition within a waterbody responding to its watershed.

To those in my life that have supported me in achieving my goals.

ACKNOWLEDGMENTS

This study would not have been possible without the guidance, support and encouragement of my professor, Dr. John A. Osborne, who assisted me in numerous ways including specimen identifications, sampling techniques, writing styles and reviews. Dr. Osborne, offering good advice throughout my student career, helped me to stay focused on what is most important of which, without this, I would have not finished. Likewise to my thesis committee, Dr. John F. Weishampel and Dr. I. Jack Stout, who strengthened me in pursuant of my degree. I would like to express my eternal gratitude to these remarkable professors.

I would like to thank Kim Ornberg, supervisor and confidant, who has supported me during my years of research and for the award of two grants to study methods in bioassessments in an ever-changing water quality world. My collogues (alphabetically) Dean Barber, Marie Lackey, Marianne Pluchino, and Shannon Wetzel who provided a pillar of encouragement and a shoulder to rest upon when I needed. I also would like to thank two brilliant biologists, Dana Denson and Jim Hulbert, for their invaluable assistance with identifications and methodologies and wonderful memories on Lake Seminary. I also would like to thank Chris Carson, my Lake Jesup sampling partner, who voyaged Saturday mornings with me in an unpredictable boat and motor.

I would like to acknowledge my parents for the devoted encouragement and love they have provided me throughout my life; they are the inspiration for all my endeavors.

Remaining is a special acknowledgment to my wonderful husband Matt Eby. Matt, enduring my ups and downs, offered unconditional patience, encouragement and support. You are my always and forever.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS/ABBREVIATIONS

BMP	Best Management Practice
CPOM	Course Particulate Organic Matter
CWA	Clean Water Act
EOT	Ephemeroptera-Odonata-Trichoptera
FDEP	Florida Department of Environmental Protection
GIS	Geographical Information System
HI	Hulbert Index
LCI	Lake Condition Index
PCU	Platinum Cobalt Units
SCI	Stream Condition Index
SJRWMD	St. Johns River Water Management District
SOP	Standard Operation Procedures
TMDL	Total Maximum Daily Load
TSI	Trophic State Index
USEPA	United States Environmental Protection Agency
WWTP	Waste Water Treatment Plant

INTRODUCTION

Section 303 (d) of the Clean Water Act (CWA) requires states to submit verified lists of water bodies (known as the 303 (d) List) that fail to meet Federal water quality standards (termed, impaired waters). Upon identification of impaired waters, states must develop a wasteload allocation known as a Total Maximum Daily Load (TMDL) to reduce pollutants to a level sufficient to sustain water quality and designated use of the system. The United States Environmental Protection Agency (EPA) requires TMDLs to be developed where other pollution regulations are insufficient to protect water quality. TMDLs are criteria established for these waters to categorize the extent of impairment and to further allow for evaluation of restoration efforts as intended by the CWA. TMDLs monitor the potential effects on water quality, biological communities and their habitat. It provides a quantitative analysis of waterbodies; whether it is parameter specific (dissolved oxygen, fecal coliform, turbidity, nutrients) or the assessment of a biological component (bioassessments). Bioassessments are an evaluation of the biological condition of a waterbody that uses biological surveys and other direct measurements of the resident biota of the waterbody. Most often, fish population, bottom dwelling insects and other invertebrates and plants or attached algae are evaluated. The mission of TMDLs is to provide accurate ecological information to enable legally defensible environmental decisions (Frydenborg 2001).

To help fulfill CWA objectives, EPA established the National Biological Criteria Program in 1988 with objective of restoring the physical, chemical and biological integrity of the nation's waters. In 1990, the EPA published Biological Criteria: National Program Guidance for Surface Waters (EPA-440/5-90-004) as guidance for the various state water pollution control

agencies to assess water quality, develop water quality standards and to determine the overall health of aquatic life in surface waters. To bring the new bioassessment approach to Florida, the Florida Department of Environmental Protection (FDEP) initiated two major projects in early 1991 with funding provided by the CWA's Nonpoint Source Pollution grant program [Section 319] (Biocriteria Fact Sheet). Through this grant program, contracted studies began to delineate and identify Florida reference lakes and streams sites, and to refine EPA's biological (benthic macroinvertebrate) sampling methods to reflect Florida's freshwater systems.

Benthic macroinvertebrate surveys directly measure the aquatic community's response to pollutants or stressors, thus can provide compelling evidence of water quality impairment and can be used to decide which waterbodies need TMDLs (USEPA 1993c). Since macroinvertebrates are near the base of the food chain, they not only provide a critical role in the natural flow of energy and nutrients through the food web, but also provide a good indication of water quality by their presence and abundance. Because of this position in trophic level, they provide early warning indications of a changing environment, are sensitive to these changes in water quality and cannot easily escape these changes.

Bioassessments are increasingly favored by regulatory agencies because they explicitly and directly evaluate the ecological effects of environmental disturbances (Barbour et al. 1999) and incorporation of bioassessment data aids in the ranking process to target waters for TMDL development. This allows for a more accurate prioritization because of the direct link between bioassessment and ecological integrity (i.e., the condition of an unimpaired ecosystem as measured by combined chemical, physical, and biological attributes of surface waters; Barbour et al. 1992). To standardize, summary scores were developed with the intention that

bioassessments could be interpreted by biologists, managers, decision makers and the general public (Merritt and Cummins 1996). Biological assessments (and criteria) address the cumulative impacts of all stressors, especially habitat degradation, loss of biological diversity, and non-point source pollution.

In support of biological/ecological assessments, FDEP developed an index for rapid assessment of stream health, the Florida Stream Condition Index (SCI; Barbour et al. 1996), based on current practices recommended by EPA and several states (e.g., Gibson et al. 1996; Barbour et al. 1999). In 1998, EPA published a draft guidance document extending the rapid bioassessment concept to lakes (Gerritsen et al. 1998). In 2000, FDEP implemented the first full-scale field application of bioassessment for lakes as proposed by EPA in a document titled Development of the Lake Condition Indexes (LCI) for Florida (Gerritsen et al. 2000). The LCI method was later adopted into Florida Administrative Code in 2004 (F.A.C. 62-160.220).

The objective of this study was to obtain a thorough characterization of the benthic macroinvertebrate community in two study lakes in Seminole County, Florida as part of a biological assessment that targets waters for TMDLs in eutrophic systems. For this study, the benthic macroinvertebrate community refers to the freshwater animals without backbones that are ubiquitous living on rocks, logs, sediment, debris and aquatic plants at some point in their life. For comparative purposes, benthic macroinvertebrates were collected monthly in eutrophic (Lake Jesup) and oligotrophic (Lake Seminary) freshwater lakes in Seminole County to further understand the dynamics of macroinvertebrates in impaired and unimpaired waterbodies. In conjunction, sampling methodologies were compared to determine effectiveness of rapid bioassessment (LCI) approaches. Such direct comparison provides an important foundation for

integrating and guiding bioassessment programs (Herbst and Silldorff 2006). This study evaluated the TMDL protocol and the use of rapid bioassessments in the TMDL process to characterize the trophic state and subsequent changes in trophic state as a measurement of restoration and water quality improvements.

MATERIALS AND METHODS

Description of Study Sites:

Lake Seminary, located in Maitland, Seminole County, Florida is classified as an oligotrophic lake (historic average Trophic State Index [TSI]; 29) and is surrounded by a low-density residential community. This 22 ha freshwater lake has a mean depth of 4.3 m and maximum depth of 9.1 m. Even in an urban setting, Lake Seminary is considered one of only a few oligotrophic lakes located in Seminole County because of its deep light penetration, exceptional water clarity and its low nutrient and chlorophyll a values. The adjacent watershed is comprised of minimal shoreline disturbance from homes, agriculture, runoff and undisturbed shoreline vegetation along 50% of the easterly shoreline. Lake Seminary sediment composition is dominantly sand-bottom with pockets of sand-muck located in the deeper sinks of the lake. Lake Seminary phytobenthic community is comprised of stonewort (*Nitella* sp.) and musk grass (*Chara* sp.). Other observed submersed aquatic macrophytes includes southern naiad (*Najas guadalupensis*) and bladderwort (*Utricularia* sp.), all which contribute to the assimilation of water column nutrients.

Lake Jesup is the largest and most eutrophic lake (historic average TSI; 80) in Seminole County, Florida. It is located on a tributary of the St. Johns River and is subjected to water level fluctuations in accordance with the river. Lake Jesup has a surface area of 3,286 ha extending over a flood plain of 6,475 ha. Its normal mean depth is 1.8 m. This muck-bottom lake has a layer of unconsolidated sediment reaching 2.7 m in some areas. Lake Jesup is prone to frequent algal blooms and fish kills as resulting from decades of poor management practices (lack of

management practices). Nutrient sources that accelerated eutrophication include direct effluent discharges from wastewater treatment plants (WWTPs; Figure 1), stormwater and agricultural runoff, shoreline disturbance via seawalls, introduction of exotic plant communities (*Phragmities* sp.), residential and industrial land use, roadway drainage and inlet channel modifications to the St. Johns River through Lake Jesup. Construction of both the SR 417 and SR 46 bridge is considered to represent major physical alterations that caused a decrease in water exchange and circulation from the lake into the St. Johns River. After 1983, direct WWTPs effluent discharge into Lake Jesup ceased and in 1994, the Florida Legislature passed the Lake Jesup Act that provided funding for restoration activities in Lake Jesup (SJRWMD). Presently, Lake Jesup is listed on the Florida 303(d) List (verified) for nutrients (TSI) and un-ionized ammonia.

Invertebrate Sampling:

Benthic communities within the two study lakes were sampled using similar methods. In Lake Seminary, two different methodologies were used for comparison of the Lake Condition Index (LCI) and conventional methods. The conventional method for collecting benthic invertebrates, a traditional style of sampling, uses a bottom grab sample. A tall Ekman grab measuring 15.2 x 15.2 x 30 cm (6"x 6"x 9") and capacity volume of 5,300 ml was used to collect two pooled bottom samples from each station. The samples were sieved through a #30 US mesh (mesh opening: 595μm) sieve bucket to removed fine sands, silts and organic debris. In the laboratory, benthic samples were re-rinsed using a #30 mesh strainer to remove the organisms. The remaining bottom debris and organisms was diluted into a white pan and all organisms were hand removed and preserved in 90% ethanol.

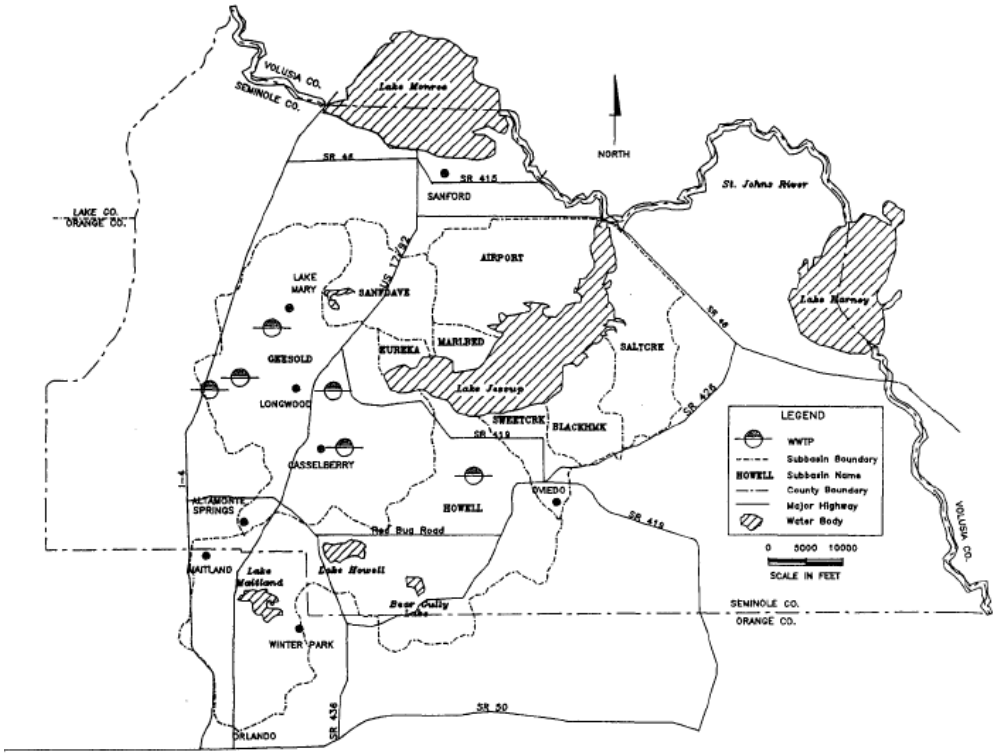

Figure 1. Location of Waste Water Treatment Plants (WWTPs) in Lake Jesup watershed (Keesecker 1992).

The abundance of the organisms was expressed as number of organisms/m^2.

The LCI method was developed by FDEP and has been designated statewide as the standard method for rapid bioassessments of lake benthic communities. As in the conventional method, the tall-form Ekman grab and #30 mesh sieve bucket are used to collect bottom samples. Organisms sampled for the LCI were evaluated to obtain a value that expresses the biological integrity on a sliding scale ranging from Very Poor to Very Good.

FDEP's Standard Operating Procedures (SOPs) for the Lake Condition Index (LCI) Sampling (FDEP-SOP-001/01 FS 7460) was used to sample benthos from Lake Seminary. The lake was divided into 12 sampling units (Figure 2). One Ekman grab sample was collected from within each unit for a total of 12 grab samples collected and pooled into one sample. The locations of the grab sample were restricted to a water depth between 2 to 4 m in the sub-littoral zone. In the laboratory, pooled samples were evenly distributed into a white pan consisting of 24, 5 cm numbered grids. Eight grids were randomly selected and removed from the original pan and placed into a new white pan consisting of 24, 5 cm numbered grids. Once evenly distributed into the second pan, 1 random grid was selected at a time, removing all organisms from within that grid and then repeating the procedure until a total of 100 organisms were removed. In the final grid, once 100 organisms had been removed, removal of organisms from that grid continued until all organisms have been removed in order to avoid bias.

Monthly benthic macroinvertebrate sampling was conducted within the same week for each lake from January 2002 to December 2003. Benthic invertebrates were picked alive from sediment samples using white larval pans and fine tip forceps and preserved in 90% ethanol. Invertebrates were identified to species or to the lowest possible taxon and enumerated using the

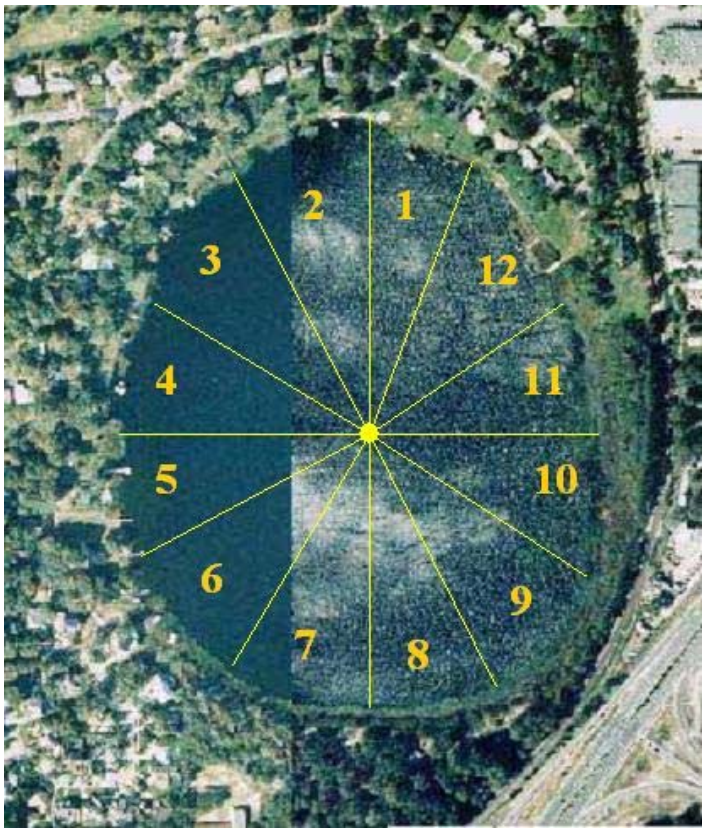

Figure 2. Lake sampling scheme as described in Development of Lake Condition Indexes (LCI) for Florida manual (Gerritsen et al. 2000).

following identification keys: Aquatic Insects and Oligochaetes of North and South Carolina (Brigham et al. 1982), Florida Damselflies (Zygoptera): A Species Guide to the Larval Stages (Daigle et al. 1991), Identification Manual for the Water Beetles of Florida (Epler 1996), Identification Manual for the Larval Chironomidae (Diptera) of North and South Carolina (Epler 2001), An Introduction to the Aquatic Insects of North America Second Edition (Merritt and Cummins 1996), Identification Manual for the Aquatic Oligochaeta of Florida, Vol.1. Freshwater Oligochaetes (Milligan 1997), Dragonflies of North America (Needham et al. 2000), Fresh-Water Invertebrates of the United States (Pennak 1953), Identification Manual for the Caddisfly (Trichoptera) Larvae of Florida (Pescador et al. 2004), Guide to the Mayfly (Ephemeroptera) Nymphs of Florida (Pescador et al. 2004), Guide to the Common Water Mite Genera of Florida (Pluchino 1984), Identification Manual for the Dragonfly Larvae (Anisoptera) of Florida (Richardson 2003), An Identification Manual for the Freshwater Snails of Florida (Thompson 2004), Damselflies of North America (Westfall and May 1996), Larvae of the North American Caddisfly Genera (Trichoptera) (Wiggins 1996).

Benthic data were collected in Lake Jesup at three predetermined locations. Since true water color of Lake Jesup (historic average; 92 PCU) exceeds FDEP's protocol for an LCI (20 PCU), only the conventional method was used to collect benthos from Lake Jesup. The sampling locations in Lake Jesup are given in Figure 3 (Grassy Point (N 28.45.994/ W 81.10.544), White's Landing (N 28.42.246/ W 81.14.378) and Soldiers Creek (N 28.42.800/ W 81.16.819).

Within Lake Seminary, GIS data were obtained to provide an aerial view of the lake; the lake was then subdivided into 12 sampling units using ArcView GIS (Figure 4).

Figure 3. Station locations using the conventional method for Lake Jesup located in Seminole County.

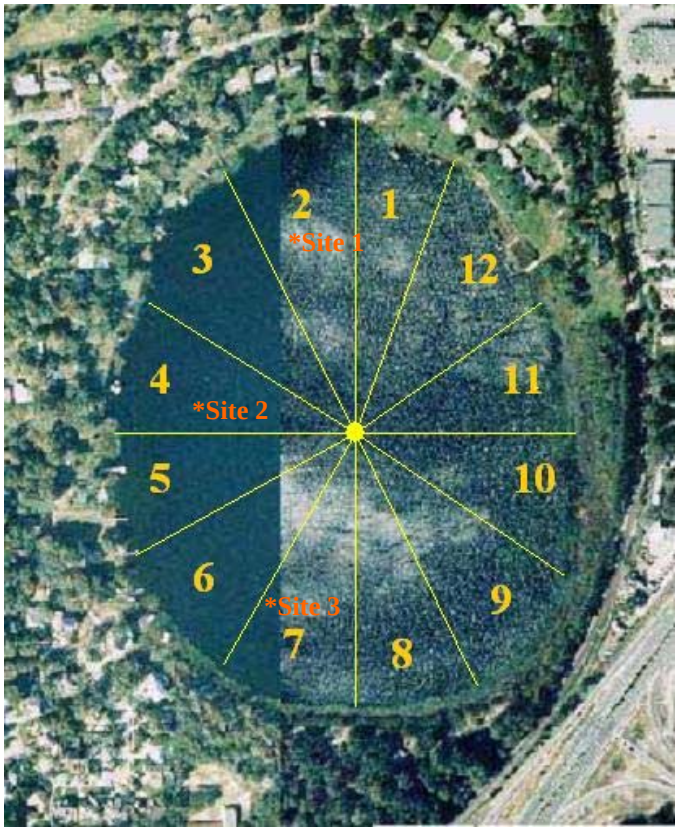

Figure 4. LCI composite sample locations (yellow) and conventional method station locations (red) for Lake Seminary located in Seminole County.

These stations were randomly selected yet restricted to the 2 to 4 m sub-littoral depths as required by the LCI protocol for comparative purposes, Figure 4.

Invertebrate Calculations:

For this study, numerical values of seven metrics were selected for the comparison of the two different sampling methodologies (LCI and conventional) for quantifying benthic invertebrate composition. These invertebrate metrics were tested by FDEP during the development of the LCI method for Florida as responsive lake stressors and remains the current metrics used to calculate the LCI score (Gerritsen et al. 2000). The seven metrics are: Total Taxa (Richness), % EOT (Ephemeroptera-Odonata-Trichoptera), Total EOT, % Diptera, Total Diptera, Hulbert's Lake Condition Index [HI], and Shannon-Weiner Diversity Index ($H' = - \Sigma p_i \ln p_i$). The Hulbert Index (HI) is a weighted taxa count of intolerant taxa, with taxa weighted by their tolerance. The HI is the macroinvertebrate index of the Hulbert's Lake Condition Index (Hulbert 1990) and was developed for macroinvertebrates found in Florida lakes

In addition, numerical values of three metrics were selected for the comparison of the two different lakes (Seminary and Jesup) for quantifying benthic invertebrate composition using the conventional method. These invertebrate metrics were calculated as mean of the three stations derived from the two pooled bottom samples per station in each lake to compare to the abundance derived using the LCI method. The three metrics calculated are: Total Taxa (Richness), Number of Organisms/m^2 and Shannon-Weiner Diversity Index ($H' = - \Sigma p_i \ln p_i$).

Physicochemical Sampling:

Physicochemical data were collected and summarized at each station corresponding to the conventional method benthic macroinvertebrate collection locations for each lake from January 2002 to December 2003 (Table 1-2).

Ambient physicochemical data were collected in situ using FDEP SOPs for General Field Testing and Measurement (FDEP-SOP-001/01 FT 1000) and consisted of water temperature (FT 1400), pH (FT 1100), specific conductivity (FT 1200) and dissolved oxygen concentration (FT 1500). Field instrumentation used was the Horiba U-10 and YSI 6600 mulitmeter sondes. Secchi disc transparency readings were collected using a 20 cm diameter, black and white disc with a calibrated depth line (Cole 1994).

In addition, quarterly water chemistry samples were collected at a half-meter subsurface depth then analyzed by Harbor Branch Environmental Laboratories (located in Deltona, Florida) in conjunction with Seminole County's Surface Water Quality Monitoring Program. Analytical parameters were tested using Standard Methods for Examination of Water & Wastewater (1999) and included chlorophyll a (SM10200H), total alkalinity (EPA 310.1), total nitrogen (EPA 351.2), and total phosphorus (EPA 365.1). Each analyte was collected and preserved on ice to 4° C using FDEP SOPs for General Sampling Procedures (FDEP-SOP-001/01 FS 1000-4). Total nitrogen and phosphorus were further fixed with sulfuric acid to a pH of less than 2. Trophic state was classified for each lake using calculations derived by Forsberg and Ryding (1980) and TSI using the Florida Water Quailty Assessment: 305 (b) Report (Hand et al. 2000).

Table 1. Mean physicochemical data obtain from Lake Seminary and Lake Jesup, Florida. Data expressed in mean value for year 2002 as indication of trophic level status.

Parameters	Lake Seminary	Lake Jesup
Chlorophyll a (µg/l)	1.7	94.3
Alkalinity (mg/l $CaCO_3$)	6.6	90.8
pH	7.6	8.1
Temperature C°	24.3	23.5
Specific conductivity (µS/cm @ 25 C°)	237.3	897.0
Dissolved oxygen (mg/l)	8.6	10.1
Total nitrogen (mg/l)	0.4	2.5
Total phosphorus (µg/l)	7.5	183.3
Secchi depth (m)	5.5	0.8
Trophic status	Oligotrophic	Hyper-eutrophic

Table 2. Mean physicochemical data obtain from Lake Seminary and Lake Jesup, Florida. Data expressed in mean value for year 2003 as indication of trophic level status.

Parameters	Lake Seminary	Lake Jesup
Chlorophyll a (µg/l)	2.4	128.5
Alkalinity (mg/l $CaCO_3$)	7.9	85.6
pH	7.4	8.7
Temperature C°	25.3	24.3
Specific conductivity (µS/cm @ 25 C°)	226.0	556.0
Dissolved oxygen (mg/l)	8.2	8.7
Total nitrogen (mg/l)	0.4	1.6
Total phosphorus (µg/l)	9.2	189.5
Secchi depth (m)	5.0	1.3
Trophic status	Oligotrophic	Hyper-eutrophic

RESULTS AND DISCUSSION

Lake Seminary: LCI vs. Conventional Methods

Upon analysis of each metric category between the two methods, data from this study infers that the LCI sampling method yielded similar results yet LCI samples (including collection, enumeration, and identification) were concluded at a faster (rapid) rate than the conventional samples however providing less sensitive taxa representation. Table 3 provides numerical values for each method in each metric evaluated for the samples collected from January to December 2002. Table 4 also provides numerical values for each method in each metric evaluated for the samples collected from January to December 2003.

Evaluating each metric individually, total number of individuals in each respective sample was compared to associate any trends in seasonal variation between the two methods. Figure 5a and 5b demonstrates when using the LCI method, the total number of individuals was both consistent and less than the conventional method due to the sampling protocol/restrictions. This restriction eliminates the ability to conduct trending analysis in seasonal variation respective to abundance. In addition, changes respective to seasonal variations were observed during late fall and winter months suggesting a more productive sampling period to conduct TMDL bioassessments. A recent study conducted by Rosenberg et al. (1997) concluded that it was best to sample either just after ice-out in the spring when late-stage larval forms are present but have not yet begun their final maturation, or in late fall after most species have mated and the immatures have had a chance to develop throughout the summer in preparation for over-wintering.

Table 3. Macroinvertebrate summary of the eight different metrics used to compare the two methodologies (LCI and conventional) on Lake Seminary, Florida for 2002.

Date/Method	Taxa	EOT	% EOT	Diptera	% Diptera	Shannon Index	Hulbert Index	# Individuals
				Metrics Compared				
26-Dec								
LCI	8.00	1.00	0.01	49.00	0.48	1.44	9.00	103.00
CONVENTIONAL (X)	13.00	3.33	0.02	48.67	0.27	1.40	11.00	180.00
16-Nov								
LCI	13.00	3.00	0.03	50.00	0.48	1.57	10.00	104.00
CONVENTIONAL (X)	14.00	4.67	0.03	79.33	0.50	1.81	12.00	159.00
15-Oct								
LCI	13.00	1.00	0.01	40.00	0.40	2.16	10.00	100.00
CONVENTIONAL (X)	10.00	5.00	0.05	12.33	0.20	1.57	6.00	60.00
25-Sep								
LCI	15.00	2.00	0.02	68.00	0.58	2.00	10.00	118.00
CONVENTIONAL (X)	12.00	2.33	0.02	30.00	0.26	1.66	8.00	115.00
17-Aug								
LCI	13.00	4.00	0.04	33.00	0.32	1.85	10.00	102.00
CONVENTIONAL (X)	7.00	2.00	0.07	15.67	0.55	1.45	6.00	29.00
27-Jul								
LCI	11.00	2.00	0.02	45.00	0.43	2.08	6.00	105.00
CONVENTIONAL (X)	9.00	1.00	0.01	15.00	0.41	1.75	5.00	37.00
23-Jun								
LCI	17.00	4.00	0.03	94.00	0.64	2.03	12.00	148.00
CONVENTIONAL (X)	14.00	5.00	0.03	58.33	0.40	2.02	7.00	144.00
18-May								
LCI	13.00	3.00	0.03	39.00	0.39	2.04	8.00	101.00
CONVENTIONAL (X)	12.00	2.67	0.04	18.00	0.27	2.07	7.00	67.00
27-Apr								
LCI	14.00	9.00	0.09	47.00	0.46	1.90	10.00	103.00
CONVENTIONAL (X)	13.00	6.67	0.07	72.33	0.69	1.81	8.00	104.00

	Metrics Compared							
Date/Method	Taxa	EOT	% EOT	Diptera	% Diptera	Shannon Index	Hulbert Index	# Individuals
16-Mar								
LCI	13.00	0.00	0.00	100.00	0.88	1.63	6.00	114.00
CONVENTIONAL (X)	12.00	2.00	0.02	75.00	0.68	1.90	7.00	110.00
16-Feb								
LCI	11.00	1.00	0.01	75.00	0.69	1.74	3.00	
CONVENTIONAL (X)	17.00	1.67	0.01	111.33	0.77	1.87	10.00	108.00
								144.00
12-Jan								
LCI	8.00	0.00	0.00	105.00	0.91	1.37	5.00	115.00
CONVENTIONAL (X)	14.00	3.33	0.02	116.33	0.76	1.62	9.00	156.00

Table 4. Macroinvertebrate summary of the eight different metrics used to compare the two methodologies (LCI and conventional) on Lake Seminary, Florida for 2003.

	Metrics Compared							
Date/Method	Taxa	EOT	% EOT	Diptera	% Diptera	Shannon Index	Hulbert Index	# Individuals
22-Dec								
LCI	18.00	3.00	0.03	64.00	0.63	2.18	14.00	102.00
CONVENTIONAL (X)	15.00	3.00	0.02	44.00	0.30	1.58	15.00	149.00
16-Nov								
LCI	16.00	2.00	0.02	54.00	0.52	2.08	11.00	103.00
CONVENTIONAL (X)	13.00	2.00	0.02	41.00	0.44	1.95	12.00	93.00
15-Oct								
LCI	24.00	3.00	0.03	67.00	0.61	2.34	15.00	110.00
CONVENTIONAL (X)	14.00	5.00	0.06	29.00	0.33	1.84	14.00	88.00
25-Sep								
LCI	19.00	2.00	0.02	63.00	0.62	2.26	11.00	102.00
CONVENTIONAL (X)	14.00	4.00	0.05	29.00	0.35	1.88	12.00	84.00
17-Aug								
LCI	19.00	2.00	0.02	64.00	0.63	2.16	11.00	102.00
CONVENTIONAL (X)	12.00	2.00	0.04	25.00	0.44	1.88	11.00	57.00
27-Jul								
LCI	15.00	1.00	0.01	78.00	0.68	2.05	10.00	114.00
CONVENTIONAL (X)	13.00	2.00	0.02	37.00	0.42	1.81	11.00	88.00
23-Jun								
LCI	15.00	0.00	0.00	33.00	0.33	1.90	7.00	100.00
CONVENTIONAL (X)	15.00	5.00	0.06	24.00	0.29	1.85	14.00	83.00
18-May								
LCI	17.00	1.00	0.01	55.00	0.50	2.28	8.00	109.00
CONVENTIONAL (X)	14.00	5.00	0.04	45.00	0.34	1.69	14.00	133.00
27-Apr								
LCI	16.00	4.00	0.04	67.00	0.66	1.82	11.00	101.00
CONVENTIONAL (X)	19.00	5.00	0.02	124.00	0.50	1.74	14.00	248.00

	Metrics Compared							
Date/Method	Taxa	EOT	% EOT	Diptera	% Diptera	Shannon Index	Hulbert Index	# Individuals
16-Mar								
LCI	17.00	1.00	0.01	81.00	0.79	2.19	11.00	103.00
CONVENTIONAL (X)	14.00	4.00	0.02	74.00	0.39	1.77	14.00	191.00
16-Feb								
LCI	16.00	2.00	0.02	77.00	0.73	2.19	10.00	106.00
CONVENTIONAL (X)	17.00	5.00	0.04	87.00	0.73	2.13	13.00	120.00
12-Jan								
LCI	16.00	2.00	0.02	85.00	0.79	2.02	13.00	107.00
CONVENTIONAL (X)	16.00	3.00	0.02	49.00	0.43	1.33	16.00	198.00

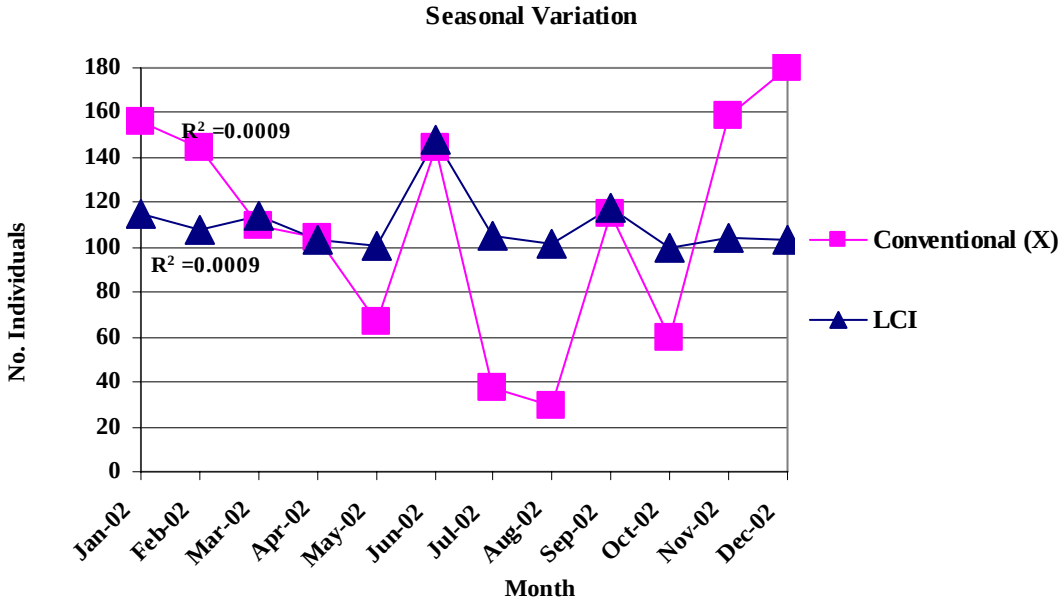

Figure a.

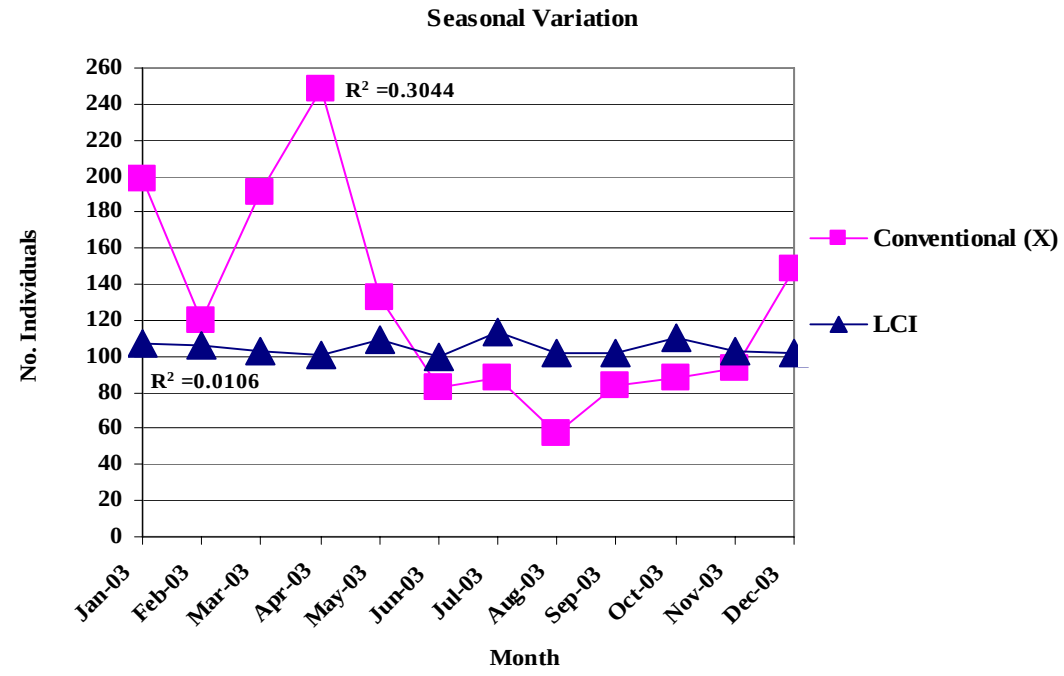

Figure b.

Figure 5a-b. Comparison of total number of individuals for LCI and conventional method (expressed as mean) for 2002-2003 data on Lake Seminary, Florida.

A closer look into the two methods, Figure 5a-b demonstrates more fluctuations in the conventional method for the x-axis suggesting this method provides a more complete assessment of organisms present in the waterbody due to the lack of sub-sampling, resulting in more sensitive taxa (EOTs) represented and less dominant taxa (Dipterans), thus elevating presence and abundance.

EOT taxa richness index establishes the stability of the community among three sensitive groups; Ephemeroptera (Mayflies), Odonata (Dragonflies), and Trichoptera (Caddisflies). These are species that are considered to be very sensitive to poor water quality conditions, therefore the presence of these organisms are indicators of good water quality. The higher population of these organisms refers to the more stable the waterbody.

When evaluating the EOT richness (EOT Total) metric for this study, data identifies between the two methods by which 66.66% of the sample, using the conventional method, were higher than the LCI method in 2002 increasing to 75.00% in 2003, suggesting that the conventional method allowed for more sensitive taxa to be collected and represented in the sample community. The differences in EOT enumeration are illustrated in Figures 6a and 6b noting seasonal variability factors previously mentioned. A limited organism count (total of 100) versus enumeration of all organisms in sample directly affected percentage of EOTs represented in sample. Additionally, there was a poor representation of EOTs for the 2002 data (figure 6a) from January to March with values for this period totaling 1 as compared to 7 for the conventional method. For the % EOT metric category, conventional method samples were equal to the LCI method samples (50.00%) in 2002 increasing to 66.66% of the samples being higher than the LCI method in 2003.

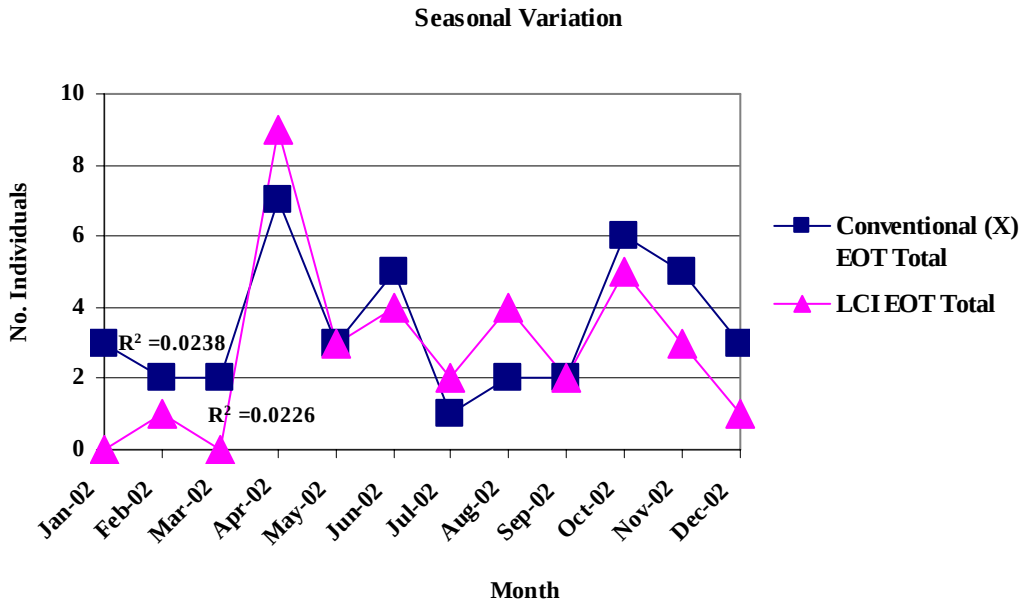

Figure a.

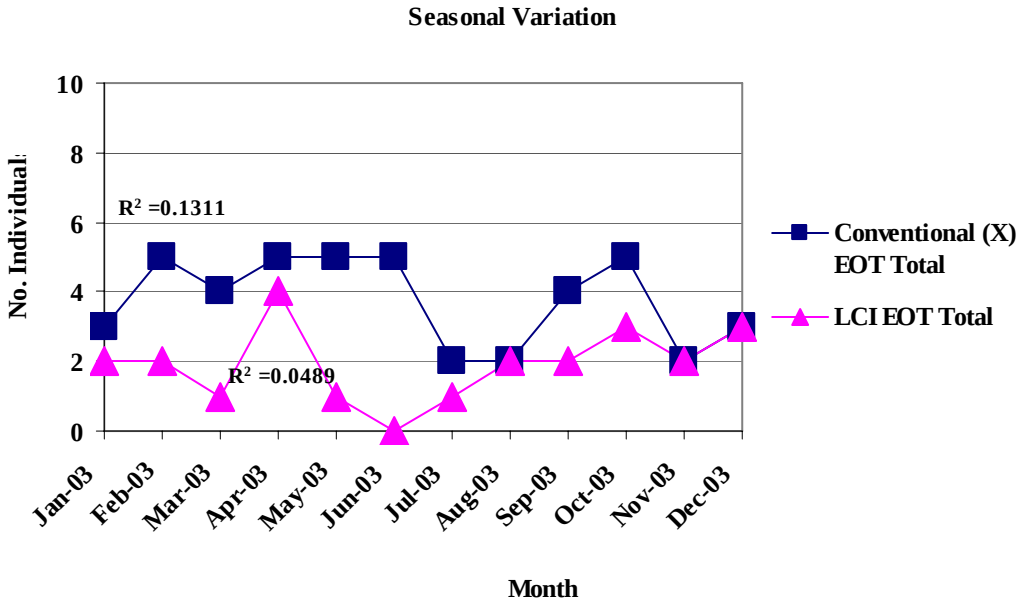

Figure b.

Figure 6a-b. Comparison of EOT metric for LCI and conventional method (expressed as mean) for 2002-2003 data on Lake Seminary, Florida.

The average % EOT score for the conventional method was 0.03 decreasing to 0.02 for the LCI method. This infers that the numerical differences in EOT Total and % EOT is associated to the total number of individuals collected in each sample that contributes to a reduced overall % EOT score.

To examine the dynamics between two benthic groups (EOT and Diptera) in invertebrate communities, the Diptera Total metric value was compared against the EOT Total metric values for each method in Lake Seminary. Data infer that the Total Diptera metric values provided a numerical inverse of the EOT metric values in that 66.66% of the samples for the conventional method were lower than the LCI method in 2002, increasing to 91.66% in 2003 (Tables 3-4). Highlighting abundance changes within the LCI method, Figures 8a and 8b reflect a decline in Dipteran abundance for the sample events in April 2002 and May 2003 thus allowing for more EOT representation within the samples.

Likewise, using the % Diptera metric values, 66.66% of the conventional method samples in 2002 were lower than the LCI method increasing to 83.33% of the samples in 2003. As previously noted, no percentage of EOTs was represented for the May and June 2003 samples using the LCI method. This relates to the increase in % Dipteran illustrated in figures 9a and 9b highlighting dynamic differences in % EOT and % Diptera representation within the samples. Graphical representations of these proportions are illustrated in Figures 9a-b when compared to the data in Figures 7a-b (% EOT). These inverse relations using the various metric categories (provided in the 2000 Development of the Lake Condition Indexes (LCI) for Florida report by Gerritsen et al.) of community structure are popular indicators of ecological responses to anthropogenic stressors (Resh and Jackson 1993).

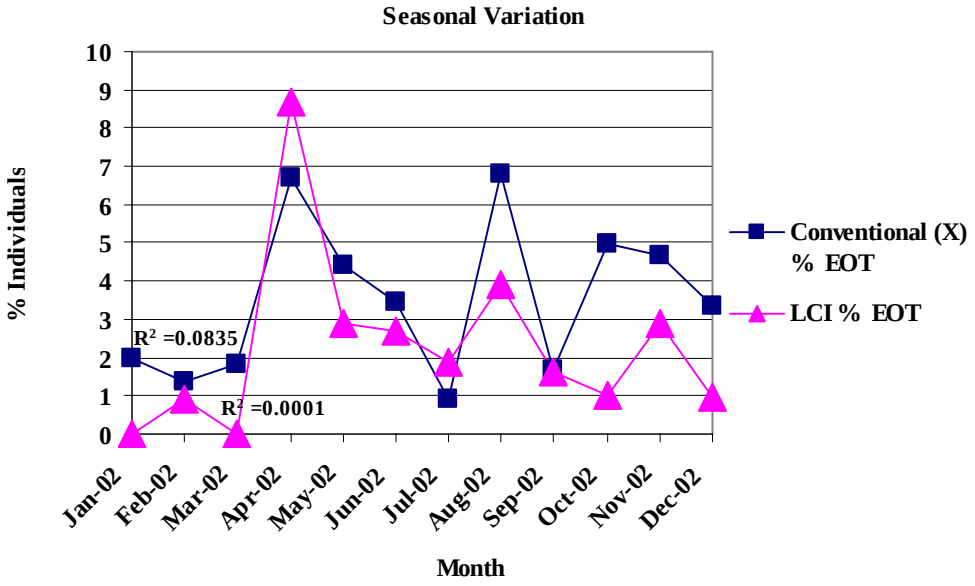

Figure a.

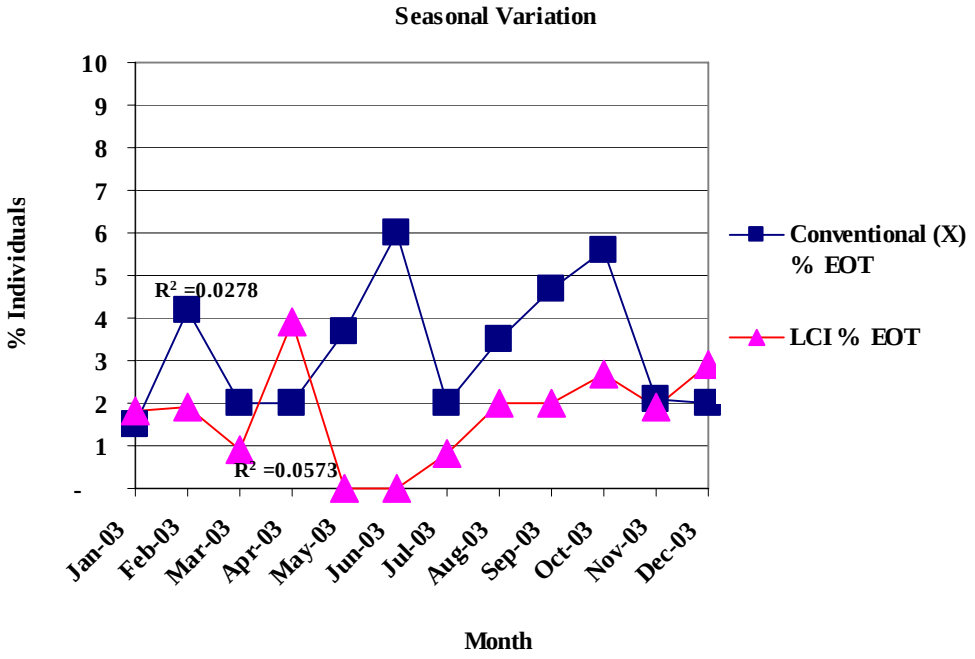

Figure b.

Figure 7a-b. Comparison of %EOT metric for LCI and conventional method (expressed as mean) for 2002-2003 data on Lake Seminary, Florida.

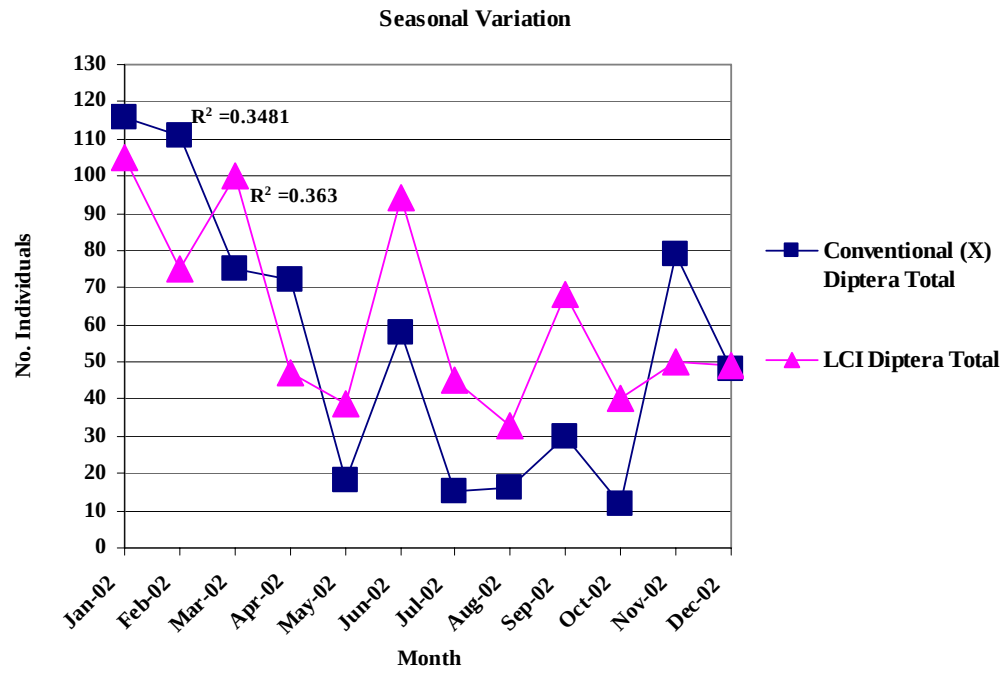

Figure a.

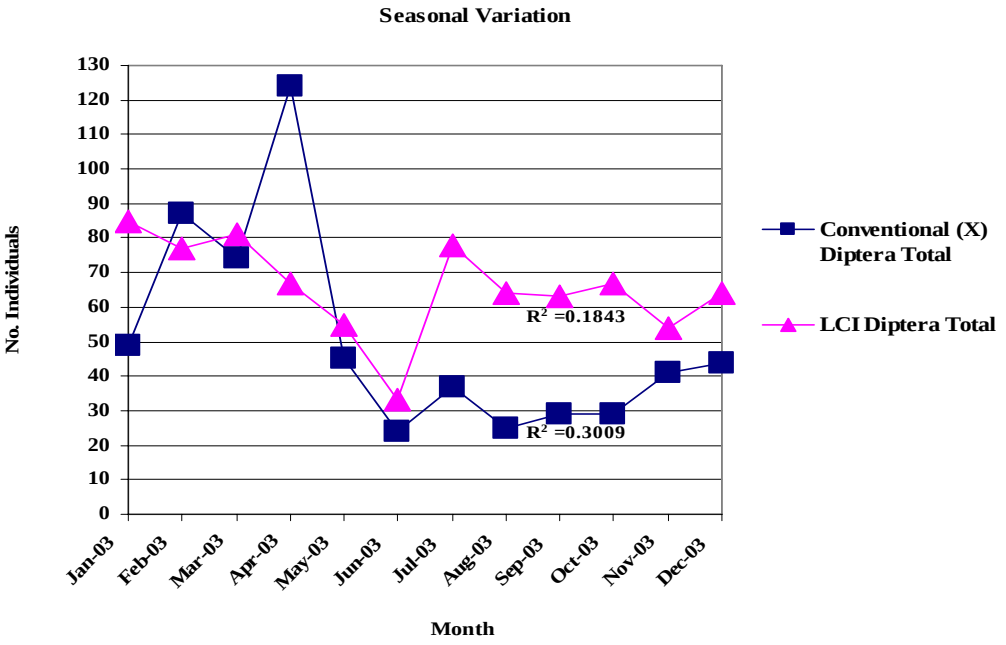

Figure b.

Figure 8a-b. Comparison of Diptera Total metric for LCI and conventional method (expressed as mean) for 2002-2003 data on Lake Seminary, Florida.

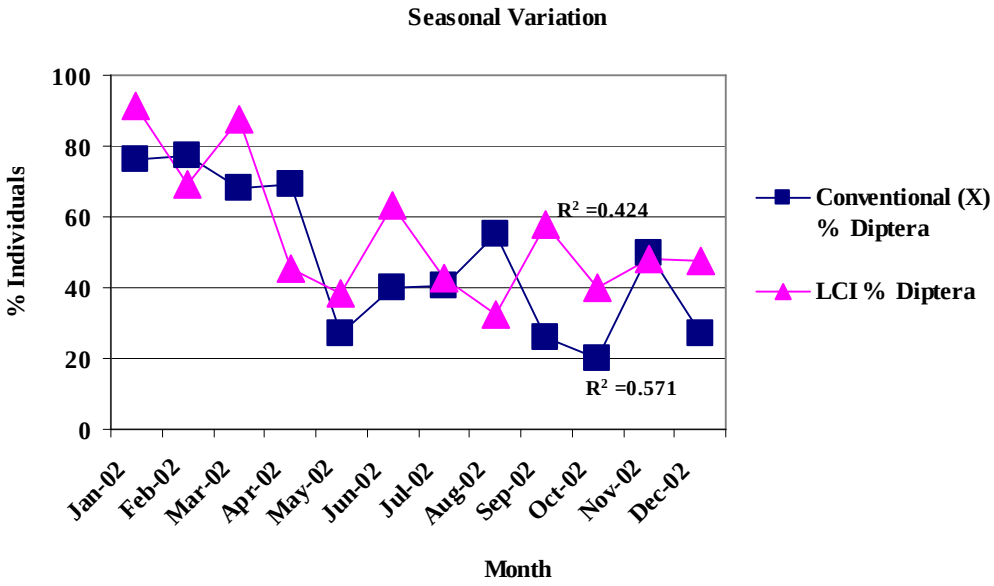

Figure a.

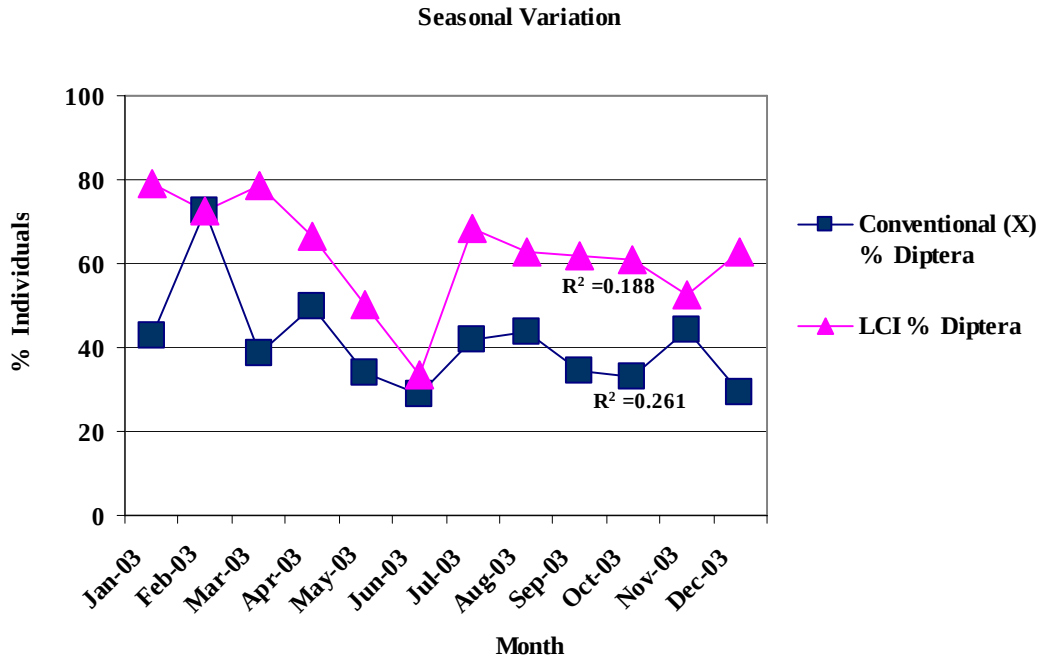

Figure b.

Figure 9a-b. Comparison of % Diptera metric for LCI and conventional method (expressed as mean) for 2002-2003 data o n Lake Seminary, Florida.

The comparison of the four metrics (% EOT/Diptera, Total EOT/Diptera) further deduces that prior to 100 organisms being collected (per protocol) less Dipteran allowed for greater enumeration of the more sensitive taxa and that for when quantifying sensitive taxa and conducting in-depth bioassessments, the conventional method should be the preferred method implemented.

Taxa Richness is a value that indicates the health of the community through its diversity and increases with increasing habitat diversity, suitability and water quality (Plafkin et al.1989). Lake Seminary, being classified as an oligotrophic lake rich in benthic communities, aided in the comparison of the two different methods specific to taxa richness. Taxa Richness equates to the total number of taxa found within the sample. The healthier the community is the greater total number of taxa is found within the community.

Taxa richness data for each method further supports the recommended sampling period this study suggests particular to changes with seasonal variation. Figure 10a and 10b illustrates the data values normalized over the respective years for each method with the exception of the LCI method in that taxa richness values for samples collected from January 2002 through March 2002 (Figure10a) were less that the taxa values associated with the conventional method. In contrast, samples collected for August through September 2003, values for the LCI samples are higher (66.66% occurrence) than the conventional method (Figure 10b). Additional sampling beyond this study timeframe would need to be analyzed to determine if these increases in summer months reflect anomalies of the system.

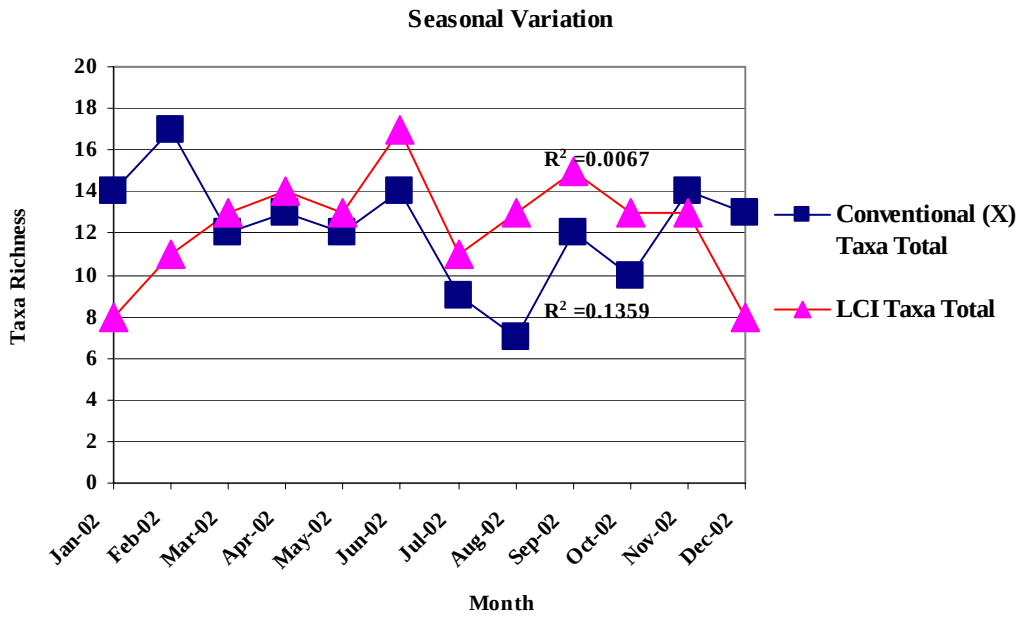

Figure a.

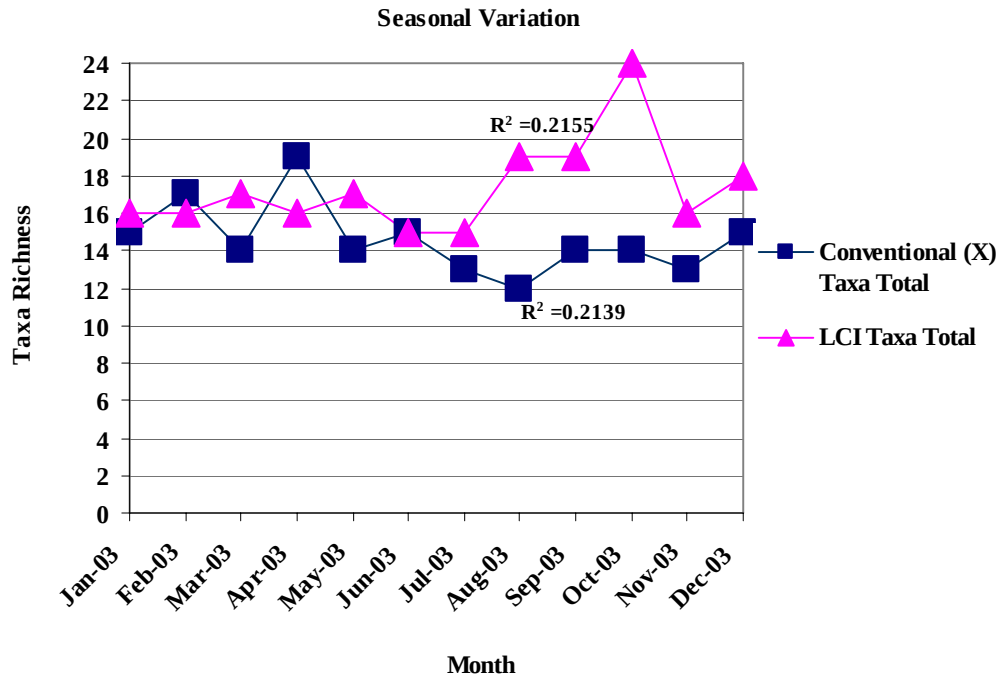

Figure b.

Figure 10a-b. Comparison of Taxa Richness metric for LCI and conventional method (expressed as mean) for 2002-2003 data on Lake Seminary, Florida.

Figure 10a-b also corresponds with the previous EOT total data in that seasonal variation and stability was observed during late fall and winter months suggesting a more productive sampling period to conduct TMDL bioassessments providing a more complete bioassessments of the macroinvertebrate community in this water body. Overall comparison with in this metric category produced similar data between the two sampling techniques when compared to a rapid assessment method (LCI).

When evaluating a variety of pollution tolerant taxa within a specific waterbody, the Hulbert Lake Condition Index (HI) provides a weighted count for these taxa types, with taxa weighted by their tolerance (Hulbert 1990). Higher HI values indicates a greater number of pollution sensitive taxa present therefore an indicator of good water quality sites. Figure 11a represents HI data for each method in 2002, reflecting the decrease in values for the January-March samples. HI metric values for the conventional method produced scores that were equal to the LCI method (50.00 % occurrence) in 2002, increasing to 75.00% in 2003 (Tables 3-4). This infers decreased representation of the pollution sensitive taxa using the LCI method since the EOT taxa values were poorly represented. Although the overall LCI values for HI were less than the conventional method, the values for each method in 2003 remained consistent with seasonal variation demonstrating increases during fall/winter months (Figure 11b).

Shannon-Weiner Diversity Index ($H' = - \Sigma p_i \ln p_i$) is used to measure/compare habitat quality that may be degraded by human activities and is based on the number of species and the distribution of the individuals between the species. The value of this index is known to be more sensitive to adding a new species rather than a change in abundance among the species.

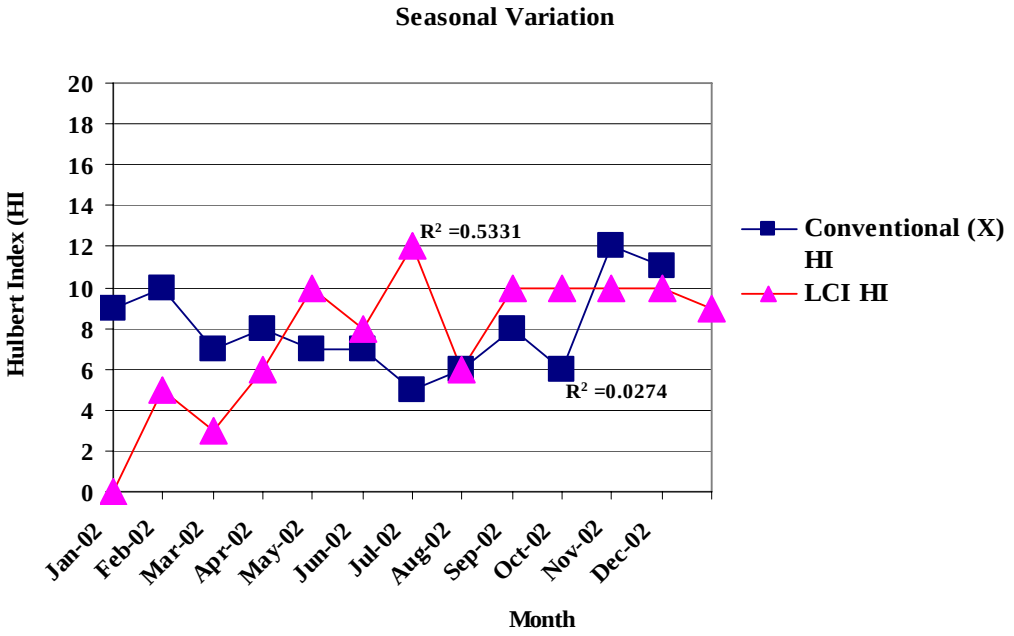

Figure a

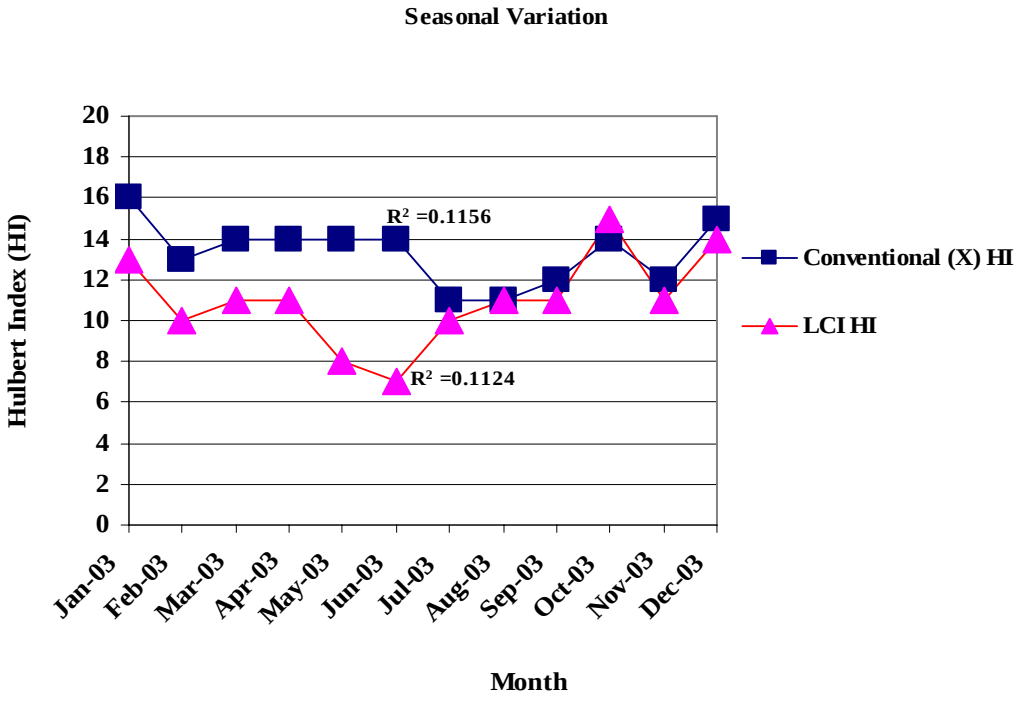

Figure b

Figure 11a-b. Comparison of Hulbert Index (HI) metric for LCI and conventional method (expressed as mean) for 2002-2003 data on Lake Seminary, Florida.

High species diversity indicates the presence of a complex ecological community (MacAuther 1958) by calculating the number of species in the community (richness) and the relative abundance (Molles 2005). As hypothesized, with Lake Seminary's pristine condition rich in benthic marcophtyes, numerical values contained little change in distribution and abundance between species for each method. This deduces that when using H' metric in an oligotrophic system, values would refrain from variance due to the complexity of this type of system. Figures 12a and 12b graphically represent the H' data for this study illustrating consistent numerical values with each sample in each method. Data results within this metric category produced similar data between the two sampling techniques when compared to a rapid assessment technique (LCI).

Lake Jesup vs. Lake Seminary: Conventional Method Data Comparison

Monthly benthic samples were collected and compared in Lake Jesup and Lake Seminary using identical methodologies to further evaluate impaired and unimpaired waterbodies. These monthly metric values are numerically listed in Table 5 for samples collected from January to December 2002 and Table 6 for samples collected from January to December 2003.

For Lake Jesup, species composition was predominantly Oligocheta (mainly Tubificidae), followed by Chaobridae (*Chaoborus punctipenis*), Chironomidae, Gastropoda and Hirudinea. Lake Jesup species are enumerated and listed in Appendix C for 2002 data and Appendix F for 2003 data. Each of the stations within Lake Jesup varied most with taxa richness (values ranging from 0-8) with station 1 presenting elevated taxa richness values as compared to stations 2 and 3.

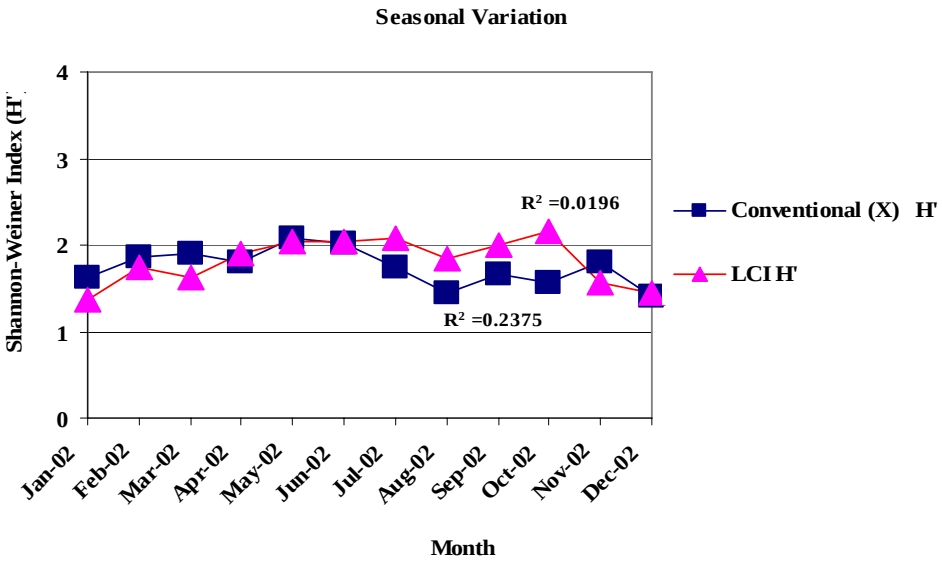

Figure a

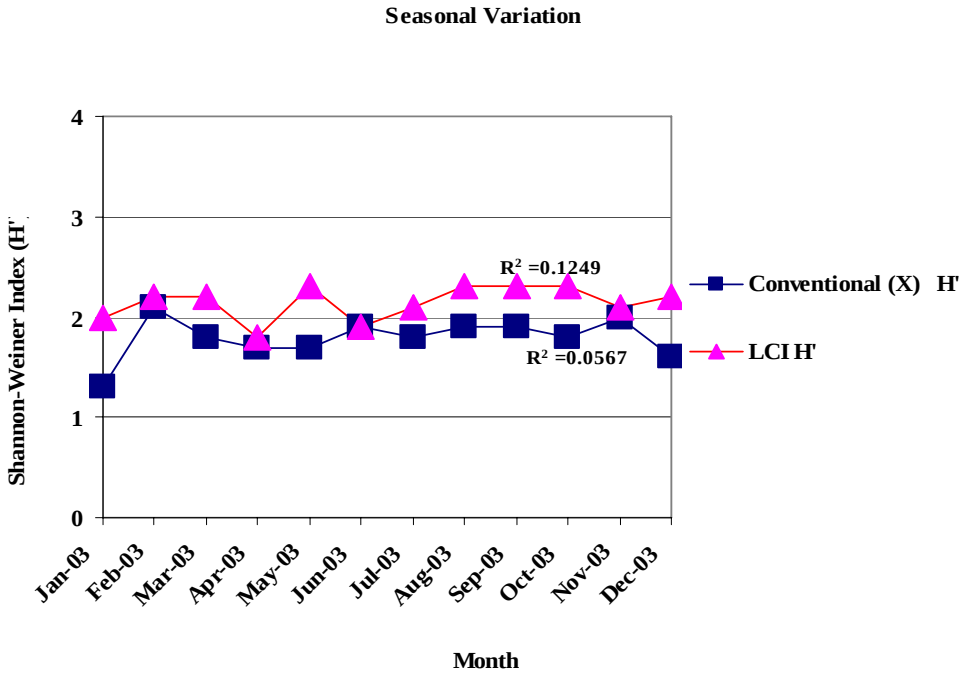

Figure b

Figure 12a-b. Comparison of Shannon-Weiner Diversity Index (H') for LCI and conventional method for 2002-2003 data on Lake Seminary, Florida.

Table 5. Monthly mean values for the Shannon Index, total number of taxa and No. Individuals/m^2 for Lake Jesup and Lake Seminary, 2002.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lake Jesup												
Shannon Index	0.8	0.9	1.2	1.1	1.3	1.0	0.5	0.3	0.4	0.5	0.3	1.1
Total Taxa	5.0	5.0	4.0	6.0	5.0	2.0	2.0	2.0	2.0	2.0	2.0	5.0
No./m^2	3581.0	3290.0	2442.0	1776.0	1191.0	1095.0	111.0	444.0	236.0	1154.0	799.0	2397.0
Lake Seminary												
Shannon Index	1.6	1.9	1.9	1.8	2.1	2.0	1.8	1.5	1.7	1.6	1.6	1.4
Total Taxa	15.0	17.0	12.0	13.0	12.0	14.0	9.0	7.0	12.0	10.0	14.0	13.0
No./m^2	3270.0	2693.0	2205.0	2109.0	880.0	2508.0	688.0	547.0	2227.0	925.0	3889.0	3811.0

Table 6. Monthly mean values for the Shannon Index, total number of taxa and No. Individuals/m^2 for Lake Jesup and Lake Seminary, 2003.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lake Jesup												
Shannon Index	0.9	1.5	1.4	1.3	1.1	1.1	1.1	1.1	1.0	0.6	0.3	1.3
Total Taxa	5.0	8.0	6.0	6.0	5.0	5.0	4.0	5.0	5.0	2.0	3.0	7.0
No./m^2	2027.6	1568.8	1391.0	1435.6	1517.0	466.2	162.8	680.8	910.2	614.2	436.6	2582.6
Lake Seminary												
Shannon Index	1.6	2.1	1.8	1.7	1.7	1.9	1.8	1.9	1.9	1.8	2.0	1.7
Total Taxa	16.0	17.0	14.0	19.0	14.0	15.0	13.0	12.0	14.0	14.0	13.0	15.0
No./m^2	4225.4	2212.6	3966.4	4965.4	2627.0	1457.8	1790.8	1139.6	1620.6	1702.0	1850.0	3085.8

These elevated values for station 1 are mainly contributed to the benthic substrate consisting of course particulate organic matter (CPOM) providing more available invertebrate habitat where as the benthic substrate of stations 2 and 3 consisted of high concentrations of mud/muck most of which was unconsolidated material. For station 1, CPOM deposition is directly related to the discharge of Soldier's Creek into Lake Jesup, just west of station 1 location (Figure 3). In a study conducted by Lobinske et al. (1998), similar benthic fauna composition was observed and concluded that higher density and diversity of macroinvertebrates were found in firmer substrate stations within Lake Jesup.

Biological integrity is associated with how undisturbed an environment is and its function relative to the state of the ecosystem prior to human disturbance (Karr 1981). The more a watershed is altered, the less biological integrity a waterbody holds for the community. According to J. R. Karr, biological integrity is the ability of an aquatic ecosystem to support and maintain a balanced community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitats within a region (termed a reference lake; 1991). Thus, Lake Seminary's species composition contains high biological integrity with a balance of sensitive taxa (EOTs), tolerant taxa and a robust assemblage of functional feeding groups of which all lack presence in the species composition of Lake Jesup. This classifies Lake Seminary as a reference lake within the watershed.

Lake Seminary's species composition consists of various species in the following classifications; Acariformes, Amphipoda, Coleoptera, Decapoda, Diptera, Ephemeroptera, Gastropoda, Odonata, Oligochaeta, Trichoptera, and Turbellaria. Lake Seminary species are enumerated and listed in Appendix A for 2002 data and Appendix D for 2003 data.

When comparing taxa total (or richness) present in Lake Jesup, Figures 13a and 13b illustrates a maximum of 8 taxa identified (which mainly consisted of Diptera and Oligochaeta representatives) whereas Lake Seminary's taxa richness consisted of a minimum of 7 different taxa and a maximum of 19 different taxa. These vast differences in taxa richness support the use of benthic sampling in an impaired and unimpaired waterbody, tracking changes in the biological integrity of the system as pollution control measures and best management practices (BMPs) are implemented within a watershed. Further study would be required to better determine macroinvertebrate response to direct pollution control measures or BMP activity associated to a specific waterbody.

Directly affecting taxa richness, species diversity was also compared between Lake Jesup and Lake Seminary to further assess these changes in different environments. The Shannon-Weiner Diversity Index values in Lake Jesup maintained a maximum value of 1.27 indicating very poor biotic diversity where as Lake Seminary produced a minimum value of 1.45 (Tables 5-6). In addition, although differences in taxa richness were observed within the various stations in Lake Jesup, there were little differences related to H' values. Figure 14a illustrates this extreme difference in diversity values for each lake in 2002 and Figure 14b for 2003. Excessive amounts of nutrients such as nitrogen and phosphorus can lead to an overabundance of primary producers, such as vascular plants and algae, which eventually lead to fish kills and decreased biological diversity caused by a low amount of dissolved oxygen (Wetzel 1983). Species diversity values (H' metric) are numerically represented and compared in Figures 14a and 14b for each lake illustrating a drastic decrease in H' for the hypo-eutrophic Lake Jesup.

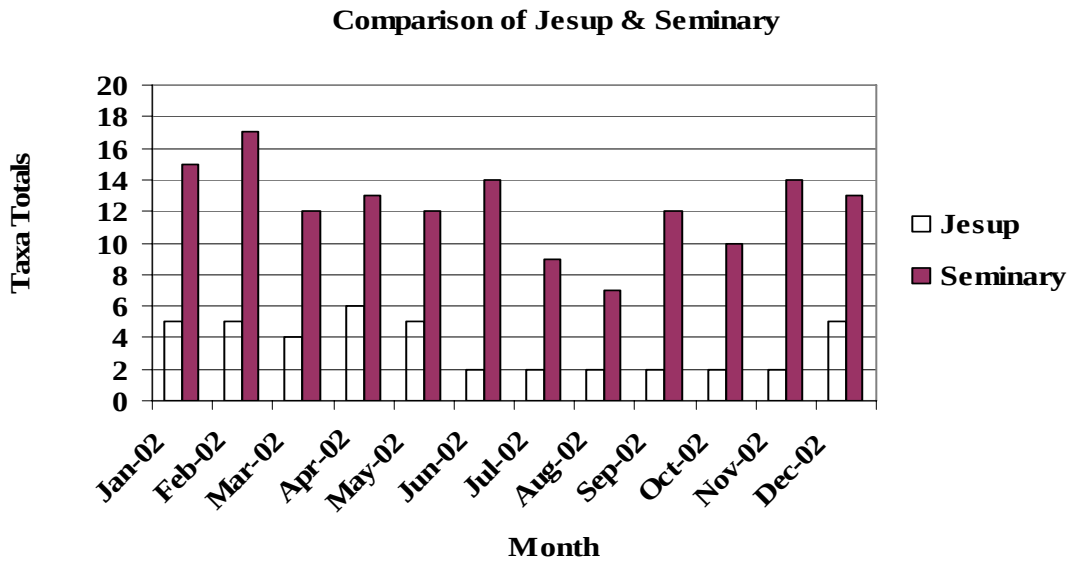

Figure a

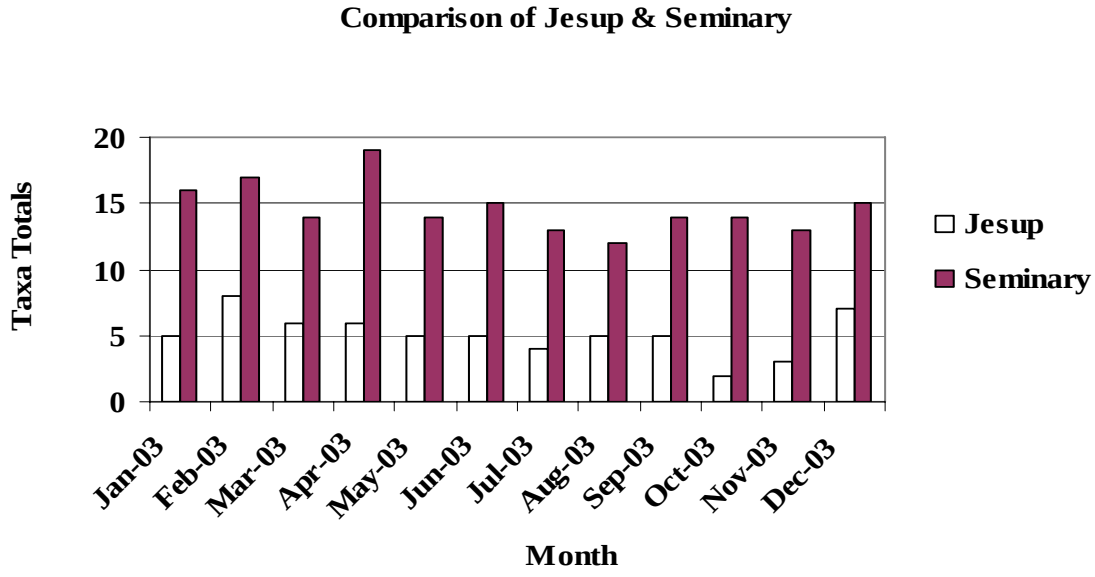

Figure b

Figure 13a-b. Comparison of taxa richness metric. Comparison represents data collected in both an impaired (Jesup) and unimpaired (Seminary) waterbody.

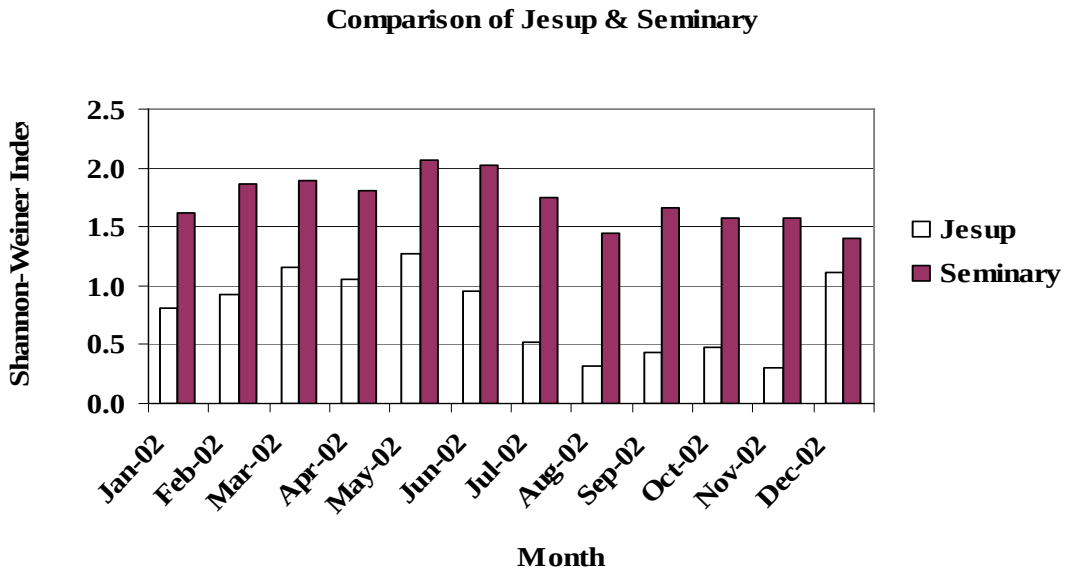

Figure a

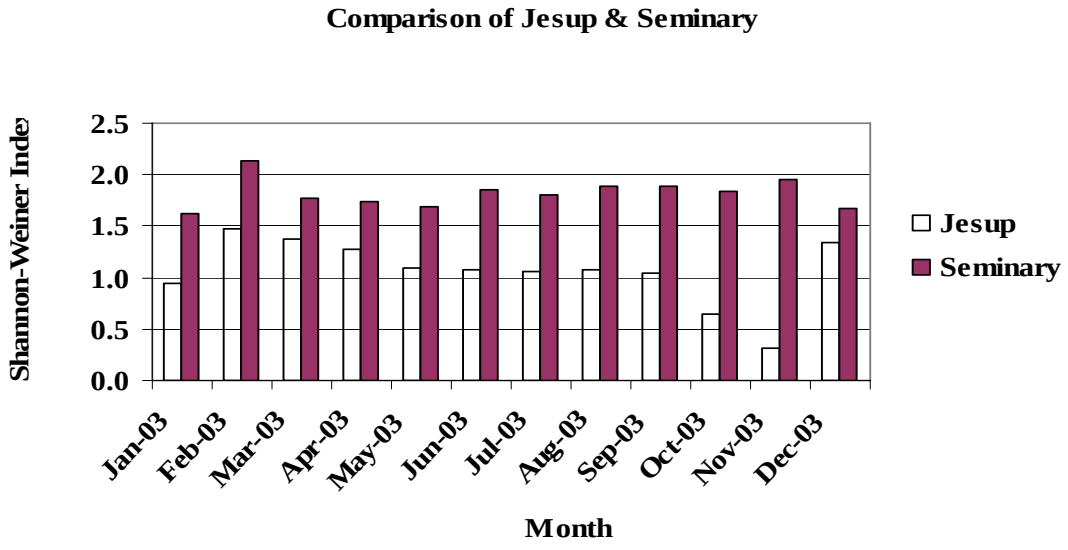

Figure b

Figure 14a-b. Comparison of H' metric. Comparison represents data collected in both an impaired (Jesup) and unimpaired (Seminary) waterbody.

By quantifying and comparing taxa richness and species diversity in a eutrophic lake to a reference (oligotrophic) lake, the assessment establishes TMDL criteria for this freshwater system.

R.G. Wetzel (1983) states that as lakes become more eutrophic, a shift occurs in the percentage composition of two dominant benthic groups, with a decrease in the dipteran chironomid larvae and an increase in the more tolerant oligochaete worms (e.g., tubificids). Demonstrating this shift in percent composition of taxa in a eutrophic system, abundance (number of organisms/m^2) within Lake Jesup was dominant with Dipterans and Oligochaetes. Differences in the abundance metric between the two lakes during the summer season further illustrated the high degree of impairment in Lake Jesup. Lake Jesup was biologically unproductive with only 111 organisms/m^2 collected from all three stations in July 2002, whereas in Lake Seminary, 688 organisms/m^2 were collected (Table 5). Likewise, for 2003 data, only 163 organisms/m^2 were collected from all three stations in July, whereas in Lake Seminary, 1,791 organisms/m^2 were collected (Table 6). Good biotic conditions would be reflected in communities with an even distribution among all four major groups. Skewed populations having a disproportionate number of Chironomidae relative to the more sensitive organisms (Ephemeroptera, Odonata, and Trichoptera) indicate environmental stress (EPA 1990). This plays an important role in the TMDL process and ranking of lakes when using benthic data based on major taxonomic metrics/groups.

Summer months in eutrophic systems present a higher degree of an unstable environment with increases in algal production, fish kills and low dissolved oxygen levels. The benthic region of Lake Jesup during these summer months yielded dissolve oxygen values unsustainable

for aquatic life use; 1.8 mg/L in August 2002 and 4.0 mg/L in September 2003 and indicated in Figures 15a-b. Monthly physicochemical data for this parameter in Lake Jesup can be found in Appendix H for 2002 data and Appendix J for 2003 data. In addition, deformities within identification characteristics of the Chironomidae family were observed in the Lake Jesup samples. The mentum, or toothed plate, is the most notable structure and is located on the anterior ventral margin of the sclerotized head capsule (Epler 2001). Several Lake Jesup specimens appeared to have irregularities in mentum shape such as asymmetry or gapped mentum plate indicating sediment contamination. Mentum deformities were not observed in the Lake Seminary's identifications/samples.

In addition, calculating pollution-intolerant (HI) species present provides a degree of impairment related to the conditions of the waterbody. Of the Hulbert Index scores for the 72 samples collected in Lake Jesup, only 3 samples had a score of 1 (three occurrences of a single *Hyalella azteca* present in station 3) leaving 69 samples with a score of 0. According to Hulbert (1990), lakes with these values fall into the category of grossly altered.

Total number of individuals in each respective sample was also calculated and compared to correlate any trends in seasonal variation between the two lakes. Figures 16a and 16b express the total number of individuals for each lake using the conventional method for trending seasonal variation respective to abundance. As previously mentioned, with the comparison of the two methodologies (conventional and LCI) this study demonstrated that the conventional method provides a more complete assessment of organisms present in the waterbody due to the lack of sub-sampling, resulting in more sensitive taxa (EOTs) represented and less dominant taxa (Dipterans), thus elevating presence and abundance.

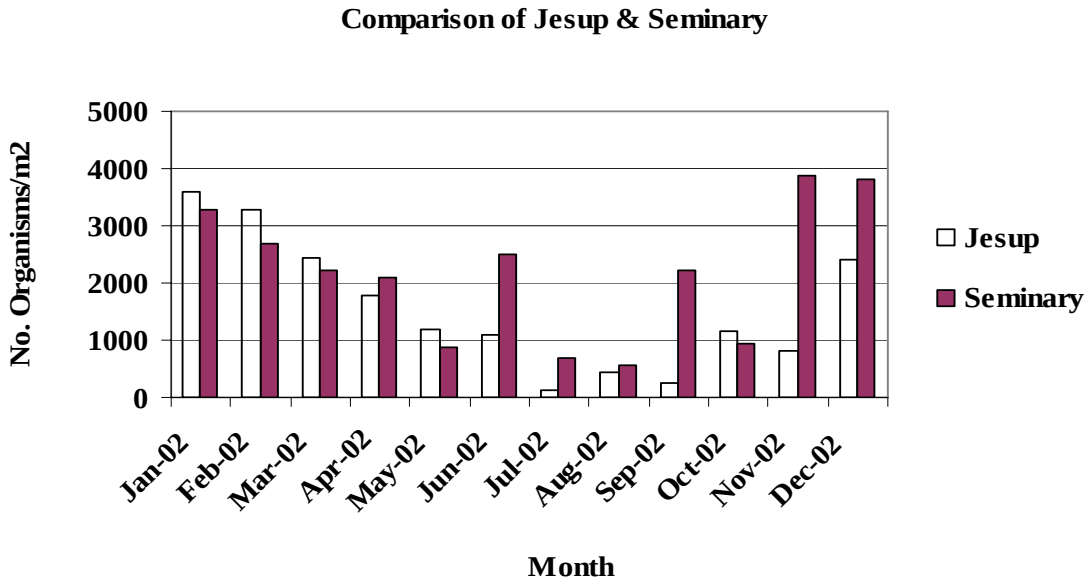

Figure a

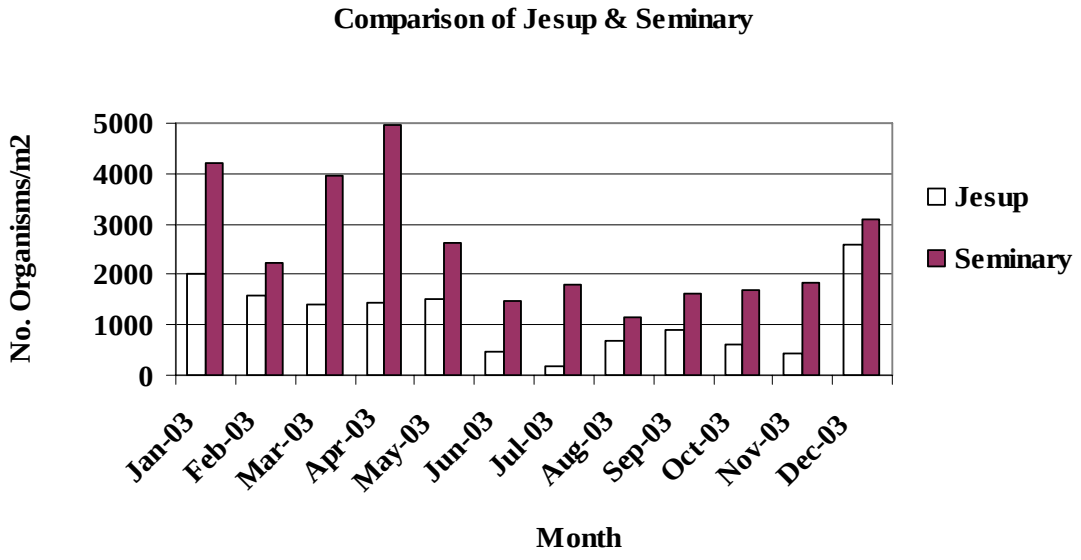

Figure b

Figure 15a-b. Comparison of number of individuals/m^2 metric. Comparison represents data collected in both an impaired (Jesup) and unimpaired (Seminary) waterbody.

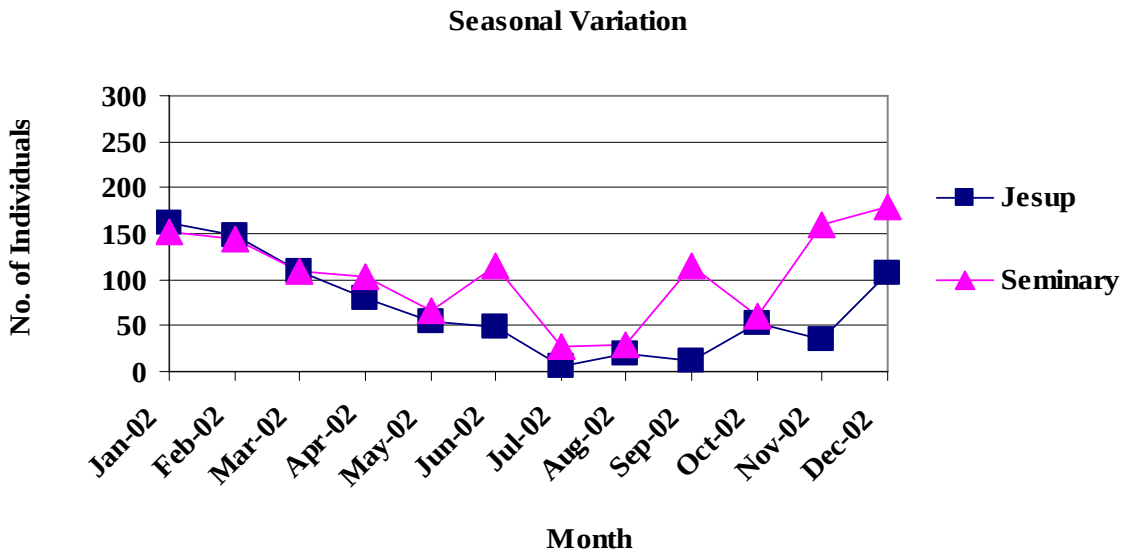

Figure a

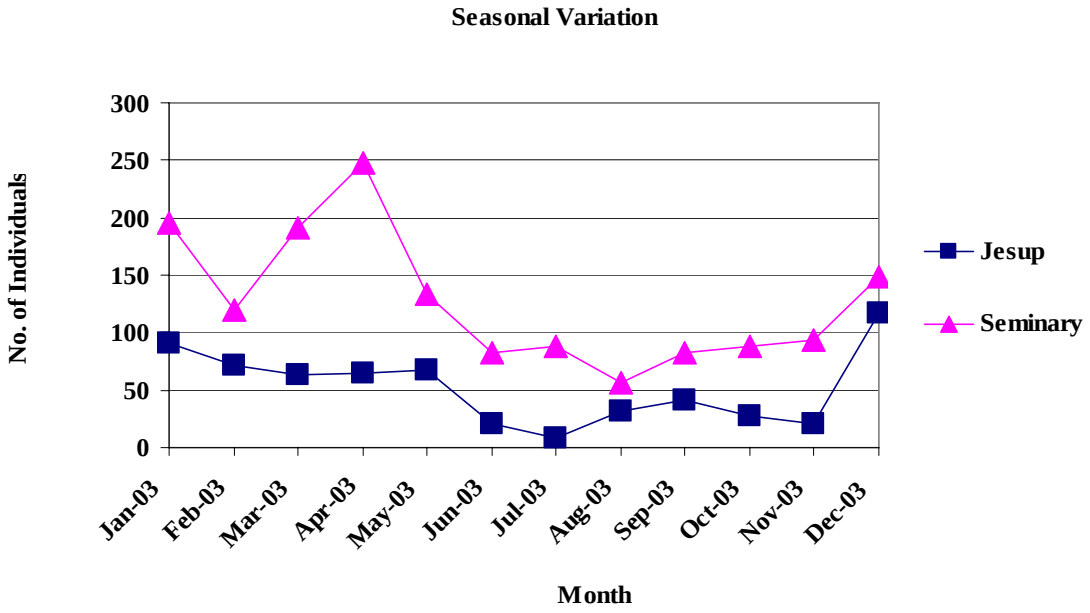

Figure b

Figure 16a-b. Comparison of abundance comparing seasonal variation. Comparison represents data collected in both an impaired (Jesup) and unimpaired (Seminary) waterbody.

Seasonal variation between the two lakes was also observed during late fall and winter months further suggesting a more productive sampling period to conduct TMDL bioassessments and that fluctuations in the conventional method further suggests this method provides a more complete bioassessments of the macroinvertebrate community in a water body.

CONCLUSION

The results of this study conclude the effective use of benthic macroinvertebrates for TMDL bioassessments. Comparative methodology between the LCI and conventional methods indicate that the LCI is a valid, cost-effective and rapid bioassessment method when compared to the conventional method and that the conventional method is an effective tool when more in depth benthic studies are needed as it shows distinct seasonal patterns and accounts for more of the sensitive, intolerant taxa. Furthermore, this type of biological monitoring and trend analysis aids in the implementation of anthropogenic controls that targets waters for TMDLs in suspect systems. The multi-metric approach to bioassessments defines an array of measurements, each of which represents a measurable characteristic of the biological assemblage that changes in a predictable way with increased or decreased environmental stress (Karr 1991, Gibson et al. 1996). When integrated within a watershed management plan, multi-metric indexing functions as an effective overall indicator of the biological condition within a waterbody responding to its watershed. By quantifying multi-metric scores in two methodologies for benthic macroinvertebrates in a eutrophic lake vs. a reference (oligotrophic) lake, establishes TMDL bioassessment criteria for the respective watershed.

In comparison between an impaired and unimpaired waterbody, these types of data provided a pictorial of the spectrum of water quality. On one end, this type of assessment can closely monitor human effects that influence changes in the environment as demonstrated in Lake Seminary, an oligotrophic system. In a rapidly developing watershed, before a lake reaches impairment status, we can use benthic data to monitor these changes in the biotic component and take measures to control the eutrophication process. On the other end, this type of assessment

can monitor reversal trends in eutrophication as demonstrated in Lake Jesup, a eutrophic system. Because the primary stress on Florida lakes is nutrient enrichment and eutrophication, the LCI can be used as a primary variable for determining nutrient criteria for Florida lakes. Traditional water quality measures, especially chlorophyll, are less sensitive than the benthic macroinvertebrates for detecting early changes due to nutrient enrichment in clear lakes (Gerritsen et al. 2000).

As restoration efforts continue to take place in Lake Jesup and its watershed, benthic macroinvertebrate data can monitor these reversal trends via changes in species composition and aid in the implementation of continual restorative efforts. Scientists in many countries have recognized the merits of this approach and are increasingly emphasizing water quality criteria (such as TMDLs) based on benthic macroinvertebrate data (Merritt and Cummins 1996).

In Florida, rapid bioassessment procedures are designed to reduce costs of environmental assessment at a site or group of sites and have both strong supporters and strong detractors. The design of any aquatic insect biomonitoring survey involves making decisions about the use of control or reference sites, the duration of study, the frequency of sampling, the number of sample replicates taken, whether sampling will be confined to specific habitats, the level of taxonomic identifications, and the measures and analysis techniques to be used (Merritt and Cummins 1996). This study supports the use of macroinvertebrate data and the LCI method in rapid bioassessment protocols concluding that it provides an excellent way to examine biological aspects of water quality within the TMDL process for lakes.

APPENDIX A:
MACROINVERTEBRATE ABUNDANCE IN LAKE SEMINARY, SAMPLED BY CONVENTIONAL METHOD, 2002

Table 7. Macroinvertebrate abundance in Lake Seminary, January 12, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	2	10	29	14	303
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	1	1	4	2	44
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.					
Chironomidae					
Chironominae-	1	7	8	5	118
Chironomus sp.	22	98	91	70	1561
Dicrotendipes sp	11			4	81
Polypedilum sp	61	11	7	26	585
Tanytarsus sp.	5	1	11	6	126
Cladotanutarsus sp.	2			1	15
Pseudochironomus sp.					
Glyptotendipes sp.					
Tanypodinae-					
Tanypodinae sp.			2	1	15
Procladius sp.	3	1	2	2	44
Ablabesmyia sp	1	2	2	2	37
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata			1	0	7
Caenis punctata		1	4	2	37
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.					
Cernotia sp.					
Acariformes:					
Hydracarina sp.	5	7	4	5	118
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae	15		5	7	148
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria	1			0	7
Gastropoda					
Micromene sp.					
Planorbella scalaris			1	0	7
Physella sp.	3	8	2	4	96
Total # Species:	14	11	15	13	
Total # Individuals:	133	147	173	151	
# individuals/m2	2953	3263	3841	3352	3241
Shannon-Weiner Index:	1.82	1.28	1.77	1.62	

Table 8. Macroinvertebrate abundance in Lake Seminary, February 16, 2002.

		No. individuals found			Average	No./m2
		Station 1	Station 2	Station 3		
Amphipoda						
Hyalella azteca		6	6	3	5	111
Coleoptera						
Haliplus sp.						
Decapoda						
Palaemonetes paluodousus			2		1	15
Procambarus sp.						
Diptera						
Pupa						
Ceratopogonidae						
	Bezzia sp.	3	1		1	30
	Chaoborus sp.		1		0	7
Chironomidae						
	Chironominae-	8	13	7	9	207
	Chironomus sp.	40	41	54	45	999
	Dicrotendipes sp	3	2		2	37
	Polypedilum sp	61	51	17	43	955
	Tanytarsus sp.	4	3		2	52
	Cladotanutarsus sp.					
	Pseudochironomus sp.	2	1		1	22
	Glyptotendipes sp.		1		0	7
	Tanypodinae-					
	Tanypodinae sp.	1			0	7
	Procladius sp.	7	6	3	5	118
	Ablabesmyia sp		1	1	1	15
	Anatopynia sp.	1			0	7
	Labrundinia sp.					
	Tanypus sp.		1		0	7
Ephemeroptera						
Caenis diminutata		1			0	7
Caenis punctata						
Caenis sp.						

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia	1			0	7
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri	1			0	7
Oecetis species A					
Oxyrthira sp.	1		1	1	15
Cernotia sp.					
Acariformes:					
Hydracarina sp.	6	1	1	3	59
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae	27	14		14	303
Limnodrilus hoffmeisteri	2	5		2	52
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.			1	0	7
Planorbella scalaris	1	2	1	1	30
Physella sp.	3	4	8	5	111
Total # Species:	20	19	11	17	
Total # Individuals:	179	156	97	144	
# individuals/m2	3974	3463	2153	3197	2694
Shannon-Weiner Index:	2.07	2.06	1.47	1.87	

Table 9. Macroinvertebrate abundance in Lake Seminary, March 16, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	18	28	11	19	422
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	2			1	15
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.	2			1	15
Chaoborus sp.					
Chironomidae					
Chironominae-	17		39	19	414
Chironomus sp.	11	28	28	22	496
Dicrotendipes sp			2	1	15
Polypedilum sp	31	17	11	20	437
Tanytarsus sp.	7		8	5	111
Cladotanutarsus sp.		2	1	1	22
Pseudochironomus sp.					
Glyptotendipes sp.	3			1	22
Tanypodinae-					
Tanypodinae sp.			3	1	22
Procladius sp.		1	12	4	96
Ablabesmyia sp	2			1	15
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri	1		1	1	15
Oecetis species A		1		0	7
Oxyrthira sp.			1	0	7
Cernotia sp.					
Acariformes:					
Hydracarina sp.	5	2	3	3	74
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae	16		1	6	126
Limnodrilus hoffmeisteri	4			1	30
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.					
Planorbella scalaris		1		0	7
Physella sp.	6	4		3	74
Total # Species:	14	9	13	12	
Total # Individuals:	125	84	121	110	
# individuals/m2	2775	1865	2686	2442	2205
Shannon-Weiner Index:	2.27	1.45	1.97	1.90	

Table 10. Macroinvertebrate abundance in Lake Seminary, April 27, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	15	9	14	13	281
Coleoptera					
Haliplus sp.	1			0	7
Decapoda					
Palaemonetes paluodousus		2	1	1	22
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.		4		1	30
Chironomidae					
Chironominae-	5		11	5	118
Chironomus sp.	13	1	9	8	170
Dicrotendipes sp	1	1	2	1	30
Polypedilum sp	33	13	114	53	1184
Tanytarsus sp.			3	1	22
Cladotanutarsus sp.					
Pseudochironomus sp.					
Glyptotendipes sp.			1	0	7
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.	2		3	2	37
Ablabesmyia sp		1		0	7
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.			1	0	7
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.	5	8	6	6	141
Cernotia sp.					
Acariformes:					
Hydracarina sp.	2	2	2	2	44
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae	3	1	1	2	37
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.		2	1	1	22
Planorbella scalaris		1	3	1	30
Physella sp.	3	8	3	5	104
Total # Species:	11	13	16	13	
Total # Individuals:	83	53	175	104	
# individuals/m2	1843	1177	3885	2301	2109
Shannon-Weiner Index:	1.83	2.15	1.45	1.81	

Table 11. Macroinvertebrate abundance in Lake Seminary, May 18, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	4	28	10	14	311
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	3	7		3	74
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.	2			1	15
Chaoborus sp.			1	0	7
Chironomidae					
Chironominae-	1			0	7
Chironomus sp.		12	17	10	215
Dicrotendipes sp		2		1	15
Polypedilum sp	9	5	2	5	118
Tanytarsus sp.	1			0	7
Cladotanutarsus sp.	1			0	7
Pseudochironomus sp.					
Glyptotendipes sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.		1		0	7
Ablabesmyia sp					
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.	6	1	1	3	59
Cernotia sp.					
Acariformes:					
Hydracarina sp.	2	1	1	1	30
Koenika sp.					
Krendowskia sp.					
Neumania sp.		1		0	7
Oligochaeta					
Lumbericulidae sp.					
Tubificidae	9		1	3	74
Limnodrilus hoffmeisteri	4			1	30
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.		9	13	7	163
Planorbella scalaris	4	8	9	7	155
Physella sp.	6	16	4	9	192
Total # Species:	13	12	10	12	
Total # Individuals:	52	91	59	67	
# individuals/m2	1154	2020	1310	1495	881
Shannon-Weiner Index:	2.34	2.01	1.85	2.07	

Table 12. Macroinvertebrate abundance in Lake Seminary, June 23, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	65	8	38	37	821
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	7	2	9	6	133
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae	1			0	7
Bezzia sp.					
Chaoborus sp.					
Chironomidae					
Chironominae-	13	1		5	104
Chironomus sp.	3	5	32	13	296
Dicrotendipes sp	11		14	8	185
Polypedilum sp	46	2	33	27	599
Tanytarsus sp.	1			0	7
Cladotanutarsus sp.			1	0	7
Pseudochironomus sp.	5			2	37
Glyptotendipes sp.	4			1	30
Tanypodinae-					
Tanypodinae sp.			3	1	22
Procladius sp.					
Ablabesmyia sp					
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.	1			0	7

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia	4		2	2	44
Libellulidae sp.					
Libellula sp.		1		0	7
Enallagma sp.					
Trichoptera:					
Oecetis sp.	5			2	37
Oecetis porteri	1			0	7
Oecetis species A					
Oxyrthira sp.	1			0	7
Cernotia sp.					
Acariformes:					
Hydracarina sp.	13	1	3	6	126
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.	1			0	7
Tubificidae	2			1	15
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	4	16	28	16	355
Planorbella scalaris	3	1	7	4	81
Physella sp.	7	16	10	11	244
	21	10	12	14	
Total # Species:	198	53	180	144	
Total # Individuals:	4396	1177	3996	3189	2509
# individuals/m2	2.21	1.77	2.08	2.02	
Shannon-Weiner Index:	2.54	2.12	2.11	2.23	

Table 13. Macroinvertebrate abundance in Lake Seminary, July 27, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	26		8	11	252
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	4	2	1	2	52
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.					
Chironomidae					
Chironominae-		1		0	7
Chironomus sp.	1	6	1	3	59
Dicrotendipes sp	6		2	3	59
Polypedilum sp	11		10	7	155
Tanytarsus sp.	1			0	7
Cladotanutarsus sp.			4	1	30
Pseudochironomus sp.					
Glyptotendipes sp.		1		0	7
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Ablabesmyia sp			1	0	7
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.	1			0	7
Cernotia sp.					
Acariformes:					
Hydracarina sp.	3	1	1	2	37
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae	1			0	7
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	5			2	37
Planorbella scalaris	5		1	2	44
Physella sp.	4	4		3	59
Total # Species:	12	6	9	9	
Total # Individuals:	68	15	29	37	
# individuals/m2	1510	333	644	829	688
Shannon-Weiner Index:	1.97	1.52	1.76	1.75	

Table 14. Macroinvertebrate abundance in Lake Seminary, August 17, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	4	5	10	6	141
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus					
Procambarus sp.					
Diptera					
Pupa	1			0	7
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	2			1	15
Chironomidae					
Chironominae-					
Chironomus sp.	18	11	7	12	266
Dicrotendipes sp			1	0	7
Polypedilum sp					
Tanytarsus sp.	1			0	7
Cladotanutarsus sp.					
Pseudochironomus sp.					
Glyptotendipes sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Ablabesmyia sp	2	4		2	44
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri	1			0	7
Oecetis species A					
Oxyrthira sp.	1		4	2	37
Cernotia sp.					
Acariformes:					
Hydracarina sp.		1	1	1	15
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae					
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.					
Planorbella scalaris		1		0	7
Physella sp.	3	3	6	4	89
Total # Species:	9	6	6	7	
Total # Individuals:	33	25	29	29	
# individuals/m2	733	555	644	644	548
Shannon-Weiner Index:	1.56	1.48	1.32	1.45	

Table 15. Macroinvertebrate abundance in Lake Seminary, September 25, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	36	22	129	62	1384
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	4	1	4	3	67
Procambarus sp.					
Diptera					
Pupa		1		0	7
Ceratopogonidae					
Bezzia sp.			1	0	7
Chaoborus sp.					
Chironomidae					
Chironominae-	2	2	1	2	37
Chironomus sp.	4			1	30
Dicrotendipes sp	29	6	29	21	474
Polypedilum sp	2		3	2	37
Tanytarsus sp.			1	0	7
Cladotanutarsus sp.					
Pseudochironomus sp.					
Glyptotendipes sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.			2	1	15
Ablabesmyia sp	2	3	1	2	44
Anatopynia sp.					
Labrundinia sp.	1			0	7
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia	1			0	7
Libellulidae sp.		1	1	1	15
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri	1		2	1	22
Oecetis species A					
Oxyrthira sp.	1			0	7
Cernotia sp.					
Acariformes:					
Hydracarina sp.	5		3	3	59
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae					
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.					
Planorbella scalaris	2	3	9	5	104
Physella sp.	6	23		10	215
Total # Species:	14	9	13	12	
Total # Individuals:	96	62	186	115	
# individuals/m2	2131	1376	4129	2546	2227
Shannon-Weiner Index:	1.83	1.14	2.00	1.66	

Table 16. Macroinvertebrate abundance in Lake Seminary, October 15, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	9	19	39	22	496
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus					
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.					
Chironomidae					
Chironominae-	1			0	7
Chironomus sp.	1			0	7
Dicrotendipes sp	24	3		9	200
Polypedilum sp	1			0	7
Tanytarsus sp.		2		1	15
Cladotanutarsus sp.					
Pseudochironomus sp.	1			0	7
Glyptotendipes sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Ablabesmyia sp	1	3		1	30
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.		2		1	15
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.	1			0	7
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.	7	2	5	5	104
Cernotia sp.					
Acariformes:					
Hydracarina sp.		2	2	1	30
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.	2			1	15
Tubificidae	5			2	37
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	10	1	3	5	104
Planorbella scalaris	1		1	1	15
Physella sp.	7	11	14	11	237
Total # Species:	14	9	6	10	
Total # Individuals:	71	45	64	60	
# individuals/m2	1576	999	1421	1332	925
Shannon-Weiner Index:	2.06	1.59	1.06	1.57	

Table 17. Macroinvertebrate abundance in Lake Seminary, November 16, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	46	33	120	66	1473
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	1	1	1	1	22
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.			2	1	15
Chironomidae					
Chironominae-	1	1	3	2	37
Chironomus sp.	34	59		31	688
Dicrotendipes sp	23	7	60	30	666
Polypedilum sp	5	7	4	5	118
Tanytarsus sp.			2	1	15
Cladotanutarsus sp.					
Pseudochironomus sp.	17	1	2	7	148
Glyptotendipes sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.		1		0	7
Ablabesmyia sp	4	2	2	3	59
Anatopynia sp.					
Labrundinia sp.			1	0	7
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.	1	1		1	15

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia	1			0	7
Libellulidae sp.					
Libellula sp.			1	0	7
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.	5	1		2	44
Cernotia sp.	1		3	1	30
Acariformes:					
Hydracarina sp.	3		1	1	30
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae					
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	1			0	7
Planorbella scalaris		1	4	2	37
Physella sp.	11	3		5	104
Total # Species:	15	13	14	14	
Total # Individuals:	154	118	206	159	
# individuals/m2	3419	2620	4573	3537	3389
Shannon-Weiner Index:	2.00	1.48	1.23	1.57	

Table 18. Macroinvertebrate abundance in Lake Seminary, December 26, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	270	29	52	117	2597
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	1	3		1	30
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.					
Chironomidae					
Chironominae-	1			0	7
Chironomus sp.	13	42	22	26	570
Dicrotendipes sp	10	5	13	9	207
Polypedilum sp	2	5	4	4	81
Tanytarsus sp.			1	0	7
Cladotanutarsus sp.					
Pseudochironomus sp.	10	4	5	6	141
Glyptotendipes sp.		1		0	7
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Ablabesmyia sp	3	2	3	3	59
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Pupa	1			0	7
Oecetis sp.					
Oecetis porteri	1		1	1	15
Oecetis species A					
Oxyrthira sp.		1	1	1	15
Cernotia sp.	5			2	37
Acariformes:					
Hydracarina sp.	3		1	1	30
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.	1			0	7
Tubificidae					
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	6		2	3	59
Planorbella scalaris	3		1	1	30
Physella sp.	1	5	6	4	89
Total # Species:	16	10	13	13	
Total # Individuals:	331	97	112	180	
# individuals/m2	7348	2153	2486	3996	3811
Shannon-Weiner Index:	0.9	1.5	1.79	1.40	

APPENDIX B:
MACROINVERTEBRATE ABUNDANCE IN LAKE SEMINARY, SAMPLED BY THE DEP/LCI METHOD, 2002

Table 19. Macroinvertebrate abundance in Lake Seminary, January 12, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	7
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	
Chironomidae	
Chironominae-	7
Chironomus sp.	35
Dicrotendipes sp	1
Polypedilum sp	56
Tanytarsus sp.	3
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	
Ablabesmyia sp	3
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	
Cernotia sp.	
Acariformes:	
Hydracarina sp.	3
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	
Planorbella scalaris	
Physella sp.	
Total # Species:	8
Total # Individuals:	115
Shannon-Weiner Index:	1.37

Table 20. Macroinvertebrate abundance in Lake Seminary, February 16, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	15
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	
Chironomidae	
Chironominae-	2
Chironomus sp.	34
Dicrotendipes sp	2
Polypedilum sp	36
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	1
Ablabesmyia sp	
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	1
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	
Cernotia sp.	
Acariformes:	
Hydracarina sp.	5
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	1
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	3
Planorbella scalaris	1
Physella sp.	7
Total # Species:	11
Total # Individuals:	108
Shannon-Weiner Index:	1.74

Table 21. Macroinvertebrate abundance in Lake Seminary, March 16, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	6
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	1
Chaoborus sp.	
Chironomidae	
Chironominae-	12
Chironomus sp.	17
Dicrotendipes sp	3
Polypedilum sp	60
Tanytarsus sp.	3
Cladotanutarsus sp.	1
Pseudochironomus sp.	
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	1
Ablabesmyia sp	2
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	
Cernotia sp.	
Acariformes:	
Hydracarina sp.	
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	6
Limnodrilus hoffmeisteri	1
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	
Planorbella scalaris	1
Physella sp.	
Total # Species:	13
Total # Individuals:	114
Shannon-Weiner Index:	1.63

Table 22. Macroinvertebrate abundance in Lake Seminary, April 27, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	25
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	3
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	1
Chironomidae	
Chironominae-	2
Chironomus sp.	2
Dicrotendipes sp	1
Polypedilum sp	39
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	1
Ablabesmyia sp	1
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	2
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	1
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	6
Cernotia sp.	
Acariformes:	
Hydracarina sp.	
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	5
Planorbella scalaris	2
Physella sp.	12
Total # Species:	14
Total # Individuals:	103
Shannon-Weiner Index:	1.9

Table 23. Macroinvertebrate abundance in Lake Seminary, May 18, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	35
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	5
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	
Chironomidae	
Chironominae-	1
Chironomus sp.	15
Dicrotendipes sp	
Polypedilum sp	20
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	2
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	
Ablabesmyia sp	1
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	3
Cernotia sp.	
Acariformes:	
Hydracarina sp.	
Koenika sp.	1
Krendowskia sp.	1
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	2
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	3
Planorbella scalaris	5
Physella sp.	7
Total # Species:	13
Total # Individuals:	101
Shannon-Weiner Index:	2.04

Table 24. Macroinvertebrate abundance in Lake Seminary, June 23, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	18
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	2
Procambarus sp.	1
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	
Chironomidae	
Chironominae-	
Chironomus sp.	12
Dicrotendipes sp	17
Polypedilum sp	58
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	1
Glyptotendipes sp.	2
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	1
Ablabesmyia sp	3
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	
Caenis sp.	1

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	1
Libellulidae sp.	
Libellula sp.	1
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	1
Cernotia sp.	
Acariformes:	
Hydracarina sp.	
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	2
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	18
Planorbella scalaris	3
Physella sp.	6
Total # Species:	17
Total # Individuals:	148
Shannon-Weiner Index:	2.03

Table 25. Macroinvertebrate abundance in Lake Seminary, July 27, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	26
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	3
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	
Chironomidae	
Chironominae-	4
Chironomus sp.	9
Dicrotendipes sp	7
Polypedilum sp	25
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	
Ablabesmyia sp	
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	1
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	1
Cernotia sp.	
Acariformes:	
Hydracarina sp.	
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	3
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	4
Planorbella scalaris	4
Physella sp.	17
Mysidacea	
Mysid sp.	1
Total # Species:	11
Total # Individuals:	105
Shannon-Weiner Index:	2.08

Table 26. Macroinvertebrate abundance in Lake Seminary, August 17, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	40
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	1
Procambarus sp.	
Diptera	
Pupa	1
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	1
Chironomidae	
Chironominae-	1
Chironomus sp.	18
Dicrotendipes sp	9
Polypedilum sp	1
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	
Ablabesmyia sp	2
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	4
Cernotia sp.	
Acariformes:	
Hydracarina sp.	2
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	1
Planorbella scalaris	3
Physella sp.	18
Total # Species:	13
Total # Individuals:	102
Shannon-Weiner Index:	1.85

Table 27. Macroinvertebrate abundance in Lake Seminary, September 25, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	18
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	6
Procambarus sp.	
Diptera	
Pupa	1
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	
Chironomidae	
Chironominae-	8
Chironomus sp.	1
Dicrotendipes sp	48
Polypedilum sp	6
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	2
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	1
Procladius sp.	
Ablabesmyia sp	1
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	1
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	
Cernotia sp.	1
Acariformes:	
Hydracarina sp.	11
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	1
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	
Planorbella scalaris	4
Physella sp.	8
Total # Species:	15
Total # Individuals:	118
Shannon-Weiner Index:	2.00

Table 28. Macroinvertebrate abundance in Lake Seminary, October 15, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	23
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	2
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	9
Chironomidae	
Chironominae-	
Chironomus sp.	3
Dicrotendipes sp	19
Polypedilum sp	3
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	1
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	
Ablabesmyia sp	5
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	5
Cernotia sp.	
Acariformes:	
Hydracarina sp.	6
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	4
Micromene sp.	1
Planorbella scalaris	19
Physella sp.	
Total # Species:	13
Total # Individuals:	100
Shannon-Weiner Index:	2.16

Table 29. Macroinvertebrate abundance in Lake Seminary, November 16, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	40
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	3
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	1
Chironomidae	
Chironominae-	1
Chironomus sp.	14
Dicrotendipes sp	27
Polypedilum sp	5
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	
Ablabesmyia sp	2
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	3
Cernotia sp.	
Acariformes:	
Hydracarina sp.	1
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	2
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	1
Planorbella scalaris	3
Physella sp.	1
Total # Species:	13
Total # Individuals:	104
Shannon-Weiner Index:	1.81

Table 30. Macroinvertebrate abundance in Lake Seminary, December 26, 2002.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	39
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	6
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	
Chironomidae	
Chironominae-	
Chironomus sp.	41
Dicrotendipes sp	2
Polypedilum sp	1
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	2
Ablabesmyia sp	3
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	1
Cernotia sp.	
Acariformes:	
Hydracarina sp.	
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	
Planorbella scalaris	
Physella sp.	8
Total # Species:	8
Total # Individuals:	103
Shannon-Weiner Index:	1.44

APPENDIX C:
MACROINVERTEBRATE ABUNDANCE IN LAKE JESUP SAMPLED BY THE CONVENTIONAL MENTHOD, 2002

Table 31. Macroinvertebrate abundance in Lake Jesup, January 8, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	95	94	74	88	1946
Chironomidae					
Chironominae-					
Chironomus sp.	5	2	3	3	74
Glyptotendipes sp.					
Polypedilum sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.		1		0	7
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.		1	2	1	22
Tubificidae	18	46	129	64	1428
Limnodrilus hoffmeisteri	2	8	4	5	104
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae					
Total # Species:	4	6	5	5	
Total # Individuals:	120	152	212	161	
# individuals/m2	2664	3374	4706	3582	3582
Shannon-Weiner Index:	0.67	0.93	0.84	0.81	

Table 32. Macroinvertebrate abundance in Lake Jesup, February 4, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.			2	1	15
Chaoborus sp.	88	72	53	71	1576
Chironomidae					
Chironominae-					
Chironomus sp.	4	2	29	12	259
Glyptotendipes sp.					
Polypedilum sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.	4		2	2	44
Procladius sp.			1	0	7
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	33	15	128	59	1302
Limnodrilus hoffmeisteri		10		3	74
Turbellaria					
Planaria					
Gastropoda					
Physella sp.		1		0	7
Hydrobiidae		1		0	7
Total # Species:	4	6	6	5	
Total # Individuals:	129	101	215	148	
# individuals/m2	2864	2242	4773	3293	3293
Shannon-Weiner Index:	0.82	0.92	1.03	0.92	

Table 33. Macroinvertebrate abundance in Lake Jesup, March 15, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	58	47	38	48	1058
Chironomidae					
Chironominae-					
Chironomus sp.	15	4	59	26	577
Glyptotendipes sp.					
Polypedilum sp		1		0	7
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.		1		0	7
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	8	39	30	26	570
Limnodrilus hoffmeisteri	7	17	4	9	207
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae		1	1	1	15
Total # Species:	4	7	5	5	
Total # Individuals:	88	110	132	110	
# individuals/m2	1954	2442	2930	2442	2442
Shannon-Weiner Index:	0.99	1.26	1.19	1.15	

Table 34. Macroinvertebrate abundance in Lake Jesup, April 9, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	33	33	26	31	681
Chironomidae					
Chironominae-					
Chironomus sp.	13		5	6	133
Glyptotendipes sp.					
Polypedilum sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.			1	0	7
Procladius sp.					
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	18	52	37	36	792
Limnodrilus hoffmeisteri	14	0	8	7	163
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae					
Total # Species:	4	3	5	4	
Total # Individuals:	78	85	77	80	
# individuals/m2	1732	1887	1709	1776	1776
Shannon-Weiner Index:	1.30	0.66	1.18	1.05	

Table 35. Macroinvertebrate abundance in Lake Jesup, May 10, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	8	8	1	6	126
Chironomidae					
Chironominae-					
Chironomus sp.	14	1	10	8	185
Glyptotendipes sp.	1			0	7
Polypedilum sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.		1		0	7
Procladius sp.	1		10	4	81
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.	1			0	7
Tubificidae	29	18	31	26	577
Limnodrilus hoffmeisteri	16	9	2	9	200
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae					
Total # Species:	7	5	5	6	
Total # Individuals:	70	37	54	54	
# individuals/m2	1554	821	1199	1191	1191.4
Shannon-Weiner Index:	1.45	1.22	1.13	1.27	

Table 36. Macroinvertebrate abundance in Lake Jesup, June 3, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	1			0	7
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	2	3	1	2	44
Chironomidae					
Chironominae-					
Chironomus sp.	1			0	7
Glyptotendipes sp.					
Polypedilum sp	3	1	5	3	67
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.	7		3	3	74
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	29	23	58	37	814
Limnodrilus hoffmeisteri	3	2	5	3	74
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae			1	0	7
Total # Species:	6	4	6	5	
Total # Individuals:	45	29	73	49	
# individuals/m2	999	644	1621	1088	1095
Shannon-Weiner Index:	1.23	0.84	0.79	0.95	

Table 37. Macroinvertebrate abundance in Lake Jesup, July 4, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.					
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.					
Polypedilum sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.	4	1	2	2	52
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Oligochaeta					
Hirudinea sp.	5			2	37
Tubificidae		2		1	15
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae	1			0.3	7
Total # Species:	3	2	1	2	
Total # Individuals:	10	3	2	5	
# individuals/m2	222	67	44	111	111
Shannon-Weiner Index:	0.94	0.63	0.00	0.52	

Table 38. Macroinvertebrate abundance in Lake Jesup, August 8, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	1	48	4	18	392
Chironomidae		4	3	2	52
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.					
Polypedilum sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae					
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae					
Total # Species:	1	2	2	2	
Total # Individuals:	1	52	7	20	
# individuals/m2	22	1154	155	444	444
Shannon-Weiner Index:	0.00	0.27	0.68	0.32	

Table 39. Macroinvertebrate abundance in Lake Jesup, September 5, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	1	3	4	3	59
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.					
Polypedilum sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	16			5	118
Limnodrilus hoffmeisteri	7			2	52
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae		1		0.3	7
Total # Species:	3	2	1	2	
Total # Individuals:	24	4	4	11	
# individuals/m2	533	89	89	237	237
Shannon-Weiner Index:	0.76	0.56	0.00	0.44	

Table 40. Macroinvertebrate abundance in Lake Jesup, October 4, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	30	37	62	43	955
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.					
Polypedilum sp	1	6		2	52
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	13	7		7	148
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae					
Total # Species:	3	3	1	2	
Total # Individuals:	44	50	62	52	
# individuals/m2	977	1110	1376	1154	1154
Shannon-Weiner Index:	0.70	0.75	0.00	0.48	

Table 41. Macroinvertebrate abundance in Lake Jesup, November 15, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	46	27	22	32	703
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.					
Polypedilum sp	1	9		3	74
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae					
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae		3		1	22
Total # Species:	2	3	1	2	
Total # Individuals:	47	39	22	36	
# individuals/m2	1043	866	488	799	799
Shannon-Weiner Index:	0.10	0.79	0.00	0.30	

Table 42. Macroinvertebrate abundance in Lake Jesup, December 26, 2002.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Unidentified larvae		1		0	7
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.			1	0	7
Chaoborus sp.	29	62	101	64	1421
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.			1	0	7
Polypedilum sp	5	2	11	6	133
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Anatopynia sp.					
Ablabesmyia sp					
Tanypus sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	12	31	32	25	555
Limnodrilus hoffmeisteri	11	12	12	12	259
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae		1		0	7
Total # Species:	4	6	6	5	
Total # Individuals:	57	108	158	108	
# individuals/m2	1265	2398	3508	2390	2398
Shannon-Weiner Index:	1.20	1.08	1.05	1.11	

APPENDIX D:
MACROINVERTEBRATE ABUNDANCE IN LAKE SEMINARY, SAMPLED BY CONVENTIONAL METHOD, 2003

Table 43. Macroinvertebrate abundance in Lake Seminary, January 20, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	201	92	102	132	2923
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	1	2	1	1	30
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.	1			0	7
Chaoborus sp.					
Chironomidae					
Chironominae-	1			0	7
Chironomus sp.	10	40	19	23	511
Dicrotendipes sp	9	5	13	9	200
Polypedilum sp	2	7	4	4	96
Tanytarsus sp.	1		2	1	22
Cladotanutarsus sp.					
Pseudochironomus sp.	12	4	5	7	155
Glyptotendipes sp.		1		0	7
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.	1			0	7
Ablabesmyia sp	4	3	3	3	74
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Pupa	1			0	7
Oecetis sp.					
Oecetis porteri	1		1	1	15
Oecetis species A					
Oxyrthira sp.		2	1	1	22
Cernotia sp.	4			1	30
Acariformes:					
Hydracarina sp.	12	2	1	5	111
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.	1			0	7
Tubificidae					
Limnodrilus hoffmeisteri					
Hirudinea sp.	1			0	7
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	1	2	1	1	30
Planorbella scalaris	1	2	1	1	30
Physella sp.	3	5	4	4	89
Total # Species:	20	13	14	16	
Total # Individuals:	268	167	158	198	
# individuals/m2	5950	3707	3508	4388	4225
Shannon-Weiner Index:	1.17	1.47	1.36	1.33	

Table 44. Macroinvertebrate abundance in Lake Seminary, February 25, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	6	6	3	5	111
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus		2		1	15
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.	3	1		1	30
Chaoborus sp.		1		0	7
Chironomidae					
Chironominae-	8	13	7	9	207
Chironomus sp.	29	32	17	26	577
Dicrotendipes sp	4	5		3	67
Polypedilum sp	52	41	18	37	821
Tanytarsus sp.	4	3		2	52
Cladotanutarsus sp.					
Pseudochironomus sp.	3	1		1	30
Glyptotendipes sp.		1		0	7
Tanypodinae-					
Tanypodinae sp.	2			1	15
Procladius sp.	6	6	3	5	111
Ablabesmyia sp		1	2	1	22
Anatopynia sp.	1			0	7
Labrundinia sp.					
Tanypus sp.		1		0	7
Ephemeroptera					
Caenis diminutata	1			0	7
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia	1			0	7
Libellulidae sp.		3		1	22
Libellula sp.					
Enallagma sp.		1		0	7
Trichoptera:					
Oecetis sp.					
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.	1	1	1	1	22
Cernotia sp.					
Acariformes:					
Hydracarina sp.	6	1	1	3	59
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae	14	17		10	229
Limnodrilus hoffmeisteri	1	6		2	52
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.			1	0	7
Planorbella scalaris	3	2	1	2	44
Physella sp.	7	5	4	5	118
Total # Species:	19	22	11	17	
Total # Individuals:	152	150	58	120	
# individuals/m2	3374	3330	1288	2664	2213
Shannon-Weiner Index:	2.22	2.32	1.86	2.13	

Table 45. Macroinvertebrate abundance in Lake Seminary, March 25, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	95	118	76	96	2139
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	2	3		2	37
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.		1		0	7
Chaoborus sp.					
Chironomidae					
Chironominae-	15		37	17	385
Chironomus sp.	12	20	30	21	459
Dicrotendipes sp			1	0	7
Polypedilum sp	25	35	12	24	533
Tanytarsus sp.	7		8	5	111
Cladotanutarsus sp.		2	1	1	22
Pseudochironomus sp.					
Glyptotendipes sp.	2			1	15
Tanypodinae-					
Tanypodinae sp.			2	1	15
Procladius sp.	1	1	11	4	96
Ablabesmyia sp	1			0	7
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.		1		0	7

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri	1		1	1	15
Oecetis species A		1		0	7
Oxyrthira sp.	1		1	1	15
Cernotia sp.					
Acariformes:					
Hydracarina sp.	6	4	2	4	89
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae	5		1	2	44
Limnodrilus hoffmeisteri	1			0	7
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	1	2		1	22
Planorbella scalaris		1		0	7
Physella sp.	6	7	12	8	185
Total # Species:	16	13	14	14	
Total # Individuals:	181	196	195	191	
# individuals/m2	4018	4351	4329	4233	3966
Shannon-Weiner Index:	2.14	1.33	1.83	1.77	

Table 46. Macroinvertebrate abundance in Lake Seminary, April 21, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	66	80	120	89	1968
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	1	2	3	2	44
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.	1	1	1	1	22
Chaoborus sp.					
Chironomidae					
Chironominae-					
Chironomus sp.	11	8	6	8	185
Dicrotendipes sp	8	1	17	9	192
Polypedilum sp	140	17	105	87	1939
Tanytarsus sp.		1	7	3	59
Tanytarsus limneticus	1		13	5	104
Cladotanutarsus sp.					
Pseudochironomus sp.	9	2	3	5	104
Glyptotendipes sp.	4		2	2	44
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.	2	2	3	2	52
Ablabesmyia sp	4		5	3	67
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.		1	1	1	15

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.		1		0	7
Epitheca stella/sepia					
Libellulidae sp.		2		1	15
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.	1		1	1	15
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.	2	1	3	2	44
Cernotia sp.					
Acariformes:					
Hydracarina sp.	1		11	4	89
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Hirudinea sp.	1			0	7
Lumbericulidae sp.					
Tubificidae	1	6	8	5	111
Limnodrilus hoffmeisteri		1		0	7
Mysidacea					
Mysid sp.		2		1	15
Turbellaria					
Planaria			1	0	7
Gastropoda					
Micromene sp.	1			0	7
Planorbella scalaris	2	9	5	5	118
Physella sp.	15	13	7	12	259
Total # Species:	19	18	20	19	
Total # Individuals:	271	150	322	248	
# individuals/m2	6016	3330	7148	5498	4965
Shannon-Weiner Index:	1.59	1.76	1.87	1.74	

Table 47. Macroinvertebrate abundance in Lake Seminary, May 19, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	32	92	58	61	1347
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	5	17	6	9	207
Procambarus sp.	1			0	7
Diptera					
Pupa			1	0	7
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.					
Chironomidae					
Chironominae-		2	1	1	22
Chironomus sp.	2	5	15	7	163
Dicrotendipes sp	9	5	3	6	126
Polypedilum sp	28	10	44	27	607
Tanytarsus sp.					
Tanytarsus limneticus			2	1	15
Cladotanutarsus sp.					
Pseudochironomus sp.	1	3		1	30
Glyptotendipes sp.		1	1	1	15
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.			1	0	7
Ablabesmyia sp		1	1	1	15
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.	1			0	7
Epicordulia princeps	1			0	7
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.	1			0	7
Enallagma sp.					
Trichoptera:					
Oecetis sp.		1		0	7
Oecetis porteri					
Oxyrthira sp.			1	0	7
Cernotia sp.					
Acariformes:					
Hydracarina sp.	1	2		1	22
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Hirudinea sp.	4	1		2	37
Lumbericulidae sp.					
Tubificidae	21			7	155
Limnodrilus hoffmeisteri					
Mysidacea					
Mysid sp.			4	1	30
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.					
Planorbella scalaris	3	2	2	2	52
Physella sp.	3	5		3	59
Total # Species:	15	14	14	14	
Total # Individuals:	113	147	140	133	
# individuals/m2	2509	3263	3108	2960	2627
Shannon-Weiner Index:	1.98	1.46	1.62	1.69	

Table 48. Macroinvertebrate abundance in Lake Seminary, June 27, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	27	47	32	35	784
Coleoptera		1		0	7
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus		1	1	1	15
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.	3			1	22
Chaoborus sp.		2	1	1	22
Chironomidae					
Chironominae-					
Chironomus sp.	3	1	5	3	67
Dicrotendipes sp	4	1	7	4	89
Polypedilum sp	12	6	22	13	296
Tanytarsus sp.	1			0	7
Tanytarsus limneticus					
Cladotanutarsus sp.					
Pseudochironomus sp.					
Glyptotendipes sp.		1		0	7
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.			1	0	7
Ablabesmyia sp	2	1	1	1	30
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.	1	1	1	1	22

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.	2			1	15
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.	1		1	1	15
Enallagma sp.					
Trichoptera:					
Oecetis sp.	1			0	7
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.			1	0	7
Cernotia sp.					
Acariformes:					
Hydracarina sp.	1		4	2	37
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Hirudinea sp.	7			2	52
Lumbericulidae sp.					
Tubificidae	8		4	4	89
Limnodrilus hoffmeisteri	1	1		1	15
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.					
Planorbella scalaris	4	2	3	3	67
Physella sp.	12	2	7	7	155
Total # Species:	17	13	15	15	
Total # Individuals:	90	67	91	83	
# individuals/m2	1998	1487	2020	1835	1458
Shannon-Weiner Index:	2.28	1.28	2.00	1.85	

Table 49. Macroinvertebrate abundance in Lake Seminary, July 15, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	30	12	59	34	747
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	1	1	2	1	30
Procambarus sp.					
Diptera					
Pupa			1	0	7
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	1	2		1	22
Chironomidae					
Chironominae-	1		4	2	37
Chironomus sp.	1	1	5	2	52
Dicrotendipes sp	21	25	21	22	496
Polypedilum sp	1	3	2	2	44
Tanytarsus sp.					
Tanytarsus limneticus					
Cladotanutarsus sp.					
Pseudochironomus sp.			1	0	7
Glyptotendipes sp.					
Cladopelma sp.		1	5	2	44
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Ablabesmyia sp	2	4	9	5	111
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.	1			0	7
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.	1			0	7
Cernotia sp.					
Acariformes:					
Hydracarina sp.	10	12	2	8	178
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Hirudinea sp.					
Lumbericulidae sp.					
Tubificidae	4			1	30
Limnodrilus hoffmeisteri	1			0	7
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.		1		0	7
Planorbella scalaris	2	4	3	3	67
Physella sp.	2	6		3	59
Total # Species:	15	12	12	13	
Total # Individuals:	79	72	114	88	
# individuals/m2	1754	1598	2531	1961	1791
Shannon-Weiner Index:	1.85	1.96	1.63	1.81	

Table 50. Macroinvertebrate abundance in Lake Seminary, August 25, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	14	33	15	21	459
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	1	1	4	2	44
Procambarus sp.					
Diptera					
Pupa			1	0	7
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	1	2		1	22
Chironomidae					
Chironominae-	2	1	1	1	30
Chironomus sp.	1	1	1	1	22
Dicrotendipes sp	16	3	14	11	244
Polypedilum sp	3	2	1	2	44
Tanytarsus sp.					
Tanytarsus limneticus					
Cladotanutarsus sp.					
Pseudochironomus sp.					
Glyptotendipes sp.					
Cladopelma sp.			1	0	7
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.		2	1	1	22
Ablabesmyia sp	5	10	7	7	163
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.			1	0	7

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.		2		1	15
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.	1			0	7
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.					
Cernotia sp.					
Acariformes:					
Hydracarina sp.	2		4	2	44
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Hirudinea sp.		1		0	7
Lumbericulidae sp.					
Tubificidae					
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.					
Planorbella scalaris	1		7	3	59
Physella sp.	3	4		2	52
Total # Species:	12	12	13	12	
Total # Individuals:	50	62	58	57	
# individuals/m2	1110	1376	1288	1258	1140
Shannon-Weiner Index:	1.93	1.66	2.06	1.88	

Table 51. Macroinvertebrate abundance in Lake Seminary, September 30, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	22	18	65	35	777
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	3	2	4	3	67
Procambarus sp.					
Diptera					
Pupa	1			0	7
Ceratopogonidae					
Bezzia sp.	1			0	7
Chaoborus sp.					
Chironomidae					
Chironominae-	1	2	1	1	30
Chironomus sp.	3	4	1	3	59
Dicrotendipes sp	22	15	19	19	414
Polypedilum sp	1	1	3	2	37
Tanytarsus sp.		1		0	7
Cladotanutarsus sp.					
Pseudochironomus sp.					
Glyptotendipes sp.					
Cladopelma sp.	3	2	4	3	67
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.		1		0	7
Ablabesmyia sp		2	1	1	22
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.			1	0	7
Libellula sp.	1	1		1	15
Enallagma sp.					
Trichoptera:					
Oecetis sp.					
Oecetis porteri			2	1	15
Oecetis species A					
Oxyrthira sp.		1	1	1	15
Cernotia sp.					
Acariformes:					
Hydracarina sp.	7	2		3	67
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae					
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	1			0	7
Planorbella scalaris	3	1	9	4	96
Physella sp.	4	8	6	6	133
Total # Species:	14	15	13	14	
Total # Individuals:	73	61	117	84	
# individuals/m2	1621	1354	2597	1857	1621
Shannon-Weiner Index:	1.98	2.11	1.56	1.88	

Table 52. Macroinvertebrate abundance in Lake Seminary, October 24, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	47	36	25	36	799
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	1	2	1	1	30
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.	1			0	7
Chaoborus sp.					
Chironomidae					
Chironominae-	1		1	1	15
Chironomus sp.	3	3	4	3	74
Dicrotendipes sp	19	23	20	21	459
Polypedilum sp	3	1	2	2	44
Tanytarsus sp.	1		1	1	15
Cladotanutarsus sp.					
Pseudochironomus sp.					
Glyptotendipes sp.					
Cladopelma sp.	1	2		1	22
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.	1			0	7
Ablabesmyia sp			1	0	7
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.		1	1	1	15
Libellula sp.	1			0	7
Enallagma sp.					
Trichoptera:					
Oecetis sp.			2	1	15
Oecetis porteri		1		0	7
Oecetis species A					
Oxyrthira sp.	1	2	2	2	37
Cernotia sp.					
Acariformes:					
Hydracarina sp.	5	7	7	6	141
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae					
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	1		1	1	15
Planorbella scalaris	3	1	6	3	74
Physella sp.	5	9	7	7	155
Total # Species:	16	12	15	14	
Total # Individuals:	94	88	81	88	
# individuals/m2	2087	1954	1798	1946	1702
Shannon-Weiner Index:	1.74	1.72	2.07	1.84	

Table 53. Macroinvertebrate abundance in Lake Seminary, November 27, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	45	31	25	34	747
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	1	1		1	15
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.	1			0	7
Chaoborus sp.					
Chironomidae					
Chironominae-	1			0	7
Chironomus sp.	12	22	21	18	407
Dicrotendipes sp	10	17	4	10	229
Polypedilum sp	4	3	7	5	104
Tanytarsus sp.			1	0	7
Cladotanutarsus sp.					
Pseudochironomus sp.	2		3	2	37
Glyptotendipes sp.					
Cladopelma sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.	7	5	4	5	118
Ablabesmyia sp			1	0	7
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.			2	1	15
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.	4	2	1	2	52
Cernotia sp.					
Acariformes:					
Hydracarina sp.	7	5	1	4	96
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae					
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	1	1	2	1	30
Planorbella scalaris	3	3	2	3	59
Physella sp.	5	4	8	6	126
Total # Species:	14	11	14	13	
Total # Individuals:	103	94	82	93	
# individuals/m2	2287	2087	1820	2065	1850
Shannon-Weiner Index:	1.96	1.85	2.05	1.95	

Table 54. Macroinvertebrate abundance in Lake Seminary, December 22, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca	158	67	34	86	1917
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus	1	2	1	1	30
Procambarus sp.					
Diptera					
Pupa					
Ceratopogonidae					
Bezzia sp.	1		1	1	15
Chaoborus sp.					
Chironomidae					
Chironominae-	1			0	7
Chironomus sp.	12	38	21	24	525
Dicrotendipes sp	9	13	5	9	200
Polypedilum sp	4	5	1	3	74
Tanytarsus sp.			1	0	7
Cladotanutarsus sp.					
Pseudochironomus sp.	4	4	3	4	81
Glyptotendipes sp.		1		0	7
Cladopelma sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.	5	3	2	3	74
Ablabesmyia sp		1		0	7
Anatopynia sp.					
Labrundinia sp.					
Tanypus sp.					
Ephemeroptera					
Caenis diminutata					
Caenis punctata					
Caenis sp.					

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Odonata					
Celithemis sp.					
Epitheca stella/sepia					
Libellulidae sp.					
Libellula sp.					
Enallagma sp.					
Trichoptera:					
Oecetis sp.	1		1	1	15
Oecetis porteri					
Oecetis species A					
Oxyrthira sp.	2	2	1	2	37
Cernotia sp.	1			0	7
Acariformes:					
Hydracarina sp.	5	4	1	3	74
Koenika sp.					
Krendowskia sp.					
Neumania sp.					
Oligochaeta					
Lumbericulidae sp.					
Tubificidae		1		0	7
Limnodrilus hoffmeisteri					
Turbellaria					
Planaria					
Gastropoda					
Micromene sp.	4		1	2	37
Planorbella scalaris	3	3	1	2	52
Physella sp.	5	7	6	6	133
Total # Species:	16	14	15	15	
Total # Individuals:	216	151	80	149	
# individuals/m2	4795	3352	1776	3308	3086
Shannon-Weiner Index:	1.23	1.73	1.79	1.58	

APPENDIX E:
MACROINVERTEBRATE ABUNDANCE IN LAKE SEMINARY, SAMPLED BY THE DEP/LCI METHOD, 2003

Table 55. Macroinvertebrate abundance in Lake Seminary, January 20, 2003.

		No. individuals found Composite
Amphipoda		
Hyalella azteca		9
Coleoptera		
Haliplus sp.		
Decapoda		
Palaemonetes paluodousus		1
Procambarus sp.		
Diptera		
Pupa		
Ceratopogonidae		
Bezzia sp.		
Chaoborus sp.		
Chironomidae		
Chironominae-		1
	Chironomus sp.	29
	Dicrotendipes sp	1
	Polypedilum sp	36
	Tanytarsus sp.	3
	Cladotanutarsus sp.	
	Pseudochironomus sp.	
	Glyptotendipes sp.	5
Tanypodinae-		
	Tanypodinae sp.	1
	Procladius sp.	6
	Ablabesmyia sp	3
	Anatopynia sp.	
	Labrundinia sp.	
	Tanypus sp.	
Ephemeroptera		
Caenis diminutata		1
Caenis punctata		

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	2
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	
Cernotia sp.	
Acariformes:	
Hydracarina sp.	3
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	2
Planorbella scalaris	
Physella sp.	4
Total # Species:	16
Total # Individuals:	107
Shannon-Weiner Index:	2.02

Table 56. Macroinvertebrate abundance in Lake Seminary, February 25, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	7
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	
Chironomidae	
Chironominae-	2
Chironomus sp.	31
Dicrotendipes sp	4
Polypedilum sp	26
Tanytarsus sp.	5
Cladotanutarsus sp.	1
Pseudochironomus sp.	
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	1
Procladius sp.	7
Ablabesmyia sp	
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	2
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	2
Cernotia sp.	
Acariformes:	
Hydracarina sp.	6
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	4
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	1
Planorbella scalaris	2
Physella sp.	5
Total # Species:	16
Total # Individuals:	106
Shannon-Weiner Index:	2.19

Table 57. Macroinvertebrate abundance in Lake Seminary, March 25, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	9
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	1
Chironomidae	
Chironominae-	12
Chironomus sp.	8
Dicrotendipes sp	7
Polypedilum sp	31
Tanytarsus sp.	4
Cladotanutarsus sp.	1
Pseudochironomus sp.	2
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	3
Procladius sp.	7
Ablabesmyia sp	4
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	1
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	4
Cernotia sp.	
Acariformes:	
Hydracarina sp.	
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	2
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	2
Planorbella scalaris	5
Physella sp.	
Total # Species:	17
Total # Individuals:	103
Shannon-Weiner Index:	2.19

Table 58. Macroinvertebrate abundance in Lake Seminary, April 21, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	16
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	1
Chironomidae	
Chironominae-	
Chironomus sp.	3
Dicrotendipes sp	8
Polypedilum sp	50
Tanytarsus sp.	1
Tanytarsus limneticus	
Cladotanutarsus sp.	
Pseudochironomus sp.	2
Glyptotendipes sp.	2
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	1
Ablabesmyia sp	
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	1
Epitheca stella/sepia	
Libellulidae sp.	1
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	1
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	2
Cernotia sp.	
Acariformes:	
Hydracarina sp.	
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	4
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	
Planorbella scalaris	6
Physella sp.	2
Total # Species:	16
Total # Individuals:	101
Shannon-Weiner Index:	1.82

Table 59. Macroinvertebrate abundance in Lake Seminary, May 19, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	16
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	2
Procambarus sp.	
Diptera	
Pupa	2
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	1
Chironomidae	
Chironominae-	
Chironomus sp.	11
Dicrotendipes sp	15
Polypedilum sp	19
Tanytarsus sp.	1
Tanytarsus limneticus	2
Cladotanutarsus sp.	
Pseudochironomus sp.	5
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	1
Ablabesmyia sp	
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	1
Cernotia sp.	
Acariformes:	
Hydracarina sp.	2
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	23
Limnodrilus hoffmeisteri	1
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	
Planorbella scalaris	4
Physella sp.	3
Total # Species:	17
Total # Individuals:	109
Shannon-Weiner Index:	2.28

Table 60. Macroinvertebrate abundance in Lake Seminary, June 27, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	26
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	
Procambarus sp.	
Diptera	
Pupa	1
Ceratopogonidae	
Bezzia sp.	1
Chaoborus sp.	
Chironomidae	
Chironominae-	
Chironomus sp.	2
Dicrotendipes sp	22
Polypedilum sp	3
Tanytarsus sp.	1
Tanytarsus limneticus	2
Cladotanutarsus sp.	
Pseudochironomus sp.	2
Glyptotendipes sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	
Ablabesmyia sp	1
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	
Cernotia sp.	
Acariformes:	
Hydracarina sp.	4
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	29
Limnodrilus hoffmeisteri	1
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	2
Planorbella scalaris	
Physella sp.	3
Total # Species:	15
Total # Individuals:	100
Shannon-Weiner Index:	1.90

Table 61. Macroinvertebrate abundance in Lake Seminary, July 15, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	14
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	3
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	
Chaoborus sp.	
Chironomidae	
Chironominae-	
Chironomus sp.	3
Dicrotendipes sp	30
Polypedilum sp	34
Tanytarsus sp.	2
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	
Cladopelma sp.	7
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	1
Ablabesmyia sp	1
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	2
Cernotia sp.	
Acariformes:	
Hydracarina sp.	6
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	2
Limnodrilus hoffmeisteri	
Mysidacea	
Mysid sp.	1
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	
Planorbella scalaris	3
Physella sp.	5
Total # Species:	15
Total # Individuals:	114
Shannon-Weiner Index:	2.05

Table 62. Macroinvertebrate abundance in Lake Seminary, August 25, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	14
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	1
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	1
Chaoborus sp.	1
Chironomidae	
Chironominae-	2
Chironomus sp.	3
Dicrotendipes sp	36
Polypedilum sp	16
Tanytarsus sp.	1
Cladotanutarsus sp.	
Pseudochironomus sp.	1
Glyptotendipes sp.	
Cladopelma sp.	3
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	
Ablabesmyia sp	1
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	2
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	
Cernotia sp.	1
Acariformes:	
Hydracarina sp.	9
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	5
Limnodrilus hoffmeisteri	3
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	1
Planorbella scalaris	
Physella sp.	1
Total # Species:	19
Total # Individuals:	102
Shannon-Weiner Index:	2.16

Table 63. Macroinvertebrate abundance in Lake Seminary, September 30, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	17
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	2
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	1
Chaoborus sp.	
Chironomidae	
Chironominae-	8
Chironomus sp.	2
Dicrotendipes sp	27
Polypedilum sp	18
Tanytarsus sp.	2
Cladotanutarsus sp.	
Pseudochironomus sp.	1
Glyptotendipes sp.	
Cladopelma sp.	3
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	
Ablabesmyia sp	2
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	1
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	
Oecetis porteri	1
Oecetis species A	
Oxyrthira sp.	
Cernotia sp.	
Acariformes:	
Hydracarina sp.	7
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	2
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	
Planorbella scalaris	3
Physella sp.	5
Total # Species:	17
Total # Individuals:	102
Shannon-Weiner Index:	2.26

Table 64. Macroinvertebrate abundance in Lake Seminary, October 24, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	22
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	2
Procambarus sp.	
Diptera	
Pupa	1
Ceratopogonidae	
Bezzia sp.	1
Chaoborus sp.	1
Chironomidae	
Chironominae-	2
Chironomus sp.	3
Dicrotendipes sp	31
Polypedilum sp	19
Tanytarsus sp.	2
Cladotanutarsus sp.	
Pseudochironomus sp.	1
Glyptotendipes sp.	2
Cladopelma sp.	2
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	3
Ablabesmyia sp	1
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	1
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	1
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	2
Cernotia sp.	
Acariformes:	
Hydracarina sp.	4
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	1
Limnodrilus hoffmeisteri	1
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	1
Planorbella scalaris	2
Physella sp.	4
Total # Species:	24
Total # Individuals:	110
Shannon-Weiner Index:	2.34

Table 65. Macroinvertebrate abundance in Lake Seminary, November 27, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	31
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	2
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	1
Chaoborus sp.	
Chironomidae	
Chironominae-	1
Chironomus sp.	9
Dicrotendipes sp	22
Polypedilum sp	17
Tanytarsus sp.	1
Cladotanutarsus sp.	
Pseudochironomus sp.	
Glyptotendipes sp.	
Cladopelma sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	4
Ablabesmyia sp	
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	2
Oecetis porteri	
Oecetis species A	2
Oxyrthira sp.	
Cernotia sp.	
Acariformes:	
Hydracarina sp.	3
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	1
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	
Gastropoda	
Micromene sp.	1
Planorbella scalaris	4
Physella sp.	2
Total # Species:	16
Total # Individuals:	103
Shannon-Weiner Index:	2.08

Table 66. Macroinvertebrate abundance in Lake Seminary, December 22, 2003.

	No. individuals found Composite
Amphipoda	
Hyalella azteca	21
Coleoptera	
Haliplus sp.	
Decapoda	
Palaemonetes paluodousus	1
Procambarus sp.	
Diptera	
Pupa	
Ceratopogonidae	
Bezzia sp.	2
Chaoborus sp.	1
Chironomidae	
Chironominae-	2
Chironomus sp.	7
Dicrotendipes sp	26
Polypedilum sp	22
Tanytarsus sp.	
Cladotanutarsus sp.	
Pseudochironomus sp.	1
Glyptotendipes sp.	
Cladopelma sp.	
Tanypodinae-	
Tanypodinae sp.	
Procladius sp.	3
Ablabesmyia sp	2
Anatopynia sp.	
Labrundinia sp.	
Tanypus sp.	
Ephemeroptera	
Caenis diminutata	
Caenis punctata	

	No. individuals found Composite
Odonata	
Celithemis sp.	
Epitheca stella/sepia	
Libellulidae sp.	1
Libellula sp.	
Enallagma sp.	
Trichoptera:	
Oecetis sp.	1
Oecetis porteri	
Oecetis species A	
Oxyrthira sp.	3
Cernotia sp.	
Acariformes:	
Hydracarina sp.	3
Koenika sp.	
Krendowskia sp.	
Neumania sp.	
Oligochaeta	
Lumbericulidae sp.	
Tubificidae	
Limnodrilus hoffmeisteri	
Turbellaria	
Planaria	1
Gastropoda	
Micromene sp.	
Planorbella scalaris	2
Physella sp.	3
Total # Species:	18
Total # Individuals:	102
Shannon-Weiner Index:	2.18

APPENDIX F:
MACROINVERTEBRATE ABUNDANCE IN LAKE JESUP, SAMPLED BY CONVENTIONAL METHOD, 2003

Table 67. Macroinvertebrate abundance in Lake Jesup, January 16, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca			1	0	7
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	20	21	31	24	533
Chironomidae					
Chironominae-					
Chironomus sp.	5	15	3	8	170
Glyptotendipes sp.					
Polypedilum sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.		1		0	7
Anatopynia sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.		2	2	1	30
Tubificidae	16	84	59	53	1177
Limnodrilus hoffmeisteri	2	8	4	5	104
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae					
Total # Species:	4	6	6	5	
Total # Individuals:	43	131	99	91	
# individuals/m2	955	2908	2198	2020	2028
Shannon-Weiner Index:	0.74	1.09	0.98	0.94	

Table 68. Macroinvertebrate abundance in Lake Jesup, February 13, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	17	19	8	15	326
Chironomidae					
Chironominae-					
Chironomus sp.	7	16	21	15	326
Glyptotendipes sp.	1		3	1	30
Polypedilum sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.		1	2	1	22
Procladius sp.		2	1	1	22
Anatopynia sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.	2			1	15
Tubificidae	31	17	38	29	636
Limnodrilus hoffmeisteri	4	14	1	6	141
Turbellaria					
Planaria					
Gastropoda					
Physella sp.	1	4		2	37
Hydrobiidae	1	1		1	15
Total # Species:	8	8	7	8	
Total # Individuals:	64	74	74	71	
# individuals/m2	1421	1643	1643	1569	1569
Shannon-Weiner Index:	1.42	1.70	1.28	1.47	

Table 69. Macroinvertebrate abundance in Lake Jesup, March 14, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	16	19	12	16	348
Chironomidae					
Chironominae-					
Chironomus sp.	9	4	13	9	192
Glyptotendipes sp.					
Polypedilum sp		1		0	7
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.		3		1	22
Procladius sp.		1	1	1	15
Anatopynia sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	8	39	30	26	570
Limnodrilus hoffmeisteri	7	17	4	9	207
Turbellaria					
Planaria					
Gastropoda					
Physella sp.	2			1	15
Hydrobiidae	2			1	15
Total # Species:	6	7	5	6	
Total # Individuals:	44	84	60	63	
# individuals/m2	977	1865	1332	1391	1391
Shannon-Weiner Index:	1.57	1.32	1.24	1.38	

Table 70. Macroinvertebrate abundance in Lake Jesup, April 12, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Pupa			1	0	7
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	16	32	18	22	488
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.			1	0	7
Polypedilum sp	1	1		1	15
Coelotanypus sp	1	5	1	2	52
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Anatopynia sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.	1		1	1	15
Tubificidae	9	22	40	24	525
Limnodrilus hoffmeisteri	12	18	14	15	326
Turbellaria					
Planaria					
Gastropoda					
Physella sp.					
Hydrobiidae		1		0	7
Total # Species:	6	6	7	6	
Total # Individuals:	40	79	76	65	
# individuals/m2	888	1754	1687	1443	1436
Shannon-Weiner Index:	1.33	1.30	1.21	1.28	

Table 71. Macroinvertebrate abundance in Lake Jesup, May 3, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.			3	1	22
Chaoborus sp.	4	9	17	10	222
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.			1	0	7
Polypedilum sp					
Coelotanypus sp		1	1	1	15
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Anatopynia sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	14	16	74	35	770
Limnodrilus hoffmeisteri	17	21	25	21	466
Mysidacea					
Mysid sp.		1	1	1	15
Gastropoda					
Micromene sp.					
Planorbella scalaris					
Physella sp.					
Hydrobiidae					
Total # Species:	3	5	7	5	
Total # Individuals:	35	48	122	68	
# individuals/m2	777	1066	2708	1517	1517
Shannon-Weiner Index:	0.96	1.20	1.11	1.09	

Table 72. Macroinvertebrate abundance in Lake Jesup, June 7, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.		1	14	5	111
Chironomidae					
Chironominae-					
Chironomus sp.			1	0	7
Glyptotendipes sp.					
Polypedilum sp					
Coelotanypus sp	4		4	3	59
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Anatopynia sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.	1		2	1	22
Tubificidae	7	8	15	10	222
Limnodrilus hoffmeisteri	2	1	3	2	44
Isopoda					
Cyathyria polita	1				
Gastropoda					
Physella sp.					
Hydrobiidae					
Total # Species:	5	3	6	5	
Total # Individuals:	15	10	39	21	
# individuals/m2	333	222	866	474	466
Shannon-Weiner Index:	1.17	0.63	1.41	1.07	

Table 73. Macroinvertebrate abundance in Lake Jesup, July 11, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Decapoda					
Palaemonetes paluodousus					
Procambarus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.		2		1	15
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.					
Polypedilum sp					
Coelotanypus sp	4	3	2	3	67
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.	1	1		1	15
Tubificidae	1		7	3	59
Limnodrilus hoffmeisteri					
Mysidacea					
Mysid sp.		1		0	7
Gastropoda					
Physella sp.					
Hydrobiidae	1	2		1	22
Total # Species:	4	5	2	4	
Total # Individuals:	7	9	9	8	
# individuals/m2	155	200	200	185	163
Shannon-Weiner Index:	1.15	1.52	0.52	1.06	

Table 74. Macroinvertebrate abundance in Lake Jesup, August 4, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	5	3	4	4	89
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.					
Polypedilum sp					
Coelotanypus sp	4			1	30
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Anatopynia sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.	1	2	2	2	37
Tubificidae	12	36	15	21	466
Limnodrilus hoffmeisteri	1	3	3	2	52
Isopoda					
Cyathyria polita	1			0	7
Gastropoda					
Physella sp.					
Hydrobiidae	2			1	15
Total # Species:	7	4	4	5	
Total # Individuals:	26	44	24	31	
# individuals/m2	577	977	533	696	681
Shannon-Weiner Index:	1.53	0.67	1.05	1.08	

Table 75. Macroinvertebrate abundance in Lake Jesup, September 8, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	23	5	10	13	281
Chironomidae					
Chironominae-					
Chironomus sp.		3		1	22
Glyptotendipes sp.					
Polypedilum sp	1			0	7
Coelotanypus sp	1			0	7
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.	1			0	7
Anatopynia sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.		1		0	7
Tubificidae	1	6	61	23	503
Limnodrilus hoffmeisteri	1	3	6	3	74
Mysidacea					
Mysid sp.					
Gastropoda					
Physella sp.					
Hydrobiidae	1	1		1	15
Total # Species:	7	6	3	5	
Total # Individuals:	29	19	77	42	
# individuals/m2	644	422	1709	925	910
Shannon-Weiner Index:	0.88	1.60	0.64	1.04	

Table 76. Macroinvertebrate abundance in Lake Jesup, October 13, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	12	26	19	19	422
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.					
Polypedilum sp					
Coelotanypus sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Anatopynia sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	7	7		5	104
Limnodrilus hoffmeisteri	6	6		4	89
Isopoda					
Cyathyria polita					
Gastropoda					
Physella sp.					
Hydrobiidae					
Total # Species:	3	3	1	2	
Total # Individuals:	25	39	19	28	
# individuals/m2	555	866	422	614	614
Shannon-Weiner Index:	1.05	0.86	0.00	0.64	

Table 77. Macroinvertebrate abundance in Lake Jesup, November 21, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	29	17	5	17	377
Chironomidae					
Chironominae-					
Chironomus sp.					
Glyptotendipes sp.					
Polypedilum sp					
Coelotanypus sp					
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.					
Tubificidae	4			1	30
Limnodrilus hoffmeisteri	1	1		1	15
Mysidacea	1			0	7
Mysid sp.					
Isopoda					
Cyathyria polita	1			0	7
Gastropoda					
Physella sp.					
Hydrobiidae					
Total # Species:	5	2	1	3	
Total # Individuals:	36	18	5	20	
# individuals/m2	799	400	111	437	437
Shannon-Weiner Index:	0.71	0.21	0.00	0.31	

Table 78. Macroinvertebrate abundance in Lake Jesup, December 19, 2003.

	No. individuals found			Average	No./m2
	Station 1	Station 2	Station 3		
Amphipoda					
Hyalella azteca					
Gammarus sp.	1			0	7
Coleoptera					
Haliplus sp.					
Diptera					
Ceratopogonidae					
Bezzia sp.					
Chaoborus sp.	6			2	44
Chironomidae					
Chironominae-					
Chironomus sp.		7	20	9	200
Glyptotendipes sp.					
Polypedilum sp		5	17	7	163
Coelotanypus sp	3	8	15	9	192
Tanytarsus sp.					
Tanypodinae-					
Tanypodinae sp.					
Procladius sp.			1	0	7
Anatopynia sp.					
Acariformes:					
Hydracarina sp.					
Koenika sp.					
Krendowskia sp.					
Oligochaeta					
Hirudinea sp.	4	2	1	2	52
Tubificidae	48	67	52	56	1236
Limnodrilus hoffmeisteri	24	29	39	31	681
Isopoda					
Cyathyria polita					
Gastropoda					
Physella sp.					
Hydrobiidae	2			1	15
Total # Species:	7	6	7	7	
Total # Individuals:	87	118	145	117	
# individuals/m2	1931	2620	3219	2590	2583
Shannon-Weiner Index:	1.26	1.21	1.54	1.34	

APPENDIX G:
PHYSICOCHEMICAL FIELD MEASUREMENTS TAKEN IN LAKE SEMINARY, 2002

Table 79. Physicochemical measurements for Lake Seminary, January 12, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	surface	1.7	surface	1.8	surface	1.8
Secchi disc visibility (m)	1.78 bottom		2.0 bottom		2.0 bottom	
Water Depth (m)	1.8		2.0		2.0	
Water temperature C°	14.6	15.0	15.4	15.2	15.3	15.6
Dissolved oxygen (mg/l)	9.6	9.7	9.8	9.8	10.0	9.7
pH	7.3	7.0	7.1	7.1	7.2	7.2
Specific conductivity (µS/cm @ 25 C°)	202	202	202	202	202	202

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.78 bottom	0.0	14.6	9.6	7.3	202
		1.7	15.0	9.7	7.0	202
Mean			14.8	9.7	7.2	202

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.0 bottom	0.0	15.4	9.8	7.1	202
		1.8	15.2	9.8	7.1	202
Mean			15.3	9.8	7.1	202

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.0 bottom	0.0	15.3	10.0	7.2	202
		1.8	15.6	9.7	7.2	202
Mean			15.5	9.8	7.2	202

Table 80. Physicochemical measurements for Lake Seminary, February 16, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	2.0	2.0	2.5	0.0	1.9
Secchi disc visibility (m)	2.2 bottom		2.7 bottom		2.1 bottom	
Water Depth (m)	2.2		2.7		2.1	
Water temperature C°	18.4	18.3	18.1	18.1	18.3	18.2
Dissolved oxygen (mg/l)	9.2	9.3	9.1	9.1	9.1	9.2
pH	7.7	7.3	7.3	7.3	7.7	7.7
Specific conductivity (µS/cm @ 25 C°)	238	238	231	231	231	231

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.2 bottom	0.0	18.4	9.2	7.7	238
		2.0	18.3	9.3	7.3	238
Mean			18.3	9.2	7.5	238

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.7 bottom	0.0	18.1	9.1	7.3	231
		2.5	18.1	9.1	7.3	231
Mean			18.1	9.1	7.3	231

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.1 bottom	0.0	18.3	9.1	7.7	231
		1.9	18.2	9.2	7.7	231
Mean			18.3	9.1	7.7	231

Table 81. Physicochemical measurements for Lake Seminary, March 16, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	2.1	0.0	1.7	0.0	1.4
Secchi disc visibility (m)	2.1 bottom		1.8 bottom		1.5 bottom	
Water Depth (m)	2.1		1.8		1.5	
Water temperature C°	23.3	23.2	23.4	23.3	23.8	22.8
Dissolved oxygen (mg/l)	9.0	9.2	9.3	9.7	9.7	10.3
pH	7.1	7.3	8.6	8.8	8.2	9.0
Specific conductivity (µS/cm @ 25 C°)	206	207	206	207	205	207

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.1 bottom	0.0	23.3	9.0	7.1	206
		2.1	23.2	9.2	7.3	207
Mean			23.3	9.1	7.2	207

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.8 bottom	0.0	23.4	9.3	8.6	206
		1.7	23.3	9.7	8.8	207
Mean			23.4	9.5	8.7	207

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.5 bottom	0.0	23.8	9.7	8.2	205
		1.4	22.8	10.3	9.0	207
Mean			23.3	10.0	8.6	206

Table 82. Physicochemical measurements for Lake Seminary, April 27, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.6	0.0	2.6	0.0	1.2
Secchi disc visibility (m)	1.7 bottom		2.7 bottom		1.3 bottom	
Water Depth (m)	1.7		2.7		1.3	
Water temperature C°	27.6	27.4	27.8	27.9	28.1	28.2
Dissolved oxygen (mg/l)	6.4	6.3	6.8	6.9	6.5	7.1
pH	6.6	6.3	6.9	6.9	7.0	7.2
Specific conductivity (µS/cm @ 25 C°)	208	206	208	209	204	208

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.7 bottom	0.0	27.6	6.4	6.6	208
		1.6	27.4	6.3	6.3	206
Mean			27.5	6.4	6.5	207

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.7 bottom	0.0	27.8	6.8	6.9	208
		2.6	27.9	6.9	6.9	209
Mean			27.9	6.9	6.9	209

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.3 bottom	0.0	28.1	6.5	7.0	204
		1.2	28.2	7.1	7.2	208
Mean			28.2	6.8	7.1	206

Table 83. Physicochemical measurements for Lake Seminary, May 18, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	2.9	0.0	2.0	0.0	2.2
Secchi disc visibility (m)	3.1 bottom		2.2 bottom		2.4 bottom	
Water Depth (m)	3.1		2.2		2.4	
Water temperature C°	27.9	27.7	28.2	28.3	27.9	28.2
Dissolved oxygen (mg/l)	7.1	7.1	7.2	7.2	7.2	7.2
pH	6.9	6.9	7.1	7.4	7.2	7.4
Specific conductivity (µS/cm @ 25 C°)	212	212	209	213	213	212

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	3.1					
	bottom	0.0	27.9	7.1	6.9	212
		2.9	27.7	7.1	6.9	212
Mean			27.8	7.1	6.9	212

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.2					
	bottom	0.0	28.2	7.2	7.1	209
		2.0	28.3	7.2	7.4	213
Mean			28.3	7.2	7.3	211

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.4					
	bottom	0.0	27.9	7.2	7.2	213
		2.2	28.2	7.2	7.4	212
Mean			28.1	7.2	7.3	213

Table 84. Physicochemical measurements for Lake Seminary, June 23, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.3	0.0	2.2	0.0	1.7
Secchi disc visibility (m)	1.4 bottom		2.3 bottom		1.8 bottom	
Water Depth (m)	1.4		2.3		1.8	
Water temperature C°	27.0	27.0	27.0	27.0	28.0	27.0
Dissolved oxygen (mg/l)	7.5	8.2	8.4	8.7	8.1	8.5
pH	6.5	6.4	6.7	7.2	6.7	6.6
Specific conductivity (µS/cm @ 25 C°)	190	190	200	190	200	190

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.4 bottom	0.0	27.0	7.5	6.5	190
		1.3	27.0	8.2	6.4	190
Mean			27.0	7.9	6.5	190

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.3 bottom	0.0	27.0	8.4	6.7	200
		2.2	27.0	8.7	7.2	190
Mean			27.0	8.6	7.0	195

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.8 bottom	0.0	28.0	8.1	6.7	200
		1.7	27.0	8.5	6.6	190
Mean			27.5	8.3	6.7	195

Table 85. Physicochemical measurements for Lake Seminary, July 27, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	2.4	0.0	2.0	0.0	2.2
Secchi disc visibility (m)	2.6 bottom		2.2 bottom		2.4 bottom	
Water Depth (m)	2.6		2.2		2.4	
Water temperature C°	30.9	30.8	30.8	30.8	30.9	30.9
Dissolved oxygen (mg/l)	14.8	14.9	14.6	14.2	13.4	13.2
pH	6.2	6.6	7.5	7.4	7.8	7.4
Specific conductivity (µS/cm @ 25 C°)	188	179	189	182	183	181

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.6 bottom	0.0	30.9	14.8	6.2	188
		2.4	30.8	14.9	6.6	179
Mean			30.9	14.8	6.4	184

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.2 bottom	0.0	30.8	14.6	7.5	189
		2.0	30.8	14.2	7.4	182
Mean			30.8	14.4	7.5	186

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.4 bottom	0.0	30.9	13.4	7.8	183
		2.2	30.9	13.2	7.4	181
Mean			30.9	13.3	7.6	182

Table 86. Physicochemical measurements for Lake Seminary, August 17, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	2.3	0.0	2.0	0.0	2.6
Secchi disc visibility (m)	2.5 bottom		2.2 bottom		2.8 bottom	
Water Depth (m)	2.5		2.2		2.8	
Water temperature C°	30.0	30.1	30.1	30.0	30.0	30.1
Dissolved oxygen (mg/l)	7.6	7.5	7.1	6.9	7.7	7.4
pH	7.9	7.6	7.6	7.6	7.8	7.6
Specific conductivity (µS/cm @ 25 C°)	227	226	227	227	226	226

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.5 bottom	0.0	30.0	7.6	7.9	227
		2.3	30.1	7.5	7.6	226
Mean			30.1	7.6	7.6	227

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.2 bottom	0.0	30.1	7.1	7.6	227
		2.0	30.0	6.9	7.6	227
Mean			30.1	7.0	7.6	227

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.8 bottom	0.0	30.0	7.7	7.8	226
		2.6	30.1	7.4	7.6	226
Mean			30.1	7.6	7.7	226

Table 87. Physicochemical measurements for Lake Seminary, September 25, 2002.

	Station 1				Station 2			Station 3		
Sample depth (m)	0.0	1.0	2.0	3.0	0.0	1.0	2.0	0.0	1.0	2.0
Secchi disc visibility (m)	3.9 bottom				2.4 bottom			2.4 bottom		
Water Depth (m)	3.9				2.4			2.4		
Water temperature C°	29.3	29.3	29.3	29.2	29.5	29.5	29.4	29.4	29.4	29.2
Dissolved oxygen (mg/l)	6.7	6.6	6.8	6.8	7.9	7.8	9.1	7.5	7.5	7.4
pH	6.6	6.6	6.5	6.5	6.6	6.6	7.0	7.7	6.7	6.6
Specific conductivity (µS/cm @ 25 C°)	190	190	190	193	193	192	192	192	192	193

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	3.9 bottom	0.0	29.3	6.7	6.6	190
		1.0	29.3	6.6	6.6	190
		2.0	29.3	6.8	6.5	190
		3.0	29.2	6.8	6.5	193
Mean			29.3	6.7	6.5	191

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.4 bottom	0.0	29.5	7.9	6.6	193
		1.0	29.5	7.8	6.6	192
		2.0	29.4	9.1	7.0	192
Mean			29.5	8.3	6.7	192

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.4 bottom	0.0	29.4	7.5	7.7	192
		1.0	29.4	7.5	6.7	192

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
		2.0	29.2	7.4	6.6	193
Mean			29.3	7.5	7.0	192

Table 88. Physicochemical measurements for Lake Seminary, October 15, 2002.

	Station 1			Station 2				Station 3		
Sample depth (m)	0.0	1.0	2.0	0.0	1.0	2.0	3.0	0.0	1.0	2.0
Secchi disc visibility (m)	2.1 bottom			3.1 bottom				2.2 bottom		
Water Depth (m)	2.1			3.1				2.2		
Water temperature C°	28.8	28.8	28.6	28.9	29.0	28.8	28.8	29.0	28.8	28.6
Dissolved oxygen (mg/l)	6.7	6.7	6.6	6.9	6.9	6.9	6.3	6.8	7.0	6.9
pH	8.2	8.0	7.9	7.5	7.5	7.5	7.4	7.2	7.2	7.3
Specific conductivity (µS/cm @ 25 C°)	233	234	234	233	234	234	234	233	234	234

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.1 bottom	0.0	28.8	6.7	8.2	233
		1.0	28.8	6.7	8.0	234
		2.0	28.6	6.6	7.9	234
Mean			28.7	6.7	8.0	234

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	3.1 bottom	0.0	28.9	6.9	7.5	233
		1.0	29.0	6.9	7.5	234
		2.0	28.8	6.9	7.5	234
		3.0	28.8	6.3	7.4	234
Mean			28.9	6.8	7.5	234

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.2 bottom	0.0	29.0	6.8	7.2	233
		1.0	28.8	7.0	7.2	234
		2.0	28.6	6.9	7.3	234
Mean			28.8	6.9	7.2	234

Table 89. Physicochemical measurements for Lake Seminary, October 16, 2002.

	Station 1				Station 2			Station 3		
Sample depth (m)	0.0	1.0	2.0	3.0	0.0	1.0	2.0	0.0	1.0	2.0
Secchi disc visibility (m)	3.1 bottom				2.6 bottom			2.4 bottom		
Water Depth (m)	3.1				2.6			2.4		
Water temperature C°	20.1	20.2	20.1	19.9	19.8	19.7	19.7	19.9	19.8	19.9
Dissolved oxygen (mg/l)	8.8	8.8	8.8	8.9	8.9	8.9	8.8	8.6	8.7	8.5
pH	7.1	7.2	7.2	7.2	7.2	7.2	7.3	7.5	7.4	7.3
Specific conductivity (µS/cm @ 25 C°)	232	231	231	230	233	232	232	234	233	233

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	3.1 bottom	0.0	20.1	8.8	7.1	232
		1.0	20.2	8.8	7.2	231
		2.0	20.1	8.8	7.2	231
		3.0	19.9	8.9	7.2	230
Mean			20.1	8.8	7.2	231

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.6 bottom	0.0	19.8	8.9	7.2	233
		1.0	19.7	8.9	7.2	232
		2.0	19.7	8.8	7.3	232
Mean			19.7	8.9	7.2	232

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.4 bottom	0.0	19.9	8.6	7.5	234
		1.0	19.8	8.7	7.4	233
		2.0	19.9	8.5	7.3	233
Mean			19.9	8.6	7.4	233

Table 90. Physicochemical measurements for Lake Seminary, December 26, 2002.

	Station 1			Station 2				Station 3		
Sample depth (m)	0.0	1.0	2.0	0.0	1.0	2.0	3.0	0.0	1.0	2.0
Secchi disc visibility (m)	2.4 bottom			3.4 bottom				2.1 bottom		
Water Depth (m)	2.4			3.4				2.1		
Water temperature C°	19.5	19.5	19.3	19.9	19.8	19.7	19.6	19.8	19.8	19.7
Dissolved oxygen (mg/l)	9.0	9.0	8.9	8.5	8.6	8.6	8.6	8.9	8.7	8.8
pH	7.7	7.7	7.6	7.5	7.6	7.5	7.4	7.8	7.9	7.8
Specific conductivity (µS/cm @ 25 C°)	227	224	224	226	226	225	224	224	224	224

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.4 bottom	0.0	19.5	9.0	7.7	227
		1.0	19.5	9.0	7.7	224
		2.0	19.3	8.9	7.6	224
Mean			19.4	9.0	7.7	225

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	3.4 bottom	0.0	19.9	8.5	7.5	226
		1.0	19.8	8.6	7.6	226
		2.0	19.7	8.6	7.5	225
		3.0	19.6	8.6	7.4	224
Mean			19.7	8.6	7.5	225

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.1 bottom	0.0	19.8	8.9	7.8	224
		1.0	19.8	8.7	7.9	224
		2.0	19.7	8.8	7.8	224
Mean			19.8	8.8	7.8	224

APPENDIX H:
PHYSICOCHEMICAL FIELD MEASUREMENTS TAKEN IN LAKE JESUP, 2002

Table 91. Physicochemical measurements for Lake Jesup, January 8, 2002.

	Station 1	Station 2	Station 3
Secchi disc visibility (m)	0.5	0.5	0.7
Water depth (m)	0.7	1.4	1.3
Water temperature C°	11.3	11.3	11.9
Dissolved oxygen (mg/l)	11.5	11.6	11.5
pH			
Specific conductivity (µS/cm @ 25 C°)	775	730	660

	Secchi	Water Depth	WaTemp	DO	SpCond
Station 1	0.5	0.7	11.3	11.5	775
Station 2	0.5	1.4	11.3	11.6	730
Station 3	0.7	1.3	11.9	11.5	660
Mean	0.6	1.1	11.5	11.5	722

Table 92. Physicochemical measurements for Lake Jesup, February 4, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	surface	0.7	surface	0.7	surface	0.8
Secchi disc visibility (m)	0.3		0.4		0.5	
Water Depth (m)	0.7		1.1		0.9	
Water temperature C°	18.9	18.8	20	20.1	20.1	20.2
Dissolved oxygen (mg/l)	10.8	10.8	10.4	10.2	10.2	9.8
pH	9.0	9.0	8.6	8.6	8.6	8.6
Specific conductivity (µS/cm @ 25 C°)	1070	1070	690	686	652	657

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	18.9	10.8	9.0	1070
		0.7	18.8	10.8	9.0	1070
Mean			18.9	10.8	9.0	1070

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	20.0	10.4	8.6	690
		0.7	20.1	10.2	8.6	686
Mean			20.1	10.3	8.6	688

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	20.1	10.2	8.6	652
		0.8	20.2	9.8	8.6	657
Mean			20.2	10.0	8.6	655

Table 93. Physicochemical measurements for Lake Jesup, March 15, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	surface	0.9	surface	1.2	surface	1.1
Secchi disc visibility (m)	0.6		0.6		0.6	
Water Depth (m)	0.9		1.2		1.1	
Water temperature C°	24.2	22.6	24.7	23.2	26.0	23.3
Dissolved oxygen (mg/l)	10.7	10.1	11.7	11.3	10.9	8.2
pH	8.9	8.8	8.9	8.9	8.8	7.7
Specific conductivity (µS/cm @ 25 C°)	1060	910	800	806	613	491

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	24.2	10.7	8.9	1060
		0.9	22.6	10.7	8.8	910
Mean			23.4	10.7	8.9	985

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	24.7	11.7	8.9	800
		1.2	23.2	11.3	8.9	806
Mean			24.0	11.5	8.9	803

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	26.0	10.9	8.8	613
		1.1	23.3	8.2	7.7	491
Mean			24.7	9.5	8.3	552

Table 94. Physicochemical measurements for Lake Jesup, April 9, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	surface	0.7	surface	1.1	surface	0.9
Secchi disc visibility (m)	0.3		0.4		0.4	
Water Depth (m)	0.7		1.2		1.02	
Water temperature C°	23.3	23.3	22.3	22.4	22.2	22.1
Dissolved oxygen (mg/l)	10.9	10.8	9.3	9.3	9.5	9.4
pH	9.2	9.3	8.8	9.0	8.8	8.8
Specific conductivity (µS/cm @ 25 C°)	1280	1280	795	796	818	815

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	23.3	10.9	9.2	1280
		0.7	23.3	10.8	9.3	1280
Mean			23.3	10.8	9.2	1280

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	22.3	9.3	8.8	795
		1.1	22.4	9.3	9.0	796
Mean			22.4	9.3	8.9	796

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	22.2	9.5	8.8	818
		0.9	22.1	9.4	8.8	815
Mean			22.2	9.4	8.8	817

Table 95. Physicochemical measurements for Lake Jesup, May 10, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	surface	0.5	surface	0.7	surface	0.8
Secchi disc visibility (m)	0.3		0.25		0.29	
Water Depth (m)	0.6		0.8		0.9	
Water temperature C°	31.7	30.7	31.5	29.4	31.4	30.0
Dissolved oxygen (mg/l)	8.2		14.1	13.7	13.0	
pH	10.0	10.0	9.8	9.6	9.2	9.1
Specific conductivity (µS/cm @ 25 C°)	1240	1240	1060	1020	1020	1010

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	31.7	8.2	10.0	1240
		0.5	30.7		10.0	1240
Mean			31.2	8.2	10.0	1240

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	31.5	14.1	9.8	1060
		0.7	29.4	13.7	9.6	1020
Mean			30.5	13.9	9.7	1040

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	31.4	13.0	9.2	1020
		0.8	30.0		9.1	1010
Mean			30.7	13.0	9.1	1015

Table 96. Physicochemical measurements for Lake Jesup, June 3, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	surface	0.9	surface	1.0	surface	1.1
Secchi disc visibility (m)	0.3		0.3		0.3	
Water Depth (m)	0.9		1.1		1.2	
Water temperature C°	30.0	29.5	31.9	30.0	32.8	29.6
Dissolved oxygen (mg/l)	9.1	8.7	10.7	9.8	10.8	9.9
pH	9.4	8.1	9.9	8.9	9.7	9.1
Specific conductivity (µS/cm @ 25 C°)	1520	1510	1350	1360	1250	1300

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	30.0	9.1	9.4	1520
		0.9	29.5	8.7	8.1	1510
Mean			29.8	8.9	8.8	1515

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	31.9	10.7	9.9	1350
		1.0	30.0	9.8	8.9	1360
Mean			31.0	10.3	9.4	1355

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	32.8	10.8	9.7	1250
		1.1	29.6	9.9	9.1	1300
Mean			31.2	10.4	9.4	1275

Table 97. Physicochemical measurements for Lake Jesup, July 4, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	surface	1.4	surface	1.7	surface	1.5
Secchi disc visibility (m)	0.45		0.49		0.53	
Water Depth (m)	1.45		1.74		1.60	
Water temperature C°	29.0	27.0	29.0	27.0	29.0	29.0
Dissolved oxygen (mg/l)	7.1				8.4	
pH	8.7	7.2	9.0	8.2	8.8	8.6
Specific conductivity (µS/cm @ 25 C°)	1000	900	700	690	710	700

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	29.0	7.1	8.7	1000
		1.4	27.0		7.2	900
Mean			28.0	7.1	8.0	950

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	29.0		9.0	700
		1.7	27.0		8.2	690
Mean			28.0		8.6	695

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	29.0	8.4	8.8	710
		1.5	29.0		8.6	700
Mean			29.0	8.4	8.7	705

Table 98. Physicochemical measurements for Lake Jesup, August 8, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	surface	2.1	surface	2.1	surface	1.0
Secchi disc visibility (m)	0.6		0.5		0.5	
Water Depth (m)	2.4		2.8		2.8	
Water temperature C°	28.9	28.8	28.7	28.6	28.1	28.1
Dissolved oxygen (mg/l)	2.1	2.1	1.9	2.1	7.7	7.4
pH	8.1	7.7	8.2	7.7	7.2	7.3
Specific conductivity (µS/cm @ 25 C°)	747	744	590	583	443	439

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	28.9	2.1	8.1	747
		2.4	28.8	2.1	7.7	744
Mean			28.9	2.1	7.9	746

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	28.7	1.9	8.2	590
		2.8	28.6	2.1	7.7	583
Mean			28.7	2.0	8.0	587

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	28.1	7.7	7.2	443
		2.8	28.1	7.4	7.3	439
Mean			28.1	7.6	7.3	441

Table 99. Physicochemical measurements for Lake Jesup, September 5, 2002.

	Station 1			Station 2			Station 3		
Sample depth (m)	surface	1	2.0	surface	1.0	2.0	surface	1.0	2.0
Secchi disc visibility (m)	0.6			0.8			0.8		
Water Depth (m)	2.4			2.8			2.7		
Water temperature C°	28.4	28.2	28.2	29.9	29.2	28.3	29.5	28.9	27.9
Dissolved oxygen (mg/l)									
pH	6.8	6.6	6.6	8.1	7.4	6.9	7.5	7.0	6.8
Specific conductivity (µS/cm @ 25 C°)	579	571	566	423	420	313	404	403	393

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	28.4		6.6	579
		1.0	28.2		6.6	571
		2.0	28.2		6.6	566
Mean			28.2		6.6	569

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.8	0.0	29.9		8.1	423
		1.0	29.2		7.4	420
		2.0	28.3		6.9	313
Mean			28.8		7.1	367

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.8	0.0	29.5		7.5	404
		1.0	28.9		7.0	403
		2.0	27.9		6.8	393
Mean			28.4		6.9	398

Table 100. Physicochemical measurements for Lake Jesup, October 4, 2002.

	Station 1			Station 2			Station 3		
Sample depth (m)	surface	1.0	2.0	surface	1.0	2.0	surface	1.0	2.0
Secchi disc visibility (m)	0.6			0.5			0.6		
Water Depth (m)	2.0			2.5			2.0		
Water temperature C°	28.2	28.1	28.0	27.7	27.7	27.4	27.8	27.8	27.4
Dissolved oxygen (mg/l)	7.8	7.2	6.3	0.1	0.2	0.2	0.1	0.2	0.2
pH	8.2	8.1	6.4	7.3	7.1	6.8	7.6	7.2	6.6
Specific conductivity (µS/cm @ 25 C°)	433	429	446	392	389	376	381	378	312

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	28.2	7.8	8.2	433
		1.0	28.1	7.2	8.1	429
		2.0	28.0	6.3	6.4	446
Mean			28.1	6.8	7.3	438

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	27.7	0.1	7.3	392
		1.0	27.7	0.2	7.1	389
		2.0	27.4	0.2	6.8	376
Mean			27.6	0.2	7.0	383

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	27.8	0.1	7.6	381
		1.0	27.8	0.2	7.2	378
		2.0	27.4	0.2	6.6	312
Mean			27.6	0.2	6.9	345

Table 101. Physicochemical measurements for Lake Jesup, November 11, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	surface	1.0	surface	1.0	surface	1.0
Secchi disc visibility (m)	0.4		0.5		0.6	
Water Depth (m)	1.1		2.0		1.4	
Water temperature C°	20.6	20.6	20.8	20.8	21.2	21.2
Dissolved oxygen (mg/l)	6.9					
pH	9.7	9.4	8.9	8.8	8.2	8.1
Specific conductivity (µS/cm @ 25 C°)	473	473	418	418	383	383

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	20.6	6.9	9.7	473
		1.0	20.6		9.4	473
Mean			20.6	6.9	9.6	473

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	20.8		8.9	418
		1.0	20.8		8.8	418
Mean			20.8		8.9	418

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	21.2		8.2	383
		1.0	21.2		8.1	383
Mean			21.2		8.2	383

Table 102. Physicochemical measurements for Lake Jesup, December 26, 2002.

	Station 1		Station 2		Station 3	
Sample depth (m)	surface	1.0	surface	1.0	surface	1.0
Secchi disc visibility (m)	0.3		0.5		0.3	
Water Depth (m)	1.7		2.0		1.4	
Water temperature C°	14.9	149	15	15.0	15.8	15.8
Dissolved oxygen (mg/l)						
pH	8.9	8.8	7.9	7.7	7.2	7.0
Specific conductivity (µS/cm @ 25 C°)	630	629	338	335	291	291

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.30	0.0	14.9		8.9	630
		1.0	14.9		8.8	629
Mean			14.9		8.8	630

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
		0.0	15.0		7.9	338
	0.50	1.0	15.0		7.7	335
Mean			15.0		7.8	337

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.31	0.0	15.8		7.2	291
		1.0	15.8		7.0	291
Mean			15.8		7.1	291

APPENDIX I:
PHYSICOCHEMICAL FIELD MEASUREMENTS TAKEN IN LAKE SEMINARY, 2003

Table 103. Physicochemical measurements for Lake Seminary, January 20, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	2.6 bottom		2.6 bottom		2.8 bottom	
Water Depth (m)	2.6		2.6		2.8	
Water temperature C°	14.0	14.0	14.4	14.1	14.4	14.3
Dissolved oxygen (mg/l)	9.9	9.9	9.2	9.6	9.7	9.7
pH	6.9	6.4	6.9	6.3	7.1	6.4
Specific conductivity (µS/cm @ 25 C°)	188	187	188	187	188	187

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.6 bottom	0.0	14.0	9.9	6.9	188
		1.0	14.0	9.9	6.4	187
Mean			14.0	9.9	6.7	188

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.6 bottom	0.0	14.4	9.2	6.9	188
		1.0	14.1	9.6	6.3	187
Mean			14.3	9.4	6.6	188

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.8 bottom	0.0	14.4	9.7	7.1	188
		1.0	14.3	9.7	6.4	187
Mean			14.4	9.7	6.8	188

Table 104. Physicochemical measurements for Lake Seminary, February 25, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	2.5 bottom		2.5 bottom		1.8 bottom	
Water Depth (m)	2.5		2.5		1.8	
Water temperature C°	20.4	20.3	20.4	20.4	20.3	20.2
Dissolved oxygen (mg/l)	9.6	9.7	9.7	9.8	9.6	9.5
pH	7.5	7.5	7.4	7.4	7.4	7.4
Specific conductivity (µS/cm @ 25 C°)	235	235	235	235	235	235

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.5 bottom	0.0	20.4	9.6	7.5	235
		1.0	20.3	9.7	7.5	235
Mean			20.3	9.7	7.5	235

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.5 bottom	0.0	20.4	9.7	7.4	235
		1.0	20.4	9.8	7.4	235
Mean			20.4	9.8	7.4	235

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.8 bottom	0.0	20.3	9.6	7.4	235
		1.0	20.2	9.5	7.4	235
Mean			20.3	9.6	7.4	235

Table 105. Physicochemical measurements for Lake Seminary, March 25, 2003.

	Station 1			Station 2			Station 3	
Sample depth (m)	0.0	1.0	2.0	0.0	1.0	2.0	0.0	1.0
Secchi disc visibility (m)	2.4 bottom			2.7 bottom			1.8 bottom	
Water Depth (m)	2.4			2.7			1.8	
Water temperature C°	24.1	23.7	23.5	24.2	24.1	24.0	24.3	24.2
Dissolved oxygen (mg/l)	8.5	8.3	8.7	8.7	8.6	8.8	9.2	9.0
pH	7.3	7.2	7.0	7.0	6.9	6.9	6.9	6.9
Specific conductivity (µS/cm @ 25 C°)	235	236	236	236	236	236	281	280

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.4 bottom	0.0	24.1	8.5	7.3	235
		1.0	23.7	8.3	7.2	236
		2.0	23.5	8.7	7.0	236
Mean			23.8	8.5	7.2	236

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.7 bottom	0.0	24.2	8.7	7.0	236
		1.0	24.1	8.6	6.9	236
		2.0	24.0	8.8	6.9	236
Mean			24.1	8.7	6.9	236

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.8 bottom	0.0	24.3	9.2	6.9	281
		1.0	24.2	9.0	6.9	280
Mean			24.2	9.1	6.9	281

Table 106. Physicochemical measurements for Lake Seminary, April 21, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	1.8 bottom		1.7 bottom		1.7 bottom	
Water Depth (m)	1.8		1.7		1.7	
Water temperature C°	25.4	25.1	25.6	25.3	25.5	25.4
Dissolved oxygen (mg/l)	8.5	8.6	8.8	8.7	8.7	8.7
pH	7.6	7.1	7.3	7.1	7.4	7.3
Specific conductivity (µS/cm @ 25 C°)	230	230	230	231	230	231

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.8 bottom	0.0	25.4	8.5	7.6	230
		1.0	25.1	8.6	7.1	231
Mean			25.3	8.6	7.4	231

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.7 bottom	0.0	25.6	8.8	7.3	230
		1.0	25.3	8.7	7.1	231
Mean			25.5	8.8	7.2	231

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.7 bottom	0.0	25.5	8.7	7.4	230
		1.0	25.4	8.7	7.3	231
Mean			25.5	8.7	7.4	231

Table 107. Physicochemical measurements for Lake Seminary, May 19, 2003.

	Station 1	Station 2	Station 3
Sample depth (m)	0.0	0.0	0.0
Secchi disc visibility (m)	1.8 bottom	1.8 bottom	1.8 bottom
Water Depth (m)	1.8	1.8	1.8
Water temperature C°	30.0	30.0	30.0
Dissolved oxygen (mg/l)	7.3	7.6	7.8
pH	8.0	7.7	7.7
Specific conductivity (µS/cm @ 25 C°)	234	233	234

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.8 bottom	0.0	30.0	7.3	8.0	234
Mean			30.0	7.3	8.0	234

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.8 bottom	0.0	30.0	7.6	7.7	233
Mean			30.0	7.6	7.7	233

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	1.8 bottom	0.0	30.0	7.8	7.7	234
Mean			30.0	7.8	7.7	234

Table 108. Physicochemical measurements for Lake Seminary, June 27, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	2.6 bottom		2.1 bottom		2.3 bottom	
Water Depth (m)	2.6		2.1		2.3	
Water temperature C°	29.4	29.1	30.0	29.2	29.7	29.5
Dissolved oxygen (mg/l)	8.0	9.0	7.9	10.7	8.1	9.9
pH	7.9	8.3	8.3	8.2	8.2	9.2
Specific conductivity (µS/cm @ 25 C°)	228	228	228	228	228	228

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.6 bottom	0.0	29.4	8.0	7.9	228
		1.0	29.1	9.0	8.3	228
Mean			29.3	8.5	8.1	228

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.1 bottom	0.0	30.0	7.9	8.3	228
		1.0	29.2	10.7	8.2	228
Mean			29.6	9.3	8.3	228

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.3 bottom	0.0	29.7	8.1	8.2	228
		1.0	29.5	9.9	9.2	228
Mean			29.6	9.0	8.7	228

Table 109. Physicochemical measurements for Lake Seminary, July 15, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	2.0 bottom		2.5 bottom		2.0 bottom	
Water Depth (m)	2.0		2.5		2.0	
Water temperature C°	30.3	30.2	30.4	30.2	30.5	30.3
Dissolved oxygen (mg/l)	6.9	6.9	7.3	7.8	7.2	7.7
pH	7.0	7.0	7.0	7.0	7.0	7.1
Specific conductivity (µS/cm @ 25 C°)	226	226	226	226	226	226

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.0 bottom	0.0	30.3	6.9	7.0	226
		1.0	30.2	6.9	7.0	226
Mean			30.3	6.9	7.0	226

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.5 bottom	0.0	30.4	7.3	7.0	226
		1.0	30.2	7.8	7.0	226
Mean			30.3	7.6	7.0	226

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.0 bottom	0.0	30.5	7.2	7.0	226
		1.0	30.3	7.7	7.1	226
Mean			30.4	7.5	7.1	226

Table 110. Physicochemical measurements for Lake Seminary, August 25, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	2.6 bottom		2.6 bottom		3.1 bottom	
Water Depth (m)	2.6		2.6		3.1	
Water temperature C°	29.9	30.1	29.4	29.7	29.5	28.9
Dissolved oxygen (mg/l)	7.6	7.7	8.1	8.0	7.9	7.8
pH	7.1	7.0	7.1	7.4	7.1	7.5
Specific conductivity (µS/cm @ 25 C°)	215	216	215	216	215	215

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.6 bottom	0.0	29.9	7.6	7.1	215
		1.0	30.1	7.7	7.0	216
Mean			30.0	7.7	7.1	216

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.6 bottom	0.0	29.4	8.1	7.1	215
		1.0	29.7	8.0	7.4	216
Mean			29.6	8.1	7.3	216

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	3.1 bottom	0.0	29.5	7.9	7.1	215
		1.0	28.9	7.8	7.5	215
Mean			29.2	7.9	7.3	215

Table 111. Physicochemical measurements for Lake Seminary, September 30, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	2.1 bottom		2.4 bottom		2.8 bottom	
Water Depth (m)	2.1		2.4		2.8	
Water temperature C°	29.7	29.7	29.6	29.5	29.9	29.9
Dissolved oxygen (mg/l)	7.0	6.9	4.7	6.6	7.1	7.0
pH	7.7	7.6	8.4	8.4	7.6	7.5
Specific conductivity (µS/cm @ 25 C°)	189	187	187	187	187	187

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.1 bottom	0.0	29.7	7.0	7.7	189
		1.0	29.7	4.9	7.6	187
Mean			29.7	4.0	7.7	188

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.4 bottom	0.0	29.6	4.7	8.4	187
		1.0	29.5	4.6	8.4	187
Mean			29.6	4.7	8.4	187

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.8 bottom	0.0	29.9	7.1	7.6	187
		1.0	29.9	7.0	7.5	187
Mean			29.9	7.1	7.6	187

Table 112. Physicochemical measurements for Lake Seminary, October 24, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	2.6 bottom		2.8 bottom		2.2 bottom	
Water Depth (m)	2.6		2.8		2.2	
Water temperature C°	30.1	29.9	30.1	30.0	29.9	29.8
Dissolved oxygen (mg/l)	6.6	6.5	6.9	6.8	7.0	6.9
pH	8.7	8.6	8.4	8.4	8.6	8.5
Specific conductivity (µS/cm @ 25 C°)	217	217	216	216	217	216

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.6 bottom	0.0	30.1	6.6	8.7	217
		1.0	29.9	6.5	8.6	217
Mean			30.0	6.6	8.7	217

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.8 bottom	0.0	30.1	6.9	8.4	216
		1.0	30.0	6.8	8.4	216
Mean			30.1	6.9	8.4	216

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.2 bottom	0.0	29.9	7.0	8.6	217
		1.0	29.8	6.9	8.5	216
Mean			29.9	7.0	8.6	217

Table 113. Physicochemical measurements for Lake Seminary, November 27, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	2.9 bottom		2.6 bottom		2.4 bottom	
Water Depth (m)	2.9		2.6		2.4	
Water temperature C°	16.2	16.1	16.3	16.2	16.3	16.3
Dissolved oxygen (mg/l)	8.7	8.6	8.8	8.7	8.7	8.7
pH	7.7	7.6	7.5	7.5	7.6	7.6
Specific conductivity (µS/cm @ 25 C°)	218	218	217	217	218	217

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.9 bottom	0.0	16.2	8.7	7.7	218
		1.0	16.1	8.6	7.6	218
Mean			16.2	8.7	7.7	218

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.6 bottom	0.0	16.3	8.8	7.5	217
		1.0	16.2	8.7	7.5	217
Mean			16.3	8.8	7.5	217

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.4 bottom	0.0	16.3	8.7	7.6	218
		1.0	16.3	8.7	7.6	217
Mean			16.3	8.7	7.6	218

Table 114. Physicochemical measurements for Lake Seminary, December 22, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	2.0 bottom		2.7 bottom		2.1 bottom	
Water Depth (m)	2.0		2.7		2.1	
Water temperature C°	15.8	15.8	15..9	15.9	15.9	15.9
Dissolved oxygen (mg/l)	9.7	9.6	9.8	9.6	9.9	9.8
pH	8.5	8.3	8.3	8.1	8.0	7.9
Specific conductivity (µS/cm @ 25 C°)	222	221	221	221	222	222

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.0 bottom	0.0	15.8	9.7	8.5	222
		1.0	15.8	9.6	8.3	221
Mean			15.8	9.6	8.4	222

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.7 bottom	0.0	15.9	9.8	8.3	221
		1.0	15.9	9.6	8.1	221
Mean			15.9	9.7	8.2	221

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	2.1 bottom	0.0	15.9	9.9	8.0	222
		1.0	15.9	9.8	7.9	222
Mean			15.9	9.8	8.0	222

APPENDIX J:
PHYSICOCHEMICAL FIELD MEASUREMENTS TAKEN IN LAKE JESUP, 2003

Table 115. Physicochemical measurements for Lake Jesup, January 16, 2003.

	Station 1			Station 2			Station 3		
Sample depth (m)	0.0	1.0	1.5	0.0	1.0	2.0	0.0	1.0	1.5
Secchi disc visibility (m)	0.5			0.5			0.5		
Water Depth (m)	1.9			2.1			1.9		
Water temperature C°	15.3	14.2	13.1	15.6	13.7	13.6	14.5	14.3	14.1
Dissolved oxygen (mg/l)	10.2			10.8			9.0		
pH	9.0	8.6	8.0	8.9	8.2	7.9	8.7	8.0	8.0
Specific conductivity (µS/cm @ 25 C°)	447	450	476	417	439	446	317	318	315

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	15.3	10.2	9.0	447
		1.0	14.2		8.6	450
		1.5	13.1		8.0	476
Mean			14.2	10.2	8.5	458

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	15.6	10.8	8.9	417
		1.0	13.7		8.2	439
		2.0	13.6		7.9	446
Mean			14.3	10.8	8.4	434

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	14.5	9.0	8.7	317
		1.0	14.3		8.1	318
		1.5	14.1		8.0	315
Mean			14.3	9.0	8.2	317

Table 116. Physicochemical measurements for Lake Jesup, February 13, 2003.

	Station 1			Station 2			Station 3		
Sample depth (m)	0.0	1.0	1.1	0.0	1.0	1.4	0.0	1.0	1.2
Secchi disc visibility (m)	0.4			0.5			0.6		
Water Depth (m)	1.2			1.6			1.3		
Water temperature C°	16.7	16.5	16.4	16.5	16.4	16.3	16.5	16.5	16.5
Dissolved oxygen (mg/l)	11.2	10.8	10.3	11.6	10.9	10.7	11.0	10.7	10.6
pH	9.1	8.9	8.7	8.6	8.4	8.3	8.1	8.0	8.1
Specific conductivity (µS/cm @ 25 C°)	460	461	475	509	509	507	333	332	333

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	16.7	11.2	9.1	460
		1.0	16.5	10.8	8.9	461
		1.1	16.4	10.3	8.7	475
Mean			16.5	10.8	8.9	465

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	16.5	11.6	8.6	509
		1.0	16.4	10.9	8.4	509
		1.4	16.3	10.7	8.3	507
Mean			16.4	11.1	8.4	508

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	16.5	11.0	8.1	333
		1.0	16.5	10.7	8.0	332
		1.2	16.5	10.6	8.1	333
Mean			16.5	10.8	8.1	333

Table 117. Physicochemical measurements for Lake Jesup, March 14, 2003.

	Station 1		Station 2			Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	1.5	0.0	1.0
Secchi disc visibility (m)	0.4		0.5			0.4	
Water Depth (m)	1.3		1.6			1.3	
Water temperature C°	24.1	24.0	23.9	23.8	23.7	23.7	23.4
Dissolved oxygen (mg/l)	8.6	8.5	7.6	7.5	7.5	6.9	6.8
pH	8.7	8.6	8.6	8.5	8.4	7.8	7.3
Specific conductivity (µS/cm @ 25 C°)	516	516	423	423	424	291	292

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	24.1	8.6	8.8	516
		1.0	24.0	8.5	8.7	516
Mean			24.1	8.5	8.7	516

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	23.9	7.6	8.6	423
		1.0	23.8	7.5	8.5	423
		1.5	23.7	7.5	8.4	424
Mean			23.8	7.5	8.5	423

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	23.7	6.9	7.8	291
		1.0	23.4	6.8	7.3	292
Mean			23.6	6.9	7.5	292

Table 118. Physicochemical measurements for Lake Jesup, March 12, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	0.4		0.3		0.6	
Water Depth (m)	1.2		1.6		1.4	
Water temperature C°	18.7	18.6	19.5	19.4	19.6	19.6
Dissolved oxygen (mg/l)	9.9	9.8	8.5	8.4	7.1	6.6
pH	8.3	8.1	8.1	7.8	7.7	7.4
Specific conductivity (µS/cm @ 25 C°)	562	562	477	478	381	380

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	18.7	9.9	8.3	562
		1.0	18.6	9.8	8.1	562
Mean			18.7	9.8	8.2	562

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	19.5	8.5	8.1	477
		1.0	19.4	8.4	7.8	478
Mean			19.5	8.5	7.9	478

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	19.6	7.1	7.7	381
		1.0	19.6	6.6	7.4	380
Mean			19.6	6.8	7.6	381

Table 119. Physicochemical measurements for Lake Jesup, May 3, 2003.

	Station 1		Station 2			Station 3		
Sample depth (m)	0.0	0.5	0.0	0.5	1.0	0.0	0.5	1.0
Secchi disc visibility (m)	0.3		0.3			0.3		
Water Depth (m)	0.5		1.1			1.1		
Water temperature C°	25.7	25.7	25.8	25.8	25.5	25.7	25.6	25.3
Dissolved oxygen (mg/l)	9.6	9.3	6.4					
pH	9.4	9.2	9.0	9.0	9.0	9.0	8.9	8.6
Specific conductivity (µS/cm @ 25 C°)	555	555	470	471	481	433	429	419

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	25.7	9.6	9.4	555
		0.5	25.7	9.3	9.1	555
Mean			25.7	9.4	9.2	555

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	25.8	6.4	9.0	470
		0.5	25.8		9.0	471
		1.0	25.5		9.0	481
Mean			25.7	6.4	9.0	474

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	25.7		9.0	433
		0.5	25.6		8.9	429
		1.0	25.3		8.6	419
Mean			25.5		8.8	427

Table 120. Physicochemical measurements for Lake Jesup, June 6, 2003.

	Station 1	Station 2	Station 3
Sample depth (m)	0.0	0.0	0.0
Secchi disc visibility (m)	0.3	0.3	0.3
Water Depth (m)	0.7	0.8	0.3
Water temperature C°	26.1	23.6	32.6
Dissolved oxygen (mg/l)	7.57	11.7	11.2
pH	9.27	8.8	8.8
Specific conductivity (µS/cm @ 25 C°)	1414	600	936

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0	26.1	7.57	9.27	1414
Mean			26.1	7.6	9.3	1414
Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	23.6	11.7	8.8	600
Mean			23.6	11.7	8.8	600
Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	32.6	11.2	8.8	936
Mean			32.6	11.2	8.8	936

Table 121. Physicochemical measurements for Lake Jesup, July 11, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	0.7	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	0.3		0.3		0.5	
Water Depth (m)	0.8		1.0		1.1	
Water temperature C°	30.5	30.5	31.4	30.9	32.2	31.8
Dissolved oxygen (mg/l)	8.4		9.1			
pH	8.8	8.9	8.6	8.7	8.6	8.7
Specific conductivity (µS/cm @ 25 C°)	1005	1005	520	549	472	574

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	30.5	8.4	8.8	1005
		0.7	30.5		8.9	1005
Mean			30.5	8.4	8.9	1005

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	31.4	9.1	8.6	520
		1.0	30.9		8.7	549
Mean			31.2	9.1	8.7	535

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	32.2		8.6	472
		1.0	31.8		8.7	574
Mean			32.0		8.7	523

Table 122. Physicochemical measurements for Lake Jesup, August 4, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	0.4		0.6		0.7	
Water Depth (m)	1.2		1.3		1.4	
Water temperature C°	29.3	28.9	28.9	28.1	29.9	27.3
Dissolved oxygen (mg/l)	8.2	6.0	4.6	4.1	6.5	4.2
pH	9.5	9.3	7.8	7.2	8.0	7.1
Specific conductivity (µS/cm @ 25 C°)	1004	1008	314	347	340	347

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	29.3	8.2	9.5	1004
		1.0	28.9	6.0	9.3	1008
Mean			29.1	7.1	9.4	1006

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	28.9	4.6	7.8	314
		1.0	28.1	4.1	7.2	347
Mean			28.5	4.4	7.5	331

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.7	0.0	29.9	6.5	8.0	340
		1.0	27.3	4.2	7.1	347
Mean			28.6	5.4	7.6	344

Table 123. Physicochemical measurements for Lake Jesup, September 8, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	0.5		0.6		0.6	
Water Depth (m)	1.7		1.9		2.0	
Water temperature C°	27.3	27.3	27.5	27.6	27.2	27.2
Dissolved oxygen (mg/l)	5.2		5.7		4.8	
pH	8.3	7.6	7.6	7.2	7.4	7.1
Specific conductivity (µS/cm @ 25 C°)	628	627	462	461	478	477

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	27.3	5.2	8.3	628
		1.0	27.3		7.6	627
Mean			27.3	5.2	8.0	628

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	27.5	5.7	7.6	462
		1.0	27.6		7.2	461
Mean			27.6	5.7	7.4	462

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.6	0.0	27.2	4.8	7.4	478
		1.0	27.2		7.1	477
Mean			27.2	4.8	7.3	478

Table 124. Physicochemical measurements for Lake Jesup, October 13, 2003.

	Station 1			Station 2			Station 3		
Sample depth (m)	0.0	1.0	1.5	0.0	1.0	1.5	0.0	1.0	1.5
Secchi disc visibility (m)	0.3			0.4			0.4		
Water Depth (m)	1.8			1.9			2.0		
Water temperature C°	26.4	26.2	26.0	27.0	26.8	26.8	26.9	26.7	26.6
Dissolved oxygen (mg/l)	8.4			6.5			6.9		
pH	8.7	8.0	7.3	7.7	7.4	7.3	7.9	7.5	7.3
Specific conductivity (µS/cm @ 25 C°)	705	718	767	477	500	511	512	510	508

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	26.4	8.4	8.7	705
		1.0	26.2		8.0	718
		1.5	26.0		7.3	767
Mean			26.2	8.4	8.0	730

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	27.0	6.5	7.7	477
		1.0	26.8		7.4	500
		1.5	26.8		7.3	511
Mean			26.9	6.5	7.4	496

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.4	0.0	26.9	6.9	7.9	512
		1.0	26.7		7.5	510
		1.5	26.6		7.3	508
Mean			26.7	6.9	7.6	510

Table 125. Physicochemical measurements for Lake Jesup, November 21 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	0.5		0.5		0.5	
Water Depth (m)	1.2		1.6		1.4	
Water temperature C°	21.3	20.9	21.8	21.8	22.1	22.1
Dissolved oxygen (mg/l)	13.0	11.5	13.1	11.7	11.0	11.1
pH	9.1	8.9	9.3	9.3	9.0	9.0
Specific conductivity (µS/cm @ 25 C°)	567	572	485	485	439	439

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	21.3	13.0	9.1	567
		1.0	20.9	11.5	8.9	572
Mean			21.1	12.2	9.0	570

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	21.8	13.1	9.3	485
		1.0	21.8	11.7	9.3	485
Mean			21.8	12.4	9.3	485

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	22.1	11.0	9.0	439
		1.0	22.1	11.1	9.0	439
Mean			22.1	11.1	9.0	439

Table 126. Physicochemical measurements for Lake Jesup, December 19, 2003.

	Station 1		Station 2		Station 3	
Sample depth (m)	0.0	1.0	0.0	1.0	0.0	1.0
Secchi disc visibility (m)	0.3		0.3		0.5	
Water Depth (m)	1.2		1.6		1.4	
Water temperature C°	12.1	12.2	12.9	12.9	13.3	13.3
Dissolved oxygen (mg/l)	11.7	11.4	11.1	11.0	12.2	8.3
pH	8.7	8.7	8.7	8.7	8.6	8.6
Specific conductivity (µS/cm @ 25 C°)	663	663	475	476	408	407

Station 1	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	12.1	11.7	8.7	663
		1.0	12.2	11.4	8.7	663
Mean			12.1	11.6	8.7	663

Station 2	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.3	0.0	12.9	11.1	8.7	475
		1.0	12.9	11.0	8.7	476
Mean			12.9	11.1	8.7	476

Station 3	Secchi	Water Depth	WaTemp	DO	pH	SpCond
	0.5	0.0	13.3	12.2	8.6	408
		1.0	13.3	8.3	8.6	407
Mean			13.3	10.3	8.6	408

APPENDIX K:
PHYSICOCHEMICAL LABORATORY MEASUREMENTS TAKEN IN LAKE SEMINARY

Table 127. Physicochemical analytical laboratory measurements for Lake Seminary, 2002.

Date	Alkalinity (mg/l CaCO3)	Chlorophyll a (µg/l)	Total nitrogen (mg/l)	Total phosphrous (µg/l)	TSI
19-Feb	6.2	1.9	0.5	9.1	27.6
22-May	6.7	1.0	0.5	9.1	22.6
20-Aug	6.4	2.2	0.4	6.7	24.6
26-Nov	6.9	1.8	0.4	5.2	25.4
Mean	6.6	1.7	0.4	7.5	25.0

Table 128. Physicochemical laboratory measurements for Lake Seminary, 2003.

Date	Alkalinity (mg/l CaCO3)	Chlorophyll a (µg/l)	Total nitrogen (mg/l)	Total phosphrous (µg/l)	TSI
18-Feb	6.7	0.9	0.4	6.3	17.6
21-May	7.8	1.8	0.4	8.9	26.5
26-Aug	7.6	2.3	0.3	8.5	27.7
24-Nov	9.5	4.7	0.5	13.0	37.9
Mean	7.9	2.4	0.4	9.2	27.4

APPENDIX L:
PHYSICOCHEMICAL LABORATORY MEASUREMENTS TAKEN IN LAKE JESUP

Table 129. Physicochemical analytical laboratory measurements for Lake Jesup, 2002.

Date	Alkalinity (mg/l CaCO3)	Chlorophyll a (µg/l)	Total nitrogen (mg/l)	Total phosphrous (µg/l)	TSI
2-Jun	94.4	160.0	4.5	220.0	86.9
29-Sep	92.0	68.0	1.7	190.0	67.1
22-Dec	86.0	55.0	1.4	140.0	71.3
Mean	90.8	94.3	2.5	183.3	75.1

Table 130. Physicochemical analytical laboratory measurements for Lake Jesup, 2003.

Date	Alkalinity (mg/l CaCO3)	Chlorophyll a (µg/l)	Total nitrogen (mg/l)	Total phosphrous (µg/l)	TSI
31-Mar	93.2	87.0	2.0	196.0	78.4
29-Jun	103.0	100.0	1.8	266.0	82.3
28-Sep	63.6	157.0	0.8	144.0	89.9
22-Dec	82.4	170.0	1.7	152.0	81.2
Mean	85.6	128.5	1.6	189.5	83.0

APPENDIX M:
PHYSICOCHEMICAL PROFILE MEASUREMENTS TAKEN IN LAKE SEMINARY, 2003

Table 131. Physicochemical profile measurements for Lake Seminary, May 19, 2003.

Secchi m	Water Depth m	WaTemp C°	DO mg/l	pH	SpCond (µS/cm @ 25 C°)	NTU
4.84	0.0	30.6	7.8	7.5	234	0.0
	1.0	29.9	8.0	7.4	234	0.0
	2.0	29.8	7.9	7.4	234	0.0
	3.0	29.3	6.7	7.1	234	0.1
	4.0	25.5	5.4	6.6	228	0.3
	5.0	21.7	3.8	6.3	225	0.3
	6.0	19.9	0.9	6.1	225	0.3
	7.0	19.2	0.3	6.1	226	0.3

Table 132. Physicochemical profile measurements for Lake Seminary, September 30, 2003.

Secchi m	Water Depth m	WaTemp C°	DO mg/l	pH	SpCond (µS/cm @ 25 C°)	NTU
4.87	0.0	29.7	7.0	7.7	189	0.0
	1.0	29.7	6.9	7.6	189	0.0
	2.0	29.6	6.8	7.4	189	0.0
	3.0	29.5	6.2	7.0	189	0.1
	4.0	26.2	5.7	6.4	188	0.2
	5.0	23.9	4.1	6.1	187	0.2
	6.0	21.1	1.2	5.9	186	0.3
	7.0	20.2	0.4	5.9	186	0.3

APPENDIX N:
COPYRIGHT PERMISSION LETTER

Gloria M. Eby
1188 Andes Drive
Winter Springs, FL 32708

March 12, 2008

E. Lynn Mosura-Bliss
Water and Air Research, Inc.
6821 SW Archer Road
Gainesville, Florida 32608

Dear Lynn Mosura-Bliss:

This letter will confirm our recent e-mail conversation. I am completing a master's degree at the University of Central Florida entitled " TMDL BIOASSESSMENT SAMPLING OF BENTHIC MACROINVERTEBRATES FOR LAKE JESUP AND LAKE SEMINARY." I would like your permission to reprint in my thesis excerpts from the following:

LAKE JESSUP RESTORATION DIAGNOSTIC EVALUATION WATER BUDGET AND NUTRIENT BUDGET Special Publication SJ92-SP16
Douglas H. Keesecker. 1992. Water and Air Research, Inc., Gainesville, FL; File: 91-5057

The excerpt to be reproduced is specifically FIGURE 2.1.6-1. Location of Waste Water Treatment Plants in the Lake Jessup Watershed (1991).

The requested permission extends to any future revisions and editions of my thesis, including non-exclusive world rights in all languages, and to the publication of my dissertation on demand by UMI. These rights will in no way restrict republication of the material in any other form by you or by others authorized by you. Your signing of this letter will also confirm that Water and Air Research, Inc. owns the copyright to the above-described material.

If these arrangements meet with your approval, please sign this letter where indicated below and return it to me in the enclosed return envelope. Thank you for your attention in this matter.

Sincerely,
Gloria M. Eby

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

By: C. Lynn Mosura-Bliss

Lynn Mosura-Bliss, Senior Vice President
Principal Scientist- Ecology & Env. Planning
Water & Air Research, Inc

Date: 3-13-08

LIST OF REFERENCES

Barbour, M.T., J.L. Plafkin, B.P. Bradley, C.G. Graves, and R.W. Wisseman. 1992. Evaluation of EPA's rapid bioassessment benthic metrics: Metric redundancy and variability among reference stream sites. Environmental Toxicology and Chemistry 11:437-449.

Barbour, M.T., and J. Gerritsen. 1996. Subsampling of benthic samples: A defense of the fixed-count method. J. N. Am. Benthol. Soc. 15:386-392.

Barbour, M.T., J. Gerritsen, G.E. Griffith, R. Frydenborg, E. McCarron, J.S. White, and M.L. Bastian. 1996. A framework for biological criteria for Florida streams using benthic macroinvertebrates. J. N. Am. Benthol. Soc. 15:185-211.

Barbour, M.T., J. Gerritsen, and J.S. White. 1996. Development of the stream condition index (SCI) for Florida. Prepared for Florida Department of Environmental Protection.

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: Periphyton, benthic macroinvertebrates and fish. Second Edition. EPA/841-B-99-002. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

Clescer, L. S., A.D. Eaton, A. E. Greenberg. 1999. Standard Methods for Examination of Water and Wastewater (20th edition). American Public Health Association. pp.1325

Cole, G. A. 1994. Textbook of Limnology. 4th ed. Waveland Press, Inc., IL. 186 pp.

D. H. Keesecker. 1992. Lake Jesup restoration, diagnostic evaluation, water budget and nutrient budget. Prepared for SJRWMD. Water and Air Research, Inc., Gainesville, FL. File: 91-5057

Epler, J.H. 2001. Identification manual for the larval Chironomidae (Diptera) of North and South Carolina. North Carolina Department of Environment and Natural Resources, Raleigh, NC.

Florida Department of Environmental Protection. 1992. DEP Standard Operating Procedures for Laboratory Operations and Sample Collection Activities. DEP-SOP-001/01DEP QA-001/92.

Florida Department of Environmental Protection. DEP-SOP-001/01. FT 1000
General Field Testing and Measurement. Revision Date: February 1, 2004.
http://www.dep.state.fl.us/labs/qa/draftrulesop/sops.htm

Florida Department of Environmental Protection. DEP-SOP-001/01. FS 7460.
Lake Condition Index (Lake Composite) Sampling. Revision Date: February 1, 2004.
http://www.dep.state.fl.us/labs/qa/draftrulesop/sops.htm

Frydenborg, Russel. 2001. Environmental Assessment Administrator.

Russel Frydenborg presentation on the TMDL Program. Florida Department of Environmental Protection, Environmental Assessment Section. Biocriteria Meeting.

Gerritsen, J., R.E. Carlson, D. L. Dycus, C. Faulkner, G.R. Gibson, J. Harcum, and S.A. Markowitz. 1998. Lake and reservoir bioassessment and biocriteria: technical guidance document. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Gerritsen, Jeroen, B. Jessup, E. W. Leppo, and J. White. 2000. Development of the Lake Condition Indexes (LCI) for Florida. Prepared for Florida Department of Environmental Protection Under Contracts WM 565 and WM 655. Tetra Tech, Inc., Owings Mills, MD.

Gibson, G.R. (ed.), M.T. Barbour, J.B. Stribling, J. Gerritsen, and J.R. Karr. 1996. Biological criteria: technical guidance for streams and small rivers. U.S. Environmental Protection Agency, Office of Science and Technology, Washington, DC. EPA 822-B-96-001.

Hand, Joe, L. Clemens, J. Col, J. Jackson, L. Lord, R. Odom, D. Tterlikkis. 2000. Florida Water Quality Assessment: 305 (b) Report. Florida Department of Environmental Protection, Division of Water Resource Management, Bureau of Watershed Management, Tallahasesee, FL.

Herbst, D.B. and E.L. Silldorff. 2006. Comparison of the performance of different bioassessment methods. J. N. Am. Benthol. Soc. 25(2):513-530.

Hulbert, J. L. 1990. A proposed lake condition index for Florida. North American Benthological Society, 38th Annual Meeting, Blacksburg, VA, 11 p.

Lobinske, R.J., J.L. Bortles, and A. Ali. 1998. Invertebrate populations and water and sediments physico-chemical conditions of Lake Jesup at the confluence with the St. Johns River, Central Florida. Florida Lake Management Society Meeting, A-84-85.

Karr, J. R. 1981. Assessment of biotic integrity using fish communities. Fisheries 6(6): 21-27.

Karr, J. R. 1991. Biological integrity: A long-neglected aspect of water resource management. Ecological Applications 1:66-84.

MacAuthur, R.H., and J.W. MacAuthur. 1961. On bird species diversity. Ecology 42:594-98.

Merritt, R.W. and K.W. Cummins. 1996. An Introduction to the aquatic insects of North America. Kendall-Hunt Publishing Co., Dubuque, IA, 862 pp.

Molles, M.C. Jr., 2005. Ecology concepts and applications. 3rd ed. The McGraw-Hill Companies, Inc. New York, NY, 415 p.

Plafkin, J.L. M.T. Barbour, K.D. Porter, S.K. Gross, R.M. Hughes. 1989. Rapid assessment protocols for use in streams and rivers: benthic macroinvertebrates and fish. U.S. Environmental Protection Agency. Washington, D.C.

Resh, V. H., and J. K. Jackson. 1993. Rapid assessment approaches to biomonitoring using benthic macroinvertebrates. Pages 195–233 in D. M. Rosenberg and V. H. Resh (editors). Freshwater biomonitoring and benthic macroinvertebrates. Chapman and Hall, New York, NY.

Rosenberg, D.M., V. H. Resh (eds). 1993. Freshwater Biomonitoring and Benthic Macroinvertebrates. Chapman and Hall, New York, NY.

Rosenberg, D.M., I.J. Davies, D.G. Cobb, and A.P. Wiens. 1997. Ecological Monitoring And Assessment Network (EMAN- Environment Canada)- Protocols For Measuring Biodiversity: Benthic Macroinvertebrates In Fresh Waters. Department of Fisheries and Oceans, Freshwater Institute, Winnipeg, Manitoba. 53, Appendices.

St. Johns River Water Management District Fast Fact: Lake Jesup. 2002. http://sjrwmd.com/programs/outreach/pubs/index.html.

St. Johns River Water Management District. Lake Jesup restoration. http://www.sjrwmd.com/lakejesup/index.html

U.S. Environmental Protection Agency. 1990. Biological Criteria: National Program Guidance for Surface Waters. EPA-440/5-90-004.

U.S. Environmental Protection Agency. 1990. Biocriteria Fact Sheet. Office of Water, Office of Science and Technology Health and Ecological Criteria Division. Washington, DC.

U.S. Environmental Protection Agency. 1993c. Guidelines for preparation of the 1994 state water quality assessments (305(b) reports). EPA 841-B-93-004. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Wetzel, R.G. 1983. Limnology. 2nd ed. Saunders College Publishing. Xii, 767pp, R81, I10.

Taxonomic Identification Reference:

Brigham, A.R., Brigham, W.U. and A. Gnilka. 1982. Aquatic insects and oligochaetes of North and South Carolina. Midwest Aquatic Enterprises, Mahomet, IL.

Daigle, J.J. 1991. Florida damselflies (Zygoptera): a species guide to the larval stages. Florida Department of Environmental Protection, Tallahassee, Technical Series, Vol. 7, No.1.

Epler, J.H. 1996. Identification manual for the water beetles of Florida. Florida Department of Environmental Protection, Tallahassee, FL.

Epler, J.H. 2001. Identification manual for the larval Chironomidae (Diptera) of North and South Carolina. North Carolina Department of Environment and Natural Resources, Raleigh, NC.

Merritt, R.W. and K.W. Cummins. 1996. An introduction to the aquatic insects of North America, Second Edition. Kendall/Hunt Publishing Co., Dubuque, IA.

Milligan, M.A. 1997. Identification manual for the aquatic Oligochaeta of Florida, Vol.1. Freshwater Oligochaetes. Florida Department of Environmental Protection, Tallahassee, FL.

Needham, J.G., Westfall, M.J., and M.L. May. 2000. Dragonflies of North America. Scientific Publishers, Gainesville, FL.

Pennak, R.W. 1953. Fresh-water invertebrates of the United States. The Ronald Press Company, NY.

Pescador, M.L., A.K. Rasmussen, and S.C. Harris. 2004. Identification manual for the caddisfly (Trichoptera) larvae of Florida, revised edition. Florida Department of Environmental Protection, Tallahassee, FL.

Pescador, M. L. and B. A. Richard. 2004. Guide to the mayfly (Ephemeroptera) nymphs of Florida. Florida Department of Environmental Protection, Tallahassee, FL.

Pluchino, E.S. 1984. Guide to the common water mite genera of Florida. Florida Department of Environmental Protection, Tallahassee, FL.

Richardson, J.S. 2003. Identification manual for the dragonfly larvae (Anisoptera) of Florida.
Thompson, F.G. 2004. An identification manual for the freshwater snails of Florida. Florida Museum of Natural History, Gainesville, FL.

Triplehorn, C.A. and N.F. Johnson. 2005. Borror and Delong's introduction to the study of insects, seventh edition. Thomson Brooks/Cole, Belmont, CA.

Westfall, M.J. and M.L. May. 1996. Damselflies of North America. Scientific Publishers, Gainesville, FL.

Wiggins, G.B. 1996. Larvae of the North American caddisfly genera (Trichoptera), Second Edition. University of Toronto Press, Toronto, Canada.