STATEWIDE ASSESSMENT OF TOXIC ALGAL (MICROCYSTIN) THREAT IN FLORIDA LAKES

By

DANA LYNNE BIGHAM

A THESIS PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
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To all the wonderful people in my life

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Dana Lynne Bigham

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A bi-monthly (January-December) survey of microcystin in 187 Florida lakes was completed in 2006. Mean microcystin concentrations ranged from non-detectable to 12 μg/L, with 29 % of the lakes containing detectable microcystin (≥ 0.1 μg/L). Only 7 % of the lakes had mean microcystin concentrations above the World Health Organization (WHO) drinking water standard of 1 μg/L. None of the lakes had mean microcystin concentrations above the WHO recreational standard of 20 μg/L. At any time throughout the year, microcystin concentrations can be measured at levels above 1 μg/L, but microcystin concentrations were found to increase significantly starting in May/June, with the highest concentrations occurring during September-December. Of the 862 individual water samples collected from the 187 Florida lakes, microcystin concentrations ranged from non-detectable (65 % of the samples) to 32 μg/L. Only 7 % of the individual samples exceeded the WHO drinking water standard, while 28 % of the samples contained detectable microcystin. Three individual water samples exceeded the WHO recreational standard. As expected, microcystin concentrations in Florida lakes were found to increase with cyanobacterial biomass and lake trophic status. A monthly study of six hypereutrophic lakes (Harris Chain of Lakes) completed during September 2006-August 2007 found 57 % of the samples (216 individual water samples) contained detectable microcystin and

40% of the samples were above 1 μg/L. None of the individual water samples exceeded the WHO recreational standard. Neither water sample depth (surface, 0.5 m, and integrated), container (glass versus plastic), nor storage (freezing) of water samples affected microcystin concentrations significantly. Consequently, from the measured microcystin concentrations obtained during this study, microcystin does not seem to pose the greatest toxic algae threat to Floridians for 2006 as lakes are typically not used for drinking water and the WHO recreational standard is seldom exceeded.

CHAPTER 1
INTRODUCTION

Cyanobacteria or blue-green algae are ancient organisms that have been identified in rock that dates back three billion years (Schopf and Parker 1987). As a result of their long evolutionary history, cyanobacteria have adapted to almost all terrestrial and aquatic environments including both temperate and tropical water bodies, although certain conditions favor dominance by particular species. For example, accelerated eutrophication of water bodies is often linked to a shift in the algal community to the cyanobacterial taxa *Microcystis*, *Anabaena*, and/or *Aphanizomenon* (Steinberg and Hartmann 1988). These taxa can form 'blooms' (Jacoby et al. 2000; Johnston and Jacoby 2003), which are dense surface aggregations that can cause aesthetic, access/navigation, and potential health problems for lake users (Chorus and Bartram 1999, Lawton and Codd 1991, and Codd et al. 1999).

Blue-green blooms are of particular concern as some strains of cyanobacteria produce a toxin called microcystin (Botes et al. 1984; Sivonen and Jones 1999). Microcystins are primarily produced by the cyanobacteria species *Microcystis aeruginosa*, but other genera, like *Anabaena*, *Planthorix*, and *Nostoc*, have also been shown to produce the toxin (Dawson 1998). Microcystin is a protein phosphate-inhibiting toxin that has been suggested to target the liver (Carmichael 1994). Microcystin is, therefore, a hepatotoxin. Microcystins are one of the most commonly reported toxins in freshwater systems worldwide (Carmichael 1986). Reported cases of livestock, wildlife, and pet fatalities have been attributed to consumption of freshwaters with high microcystin concentrations (Steyn 1943; Ashworth and Mason 1946; Carmichael 1986, 1994).

Human health problems caused by microcystins are not well documented. A rare case of human death occurred at a hemodialysis center in Brazil when patients received improperly treated water that contained microcystins (Jochimsen et al. 1998). With the exception of microcystin being suggested to be a possible tumor promoter (Falconer and Humpage 1996), the effects of long-term exposure to microcystins on humans are not well known (Jacoby et al. 2000).

In response to both the reported cases of microcystin sickness and death and on-going research, the World Health Organization established suggested provisional safety standards for microcystin. Assuming a human body weight of 60 kg, an average water intake of 2 L per day, and 0.8 as the proportion of total daily intake of the contaminant ingested from the drinking water, the drinking water provisional safety standard was set at 1 μg/L. Specifically, the drinking water standard is defined as "the amount of a potentially harmful substance that can be consumed daily over a lifetime with negligible risk of adverse health effects" (Falconer et al. 1999). The recreational safety standard was provisionally set at 20 μg/L for activities in direct contact with water and at 100 μg/L for activities having indirect contact with water (World Health Organization 2003). Guidelines were derived from an oral 13-week study with mice, which was supported by a 44-day study with pigs (Kuiper-Goodman et al. 1999). An uncertainty factor of 1000 (10 for intraspecies variation, 10 for interspecies variation, and 10 for other data variables) is associated with each of the microcystin standards.

Numerous studies have identified the frequency of occurrence and distribution of microcystins in freshwaters used for both drinking and recreation (Sivonen and Jones 1999; Fromme et al. 2000; Zurawell et al. 2004; Tillmanns et al. 2007; Jacoby and Kann 2007). Microcystin concentrations have been found to vary temporally by as much as three orders of magnitude within a lake over a year and among years. They also vary among lakes in a year (Kotak et al. 1995). Consequently, conflicting study results and conclusions are seen among reported microcystin concentrations, occurrence, and distribution. Despite these discrepancies, numerous studies (e.g. Chorus and Bartram 1999) emphasize the importance in establishing continual monitoring programs, initiating an early warning system, and providing objective information to inform the public about potentially toxic algae, so that informed decisions can be made about use of the resource.

Eutrophic to hypereutrophic waters are more likely to have blue-green algae (Lund 1969; Wetzel 1975) and contain higher microcystin concentrations (Wu et al. 2006, Kotak et al. 1995, 2007, and Giani et al. 2005) than oligotrophic waters. In the State of Florida, many lakes are eutrophic due to edaphic and morphological characteristics (Canfield and Hoyer 1988). Although cyanobacteria dominance have been identified in Florida lakes of all trophic states (Canfield et al. 1989), cyanobacteria have been shown to dominate over 90% of phytoplankton biomass in highly productive lakes (total phytoplankton biomass > 100 mg/L) (Duarte et al. 1992) and represent the predominant community of phytoplankton in many Florida lakes (Agusti et al. 1990). Along with warm temperatures, which are optimal for cyanobacterial growth (Rapala et al. 1997), Florida lakes offer ideal conditions (e.g., intense light, nutrient rich waters) and a longer growing season for cyanobacteria proliferation.

Awareness of toxic algal blooms heightened in Florida during the summer of 2005 when intense cyanobacterial blooms occurred in the St. Lucie River, St. Johns River, Caloosahatchee River, Lake Okeechobee, and other lakes and rivers (Havens 2006). In these waters, microcystin concentrations exceeding 100 µg/L were reported, sparking concern among scientists and the public (Havens 2006). However, these studies only focused on certain large lakes or rivers (Williams et al. 2007). No comprehensive, statewide study existed for Florida lakes, so it was difficult to determine the magnitude of the toxin (microcystin) occurrence in Florida lakes.

The primary objective of this study was to complete a statewide survey of Florida lakes to identify the quantity and range of microcystins found in lakes, frequency of occurrence of varying concentrations, and seasonal patterns of microcystin concentrations. Microcystin concentrations were measured bimonthly for 187 lakes from January-December 2006 and results were compared to the World Health Organization's drinking water and recreational standards to provide a preliminary assessment of human risk. Detectable microcystin concentrations and concentrations above WHO drinking water standard had been documented previously in the Harris Chain of Lakes (GreenWater Laboratories 2005) located in central Florida (Lake County). Monthly microcystin monitoring was therefore conducted in six of the hypereutrophic Harris Chain of Lakes to examine the microcystin concentration frequency and distribution among months and also the relationships between microcystin and selected water chemistry variables (i.e., total phosphorus, total nitrogen, and chlorophyll) during September 2006-August 2007. Results obtained for more frequent sampling of the Harris Chain of Lakes were compared to the results obtained from the 2006 statewide survey.

CHAPTER 2
METHODS

Study Lakes and Sampling

Lakes included in the Florida LAKEWATCH program were selected as candidates for the microcystin statewide assessment study due to the presence of active sampling volunteers. The 187 Florida lakes (Figure 2-1), selected for study, encompassed a statewide distribution, a wide range of trophic states, and included lakes experiencing frequent algal blooms as measured by chlorophyll concentration. These lakes were sampled bimonthly from January-December 2006. At each lake, three open water sites (where routine LAKEWATCH water sampling occurred) were sampled by a Florida LAKEWATCH volunteer. Water samples were collected at elbow depth (0.5 m) in a 250-mL acid-cleaned, triple-rinsed Nalgene bottle, following LAKEWATCH sampling protocol (Canfield et al. 2002). At each site, Secchi disk depth was measured and 4 L of surface water was collected and filtered through a Gelman Type A-E glass fiber filter and stored over silica gel desiccant for later chlorophyll analysis. All water samples and glass fiber filters were stored frozen (-15 °C) until water chemistry analyses were completed at the Department of Fisheries and Aquatic Sciences water chemistry laboratory. After nutrient analyses, the water samples (three sites) for each lake were combined into a 60-mL acid-cleaned, triple-rinsed Nalgene bottle. This composite water sample was frozen until microcystin analysis. Nutrient, chlorophyll, and microcystin concentrations were assayed within six months of freezing. Florida LAKEWATCH water samples collected and frozen by volunteers, produce water chemistry results equal to the results obtained from water samples collected and preserved by scientific professionals (Canfield et al. 2002). Some of the 187 lakes were not sampled bimonthly (266 missed water samples) due to missed volunteer sampling, loss of volunteers, or natural events such as the lake losing water due to drought.

Sampling was also completed on the Harris Chain of Lakes located in Lake County, Florida. Lake Beauclaire, Lake Dora (split into an East and West basin), Lake Eustis, Lake Harris, and Lake Griffin comprise most of the Harris Chain of Lakes (Figure 2-2). Water flows between these lakes from south to north. The flow begins at Lake Apopka, continues through Lake Beauclaire, then flows through Lake Dora East and Lake Dora West, and into Lake Eustis. Lake Harris flows into Lake Eustis and then Lake Eustis flows into Lake Griffin. Water exits Lake Griffin through the north-flowing Ocklawaha River. All lakes lie in the southern part of the central lake-district region (Griffith et al. 1997). Lakes in this region generally have elevated total phosphorus (≥ 20 µg/L), total nitrogen (> 900 µg/L), and chlorophyll (> 6.0 µg/L) concentrations. Specific conductance is typically > 99 µS/cm @ 25 °C, pH is > 7.2, and Secchi disk measurements are ≤ 1.0 m (Horsburgh 1999; Canfield and Hoyer 1988). Lakes in the Harris Chain of Lakes are large (ranging from 407 ha to 6679 ha), shallow (< 4 m), and usually hypereutrophic (chlorophyll concentrations > 40 µg/L).

The Harris Chain lakes were sampled monthly from September 2006-August 2007. Three open-water sites were randomly chosen for each lake. The longitude and latitude coordinates were recorded by a GPS system (Garmin Ltd., model # GPS 76, Kansas City, USA). At each site, water for nutrient and chlorophyll analyses was collected at 0.5 m in a brown 1-L, acid-washed, triple-rinsed Nalgene bottle. Water samples for microcystin analysis were collected in an opaque, acid-washed, triple-rinsed 60-mL Nalgene bottle. One water sample was collected at 0.5 m and another by skimming the surface layer. Secchi disk and water depths were recorded at each station. At the middle sampling stations in each lake, an integrated water sample of the entire water column was collected with a PVC pipe extending down from the surface to 0.3 m from the bottom. The pipe was corked, removed vertically; the water was expelled into a bucket, and mixed. An opaque, acid-washed, triple-rinsed 60-mL Nalgene bottle was then filled for microcystin analysis. Water samples collected for nutrient analyses were placed into a cooler with ice. Water samples collected for microcystin analyses were placed into a cooler with ice packs to prevent lysing of the cells. Upon return to the Department of Fisheries and Aquatic Sciences, all nutrient, chlorophyll, and microcystin samples were refrigerated (5 °C) and analyzed within 24 hr.

Water Chemistry Analyses

Water chemistry analyses included measurements of total phosphorus (TP), total nitrogen (TN), and total chlorophyll-a (chlorophyll, CHL) concentrations. TP concentrations (µg/L) were determined using procedures of Murphy and Riley (1962) following persulfate digestion (Menzel and Corwin 1965). TN concentrations (µg/L) were determined by oxidizing water samples with persulfate and measuring nitrate-nitrogen with second derivative spectroscopy (D'Elia et al. 1997; Simal et al. 1985, Wollin 1987; Crupmton et al. 1992; Bachmann and Canfield 1996). CHL concentrations (µg/L) were determined spectrophotometrically following pigment extraction with hot 90 % ethanol (Method 10200 H, APHA 1992; Sartory and Grobbelarr 1984). Measurements are total chlorophyll-a, as there was no correction for pheophytins.

Determination of Microcystin Concentration

To determine microcystin concentration, water samples were thawed if frozen (LAKEWATCH water samples) and all samples were allowed to reach room temperature. Aliquots of 5 mL were pipetted into 10-mL glass vials and boiled at 100 °C for 1 min to extract the microcystin in the water samples (Metcalf and Codd 2005). The boiled samples were cooled to room temperature and centrifuged for 30 min at 2000 rpm to remove particulate material. The clear, non-particulate solution was extracted and used in the ELISA (enzyme-linked immunosorbent) assay.

The ELISA kit (Abraxis LLC., product # 520011, Warminster, USA) provided the antibody-coated plate, six microcystin standards (including a positive control), and all reagents used to determine total microcystin concentration. The absorbance of the samples was read at 450 nm and at a reference of 650 nm with a Stat Fax 3200 Microplate Reader (Awareness Technology Inc., Palm City, USA). Microcystin concentrations were calculated using the slope and intercept of the linear regression equation generated from a semi-logarithm plot. The semi-logarithm plot was generated using the logarithm of the machine-read absorbance of the Abraxis, LLC. standards versus the calculated B/Bo % (the mean absorbance value of each standard divided by the mean absorbance of the Zero standard for each standard). Total microcystin concentrations were reported in μg/L. The sensitivity for microcystin detection is 0.1 μg/L. Samples with microcystin concentrations higher than 5 μg/L (highest provided standard) were diluted with distilled water to remain within the range of the standard curve. All standards and lake water samples were run in duplicate. If the measured microcystin concentrations between the two lake subsamples (duplicates) were extremely divergent, a third sample was analyzed (17 total samples) to determine which of the duplicate analyses were most likely correct.

Microcystin Preparation and Storage

To determine if freezing and storage of water samples in glass versus plastic containers affects microcystin concentrations, six acid-washed, triple-rinsed 60-mL polypropylene, Nalgene bottles and six glass 60-mL vials were filled with 25 mL of a cultured strain of *Microcystin aeruginosa* (PCC 7806). This strain was grown in BG-11 medium according to the method of Stanier et al. (1971) and the cultured strain was diluted by half with deionized water (personal communication Yilmaz 2006). A fresh microcystin sample was run immediately to determine the “initial” microcystin concentration of the culture. The subsamples of the culture were transferred into the six plastic and six glass containers and frozen (-15 °C). Once a month for a six month period, one 60-mL plastic bottle and one 60-mL glass vial container were thawed and the contents analyzed for microcystin. Microcystin analysis preparation and concentration determination proceeded as described previously. Dilutions were performed to stay within the range of the standard curve of the ELISA kit. To further examine the effect of freezing on microcystin concentrations, the above procedure was completed for five different lake samples, with the exception that only plastic containers were used.

Statistical Analyses

Standard statistical analyses (ie., summary statistics, linear regression analysis, correlations, ANOVAs) were performed using MS Excel 2007 (Microsoft) and JMP 5.0.1. (SAS Institute 1989). Statements of statistical significance imply $p \leq 0.05$

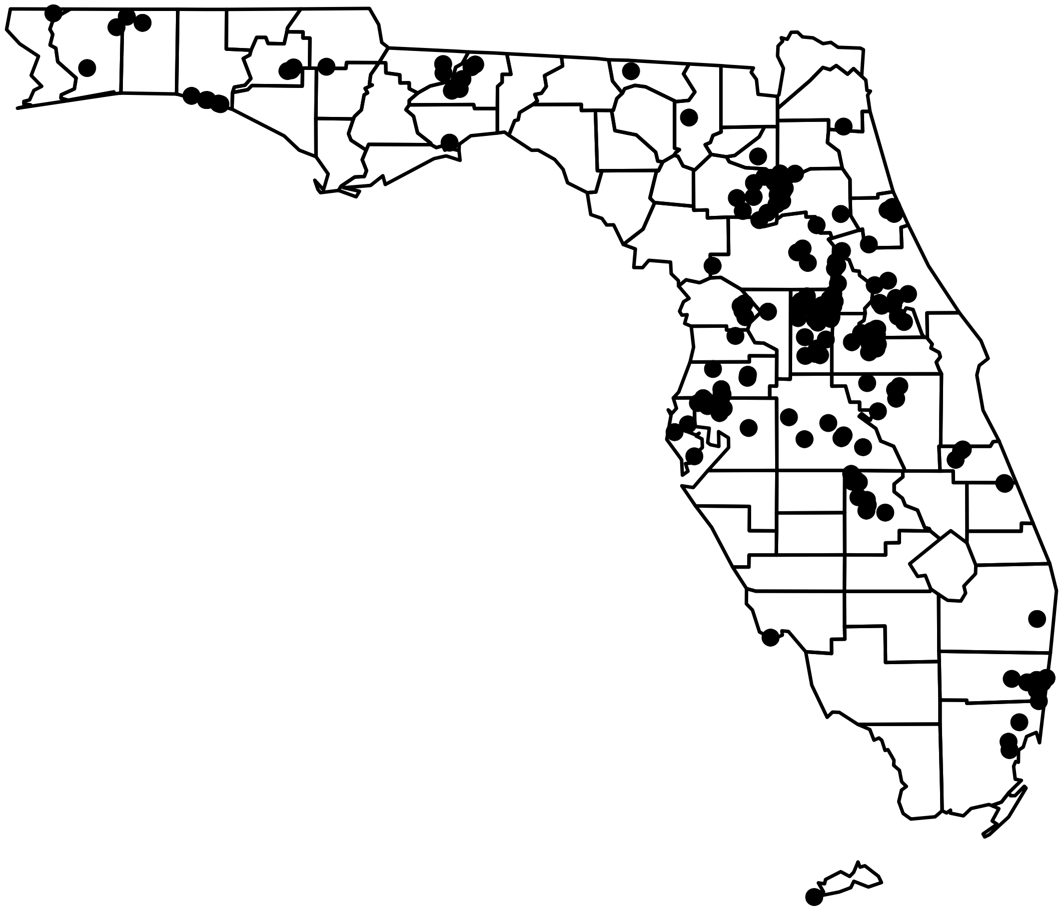


Figure 2-1. The 187 Florida lakes sampled for microcystin during January-December 2006.

Figure 2-2. Harris Chain of Lakes located in Lake County, Florida. Lakes: Beauclaire, Dora (East and West), Eustis, Harris, and Griffin were sampled during September 2006-August 2007.

CHAPTER 3
RESULTS AND DISCUSSION

Mean microcystin concentrations (μg/L) for each of the 187 lakes ranged from non-detectable to 12 μg/L. For this sample of Florida lakes, 29 % had detectable microcystin (≥ 0.1 μg/L) and 7 % of the lakes had concentrations above the World Health Organization (WHO) drinking water standard of 1 μg/L. None of the study lakes had mean microcystin concentrations above the WHO recreational standard of 20 μg/L. Similar microcystin values have been recorded from lakes located outside of Florida during other lake surveys (Table 3-1).

Compared to the WHO standards, a few of the world-wide reported microcystin concentrations exceeded levels that would be of concern among lake recreational users (Table 3-1). A greater number of the reported microcystin concentrations, however, exceeded levels that would be of concern if lakes are or were to be used for drinking water purposes. While detectable microcystins were found in a considerable number of Florida lakes, this study suggests that the occurrence of elevated microcystins, especially compared to the other microcystin studies, is infrequent in most Florida lakes (Table 3-1).

Elevated microcystin concentrations have been documented world-wide and these reported cases most likely capture intense bloom events that are producing high levels of toxin (Sivonen and Jones 1999). In Florida, microcystin bloom events have exceeded concentrations of 100 μg/L (Havens 2006) and have been as elevated as 7550 μg/L (Williams et al. 2007). Generally, these intense bloom events, such as the above Florida bloom events, are linked to adverse health effects for animals and humans (Chorus and Bartram 1999). It is important, however, to remember that an uncertainty factor of 1000 is associated with the WHO microcystin standards. The uncertainty factor accounts for the differences between inter- and intraspeices sensitivities to a chemical substance, standard default uncertainty factors, and other factors such as inadequacies in the database or severity of effects of the toxin. These recommended guideline values are based on a number of assumptions, include laboratory results from rat/ mice/ pig studies, and are suggested, not mandatory limits. Therefore, caution must be exercised when evaluating the extent of possible adverse effects that may be associated with a particular level of microcystin toxin in lake water.

An analysis of variance analysis of the 862 individual water samples collected from the 187 lakes that had detectable microcystin, demonstrated that concentrations were significantly different among bi-monthly categories with January, February, March, and April being statistically lower than September, October, November, and December, while May, June, July, and August showed no difference (F value= 8.18, p-value < 0.0001; Tukey-Kramer HSD). At any time during the year (2006), Florida lakes contained microcystin concentrations above 1.0 µg/L. Starting in May or June, concentrations began to increase (Figure 3-1) with the highest levels being reached during the later months of the year (September–December).

It is not clear, based on existing research, what genetic and environmental factors control toxin production of microcystin at any given time (Jacoby et al. 2000; Kotak et al. 2000; Giani et al. 2005; Sivonen and Jones 1999). However, seasonality consistently affects the amount of microcystins present. In temperate lakes, microcystin concentrations have been shown to peak in May (Rolland et al. 2005), and have been attributed to toxic blooms persisting underneath ice cover (Sivonen and Jones 1999). More commonly, microcystins in temperate lakes display increases beginning in May or June and peak during September-October (Rolland et al. 2005; Lehman 2007; Oh et al. 2001; Jacoby and Kann 2007; Kotak and Zurawell 2007). These peaks in microcystins most likely coincide with high water temperatures because the growth of *Micocystis aeruginosa* is enhanced as temperature reach 25 °C (Robarts and Zohary 1987) and have been suggested to peak in growth rates around 28 °C (Reynolds 1997). Cyanobacterial cell growth proliferates at high temperatures and microcystin production is suggested to increase with intensity of sunlight (Jiang et al. 2008). In temperate lakes, high water temperature and intense light occur only during few months of the year. In subtropical lakes, these conditions occur most months of the year. In subtropical lakes, blooms start earlier in the season and persist longer (Siovenen and Jones 1999). This survey of 187 Florida lakes indicates that microcystin concentrations increase starting in May or June with high levels persisting throughout the year. The highest microcystin concentrations, however, were found in the later part of the year, corresponding to higher water temperatures.

Individual water samples collected in the 187 lakes address, in part, the issue of capturing intense blooms that occur during the studied months. A total of 862 individual water samples was analyzed for microcystin concentration and concentrations ranged from non-detectable to 32 µg/L, with a mean of 0.4 µg/L. Of these water samples, 28 % contained detectable microcystin (≥ 0.1 µg/L) and 7% were above the WHO drinking water standard of 1 µg/L. These results are comparable to those obtained by averaging microcystin concentrations by lake. However, three water samples contained microcystin concentrations that were above the WHO recreational standard of 20 µg/L. The Florida lakes were grouped into WHO standard categories based on the highest microcystin concentration experienced within the lake throughout the sampling year (2006). Only two central Florida lakes (Figure 3-2) experienced microcystin values above 20 µg/L, Lake Jesup (Seminole County) and Lake Hunter (Polk County). These results again support the finding that the frequency of elevated microcystin concentrations is low in Florida lakes for 2006. This study also suggests that future microcystin monitoring efforts by resource managers probably should focus on individual lakes that consistently have detectable microcystin concentrations and microcystin concentrations exceeding levels of concern for drinking water or recreation lake users, such as Lake Jesup or Lake Hunter in Florida.

The chlorophyll concentrations, that corresponded to the 862 individual water samples, were converted to cyanobacteria total biomass (mg/L) using a Florida-specific equation developed by Canfield et al. (1985). Canfield et al. (1989) suggested that cyanobacteria consistently dominant in Florida lakes when total algal biomass exceeds 100 mg/L. Duarte et al. (1992) demonstrated that as total cyanobacterial biomass increases, the percent contribution of cyanobacteria to the phytoplankton community increases, reaching levels of 100 % dominance at a total phytoplankton biomass of 100 mg/L (Figure 3-3). This 187 Florida lake study demonstrated that as total cyanobacterial biomass increased, microcystin concentration increased significantly, and at a total biomass of 100 mg/L, where Duarte et al. (1992) showed that cyanobacteria become 100 % dominant, microcystin values reached and surpassed concentrations of 1.0 μg/L (Figure 3-4). A uniform weighted moving average was used as a robust measure to smooth the regression line.

An increase in nutrients has long been known to cause an increase in algal biomass (Deevey 1940), with Sakamoto (1966) providing some of the first quantitative evidence. Using total chlorophyll concentrations as the indicator of trophic state and the classification system of Forsburg and Ryding (1980), the 187 lakes in this study were classified into trophic categories (i.e., oligotrophic to hypereutrophic). Chlorophyll concentrations in the lakes ranged from 0.4 μg/L to 172 μg/L (Table 3-2). The same classification system was used for the 862 water samples with chlorophyll values ranging from 0.3 μg/L to 280 μg/L (Table 3-3). In both cases, as the trophic state increased, the percentage of detectable microcystin increased, with 50 % (lakes) and 43 % (water samples) increases between the eutrophic and hypereutrophic categories

(Table 3-4). The highest average microcystin concentrations were measured in lakes and water samples classified as hypereutrophic. Blue-green algae dominate eutrophic to hypereutrophic Florida lakes (Canfield et al. 1989); therefore, it is not surprising that lakes of higher trophic status yielded higher microcystin concentrations.

Kotak and Zurawell (2007) showed that frequency of occurrence of microcystin increased with trophic status as well. In Florida, a shift in phytoplankton occurs with increasing trophic state, with green algae dominating oligotrophic waters, diatoms peaking in mesotrophic waters, and cyanobacteria dominating eutrophic waters (Duarte et al. 1992). Additionally, blooms with higher cell densities usually displayed higher toxin content (Sedmack and Kosi 1998; Chorus and Bartram 1999). Therefore, an increase in nutrients causes in an increase in algal biomass, which seems to augment toxin production. Cyanobacteria have been shown to dominate in oligotrophic Florida lakes, usually at lower biomasses (Canfield et al. 1989), and microcystin did occur in lakes of lower trophic status during this 187 Florida lake study. Despite the trend of increasing microcystin concentrations with increasing trophic state, only two of the lakes in this study produced water samples with microcystin concentrations above the WHO recreational standard.

Lake managers, lake users, and community members struggle with the conundrum of determining if and when microcystin concentrations pose a threat to animals and humans. Many attempts have been made to create indices for prediction of algal abundance or bloom frequencies using nutrient data (Heiskary and Walker 1988; Havens and Walker 2002; Bachmann et al. 2003). Consequently, tables relating chlorophyll and microcystin concentrations were constructed to assist lake managers and the public to predict the frequencies of microcystin concentrations in Florida lakes, from non-detectable to detectable, to ≥ 1 μg/L, and ≥ 20 μg/L (Tables 3-5 and 3-6). The tables follow the annual and warm-season (July-November) chlorophyll averages specific to Florida lakes (Bachmann et al. 2003). The warm-season chlorophyll averages include data collected during the months July-November, a period when chlorophyll concentrations are above the annual average for Florida lakes (Brown et al. 1998; Bachmann et al. 2003). Reviewing these tables suggests that the chance of encountering elevated microcystin concentrations increases with increasing chlorophyll concentrations. These tables may, therefore, prove useful for lake managers and users to predict when a microcystin bloom event would be likely to occur (based on chlorophyll concentrations). Furthermore, these tables could be helpful in north-temperate lakes as nutrient-chlorophyll relationships are similar between Florida lakes and temperate lakes (Brown et al. 2000), and nutrient-chlorophyll relationships have been shown to be linked to microcystin concentrations in this study.

In the six hypereutrophic Harris Chain lakes, mean microcystin concentrations (for samples collected at 0.5 m) ranged from 0.3 μg/L to 1.8 μg/L, with an average of 1 μg/L (Table 3-7). With the lake acting as the experimental unit, 216 individual microcystin samples were collected, with 57 % of the individual water samples containing detectable microcystin (≥ 0.1 μg/L) and 40 % were above 1 μg/L. No individual water samples had microcystin concentrations above 20 μg/L.

The highest microcystin concentrations were consistently seen at the beginning of the Harris Chain of Lakes (Lake Beauclaire, Lake Dora East and Lake Dora West). Lake Griffin (the last lake in the chain) consistently had higher microcystin concentrations than Lake Eustis and Lake Harris (Figure 3-5). Measured concentrations of TP, TN, and CHL followed the same pattern of microcystins, meaning that high concentrations of TP, TN, and CHL corresponded to the higher microcystin concentrations seen among these lakes (Figure 3-6). Linear regressions of logarithmic nutrient and chlorophyll relationships with logarithmic microcystin concentration were weak for TP (R^2= 0.18, p-value) and CHL (R^2= 0.36, p-value < 0.001). The relationship between total nitrogen and microcystin was stronger (R^2= 0.46, p-value < 0.0001) as approximately 46 % of the variability in microcystin is explained by total nitrogen in the study lakes of the Harris Chain of Lakes. However, unexplained variability still remains suggesting that there are other factors influencing microcystin concentrations.

Within the Harris Chain of Lakes, the highest microcystin concentration measured at an individual, open water station was 15 µg/L. This water sample was collected at Lake Harris in a surface water sample. Another algal bloom was observed at the Lake Eustis boat ramp (not a normal sampling site) and the collected water sample had a microcystin concentration of 117 µg/L. Both water samples were collected in December of 2006. This is interesting because in these lakes, the microcystin concentrations began to increase around May and peaked during the period July-November. All lakes, however, had their lowest measured open-water microcystin concentrations in December (Figure 3-5). Lake Eustis fairly consistently had lower monthly microcystin concentrations compared to the other Harris Chain of Lakes.

However, high microcystin concentrations can occur at any time and place within a Florida lake. The occurrence of these high microcystin concentrations, illustrates the spatial and temporal variability in microcystin within a lake and among lakes. Blooms can occur anywhere in the lake, and many times wind concentrates blooms on shorelines or in specific areas of the lake (Verhagen 1994, Falconer et al. 1999). For instance, Lake Harris consistently had microcystin concentrations below 1 µg/L, but the highest microcystin concentration measured during the sampling period was captured at one of the three sampling stations, in December (the other two stations had negligible microcystin concentrations) (Figure 3-5).

Instances such as these, where blooms with elevated microcystins are sporadically present both within and among lakes, makes sampling and capturing bloom events very difficult. To characterize the sampling year (normal, low, or high) in comparison to other years, logarithmic transformed chlorophyll and total phosphorous concentrations for 2006 where compared to the historical concentrations (2000-2005) for the 187 Florida lakes using LAKEWATCH data. The mean chlorophyll and total phosphorus concentrations for 2006 did not significantly differ from the mean chlorophyll and total phosphorus concentrations for 2000-2005 for the 187 lakes (CHL- ANOVA: F= 0.1, p-value= 0.8 and TP- ANOVA: F= 0.5, p-value= 0.5). Furthermore, 99 of the 187 studied lakes were sampled consistently each year (2000-2006). No significant difference was seen between the mean chlorophyll and total phosphorus concentrations for 2006 compared to the years 2000-2005 (CHL- ANOVA: F= 0.04, p-value= 0.85 and TP- ANOVA: F= 0.21, p-value= 0.65) for these 99 lakes. These results suggest that 2006 is characterized as a "normal" year in regard to chlorophyll and total phosphorus; therefore, there is an increased probability that this study reflects the typical occurrences in these Florida lakes.

Measured microcystin concentrations showed no change in concentration of increasing or decreasing over a six-month freezing period for both a cultured M*icrocystis aeruginosa* strain (PCC 7806) and five lake water samples from different lakes (Figure 3-7). Freezing water samples has shown to have no effect on TP, TN, CHL concentrations or color for freshwater samples frozen up to 150 days (Canfield et al. 2002). Frozen microcystin samples, however, display high variability among months, with a coefficient of variation of 58 % for the cultured microcystin strain and a coefficient of variation ranging from 20 % to 40 % for the five lakes. A coefficient of variation < 15 % is expected for ELISA kits (Abraxis LLC.). The additional variation is most likely attributed to error associated among the ELISA kits. Comparing the measured microcystin concentrations of the standards for the 50 ELISA kits run during this study to the manufacturer microcystin concentration for each standard illustrates that slight discrepancies exist among ELISA kits with the higher concentrations yielding bigger disparities (Table 3-8). Slight differences are expected. For example, the concentration of the positive control (one of the included standards) should be in a range of +/- 25 % (Abraxis LLC., Warminster, USA).

It has been suggested that plastics absorb microcystin and affect overall microcystin concentration determination (Codd and Bell 1996). The use of polypropylene containers was found to lower microcystin concentrations by approximately 0.3 µg/L when compared to glass (Metcalf et al. 2000). Microcystin concentrations have also suggested to decrease 1.5 µg/L for each disposable pipette tip used in toxin preparation and analysis (Hyenstrand et al. 2001). Conversely, using plastics has been shown to produce reliable results (Harada et al. 1999). In this study, plastic polypropylene and glass containers were found to have no effect on microcystin concentrations for the cultured *Microycstis aeruginosa* strain (PCC 7806) over a 6 month period (Figure 3-8). The amount of microcystin being affected by using plastic over glass seems slight, especially when the study objective is to screen and monitor water bodies for concentrations above the WHO drinking water (1 µg/L) and recreational (20 µg/L) standards. If a study's objective focused on detection and monitoring of small amounts of microcystin, such as in a water treatment plant, the suggested decrease in microcystin using plastic items might be an issue of concern.

Differences in sampling techniques can magnify measurement differences (e.g., cyanobacterial biomass or microcystin concentration), leading to significantly divergent results

(Ahn et al. 2008; Chorus and Bartram 1999). Three sampling depths and techniques were used in the Harris Chain of Lakes study (surface, 0.5 m, and integrated samples). Mean microcystin concentrations for all sampling methods combined ranged from non-detectable to 15 μg/L, with a grand average of 1 μg/L. The surface water samples had microcystins ranging from non-detectable to 15 μg/L with a mean of 1.1 μg/L, the 0.5 m water samples ranged from 0.3 μg/L to 1.8 μg/L, with an average of 1 μg/L, and the integrated samples had microcystins ranging from non-detectable to 3.6 μg/L with a mean of 1.1 μg/L. No significant difference in microcystin concentrations was found among the three different sampling depths and techniques used for these six lakes (ANOVA: $F= 0.49$, p-value = 0.82). Brown et al. (1999) had similar results with no significant difference measured among estimates of TP, TN, and CHL for water samples collected at 1m, 2m, and an with integrated sampler. All of the sampling locations used in this study were at open-water sites. These different sampling techniques addressed the possible differences that might be seen in microcystin concentrations due to lake hydrological and edaphic features (Codd et al. 1999) or cyanobacterial migration throughout the water column (Hedger et al. 2004).

Table 3-1. Microcystin concentrations (µg/L) in surface waters (< 1.0 m)

Source	N samples	N lakes	Location	Duration of study	Detection Limit	Range	Highest value*
Johnston and Jacoby (2003)	.	1	Washington, USA	May-Oct. 1999	0.16	1.5 - 3.1	43
Wu et al. (2006)	30	30	Yangtze River, China	2003-2004 (Jul.- Sep.)	.	ND- 1.8	8.6
Wood et al. (2006)	102	54	New Zealand	2001-2004	0.02	ND- 36500	36500
Park et al. (1998)	30	12	Korea	1993-1995	.	0.6- 171	856
Haddix et al. (2007)	206	33	US**	Summer 2003	0.15	5.6	5.6
Williams et al. (2007)	72	6	Florida, USA	2003-2004	0.15	0.1-3.6	7500
LAKEWATCH study	862	187	Florida, USA	2006	0.1	ND- 34	34
Harris Chain of Lakes study	216	6	Florida, USA	2006-2007	0.1	ND- 15	117

*Highest value corresponds to the highest microcystin concentration measured from water samples collected during regular sampling or observed while completing sampling. **Includes lakes and reservoirs

Table 3-2. Summary statistics for nutrients, chlorophyll, and microcystin concentrations (μg/L) for 187 Florida lakes sampled from January-December 2006.

	N Lakes	Mean	Min	Max
Total Phosphorus	187	42	2.7	283
Total Nitrogen	187	1052	74	3450
Chlorophyll	187	25	0.42	172
Microcystin Concentration	187	0.4	ND*	12

*ND represents non-detectable microcystin concentration

Table 3-3. Summary statistics for nutrient, chlorophyll, and microcystin concentrations (μg/L) for 862 individual water samples collected from 187 Florida lakes sampled during January-December 2006.

	N samples	Mean	Min	Max
Total Phosphorus	860	44	2	427
Total Nitrogen	860	1043	33	5717
Chlorophyll	856	25	0.3	280
Microcystin Concentration	862	0.4	ND*	32

*ND represents non-detectable microcystin concentration

Table 3-4. Percent by trophic state category (based on chlorophyll concentrations), in which microcystins were detected for 187 Florida lakes and 862 individual water samples from the 187 Florida lakes during January-December 2006.

Trophic State*	N Lakes	% Detectable Microcystin	N Samples	% Detectable Microcystin
Oligotrophic	24	12	102	18
Mesotrophic	48	14	221	17
Eutrophic	80	35	378	33
Hypereutrophic	35	86	161	76

* Trophic states categorized by chlorophyll concentrations as indicated by Forsburg and Ryding (1980).

Table 3-5. Estimated percent of the time that microcystin will exceed the listed concentrations when chlorophyll concentrations (µg/L) exceed listed annual values. Microcystin concentrations are from 862 water samples collected from 187 Florida lakes from January-December 2006.

	Microcystin Concentration (µg/L)			
Annual average				
CHL	ND*	≥ 0.1	≥ 1	≥ 20
2	13	10	0	0
5	42	22	0	0
10	68	34	2	0
15	79	40	7	0
20	84	46	10	0
25	88	51	14	0
30	90	56	19	0
35	92	59	24	0
40	94	66	27	0
45	95	71	30	0
50	96	75	32	0
55	96	77	36	0
60	97	80	36	0
65	97	84	41	0
70	98	84	49	0
75	98	85	56	0
80	98	87	57	0
85	98	87	61	0
90	98	87	63	0
96	98	89	63	0
109	98	94	66	0
120	99	94	71	0
125	100	95	76	0
144	100	97	80	0
196	100	99	88	0
265	100	99	100	100

*ND represents non-detectable microcystin concentration

Table 3-6. Estimated percent of the time that microcystin will exceed the listed concentrations when chlorophyll concentrations (µg/L) exceed listed warm season (July-November) concentrations. Microcystin concentrations are from 862 water samples collected from 187 Florida lakes from January-December 2006.

	Microcystin Concentration (µg/L)			
Warm Season				
CHL	ND*	≥ 0.1	≥ 1	≥ 20
2	10	2	0	0
5	34	14	0	0
10	63	22	3	0
15	76	30	3	0
20	81	36	6	0
25	86	41	11	0
30	89	47	17	0
35	89	54	19	0
40	93	62	25	0
50	96	72	33	0
60	96	80	33	0
70	97	88	47	0
80	97	88	50	0
90	97	89	58	0
100	98	94	58	0
117	99	99	67	0
138	100	100	78	0
178	100	100	89	0
252	100	100	100	100

*ND represents non-detectable microcystin concentration

Table 3-7. Summary statistics for nutrient, chlorophyll, and microcystin concentrations (µg/L) sampled from September 2006-August 2007 for six Harris Chain of Lakes located in Lake County, Florida.

	N Lakes	Mean	Min	Max
Total Phosphorus	6	57	39	94
Total Nitrogen	6	3111	2006	4107
Chlorophyll	6	126	73	190
Microcystin Concentration	6	0.99	0.34	1.8

Table 3-8. The manufacturer's microcystin concentration, for each standard provided in the ELISA kit is designated as standard. The minimum, median, and maximum represent the microcystin concentration (µg/L) measured for the standards for 50 ELISA kits.

Standard	Minimum	Median	Maximum
0	0	0	0.08
0.15	0.2	0.1	0.9
0.4	0.3	0.4	0.5
0.75	0.5	0.8	1.1
1	0.5	1.2	1.8
2	1.6	2.2	2.7
5	2.8	4.27	5.2

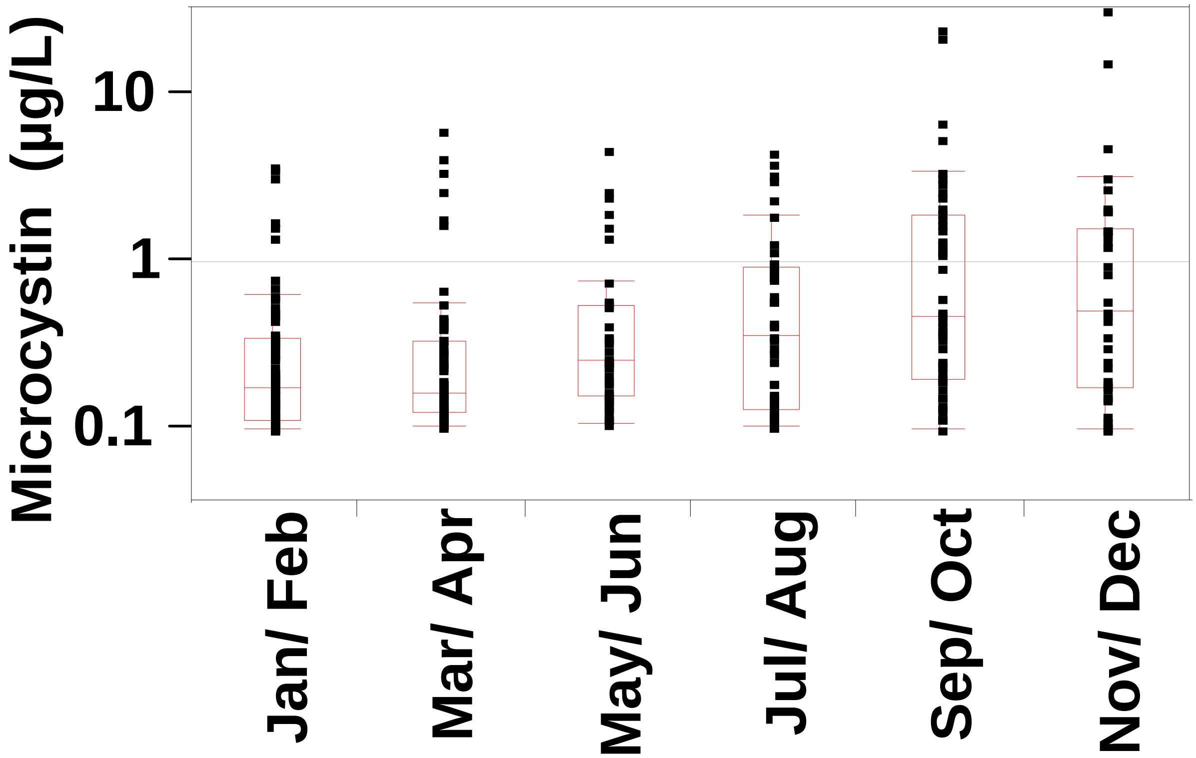
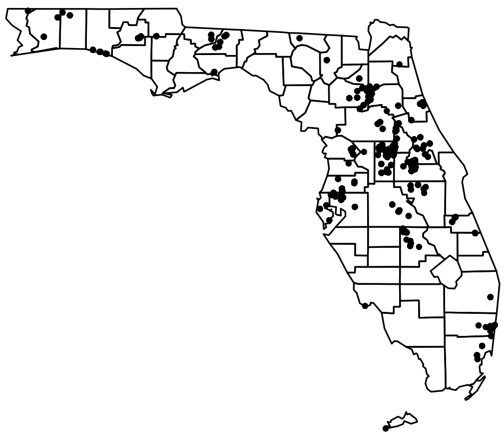


Figure 3-1. The 95 % confidence intervals for the microcystin concentrations measured from the 862 water samples collected bi-monthly from January-December 2006 for 187 Florida lakes. Water samples (560 out of 863), that contained no detectable microcystin (< 0.1 µg/L), were not included.



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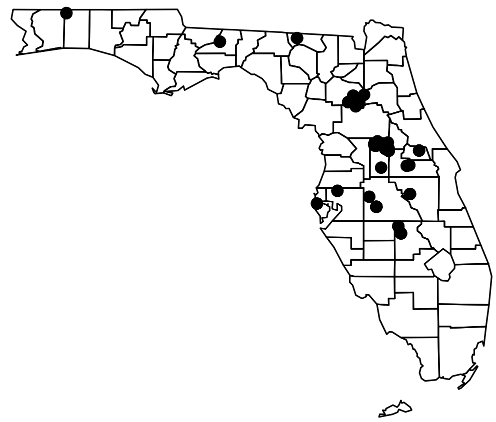

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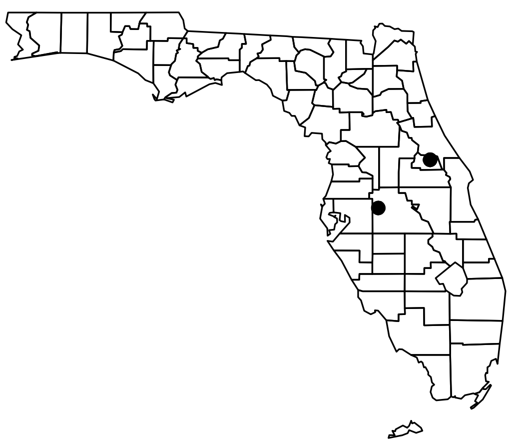


C

Figure 3-2. The 187 lakes split into categories: A represents lakes exhibiting microcystin concentrations less than 1.0 µg/L, B concentrations ≥ 1.0 µg/L, and C ≥ 20 µg/L. The lakes were grouped into WHO standard categories based on the highest microcystin concentration experienced within the lake throughout sampling.

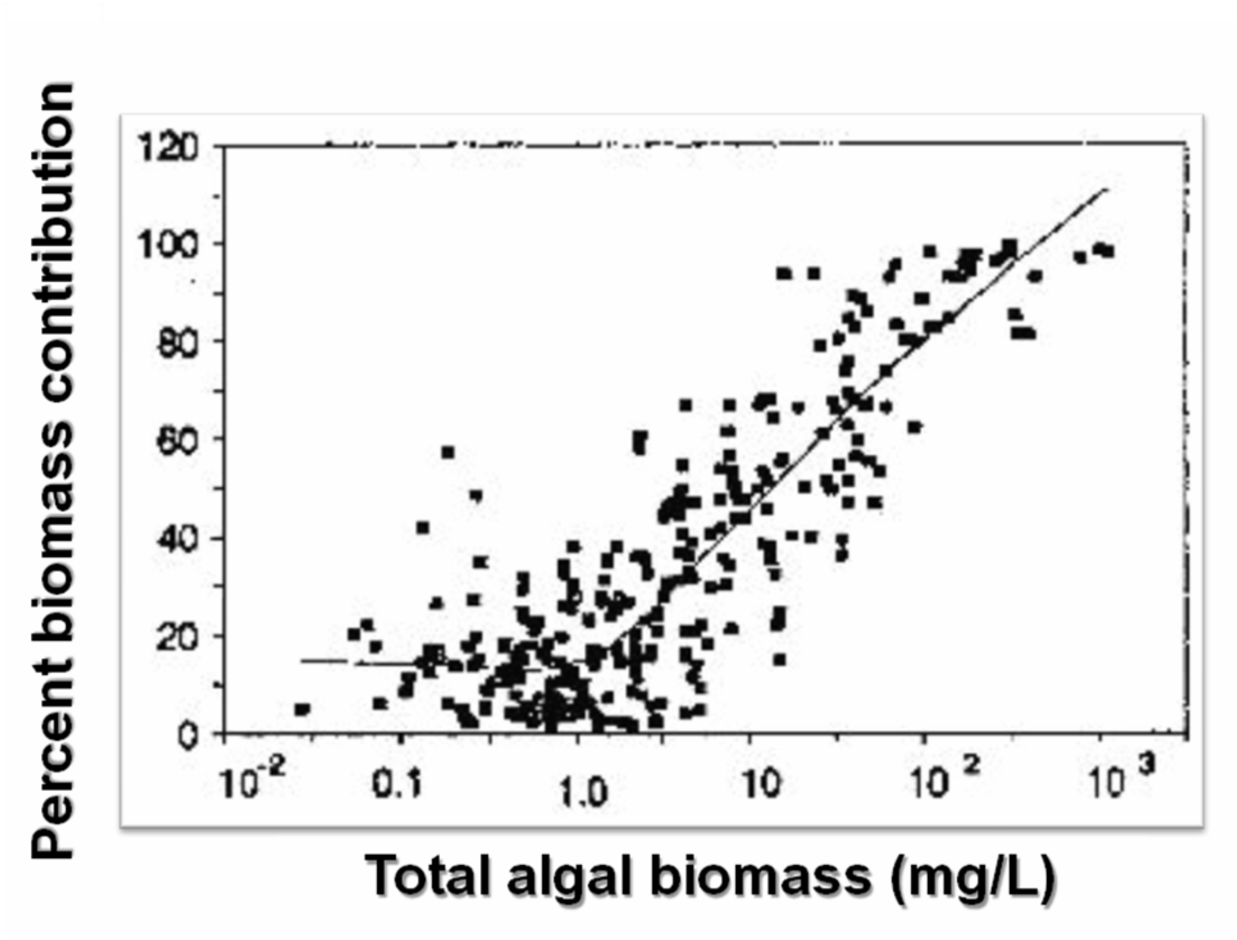


Figure 3-3. Relationship between total algal biomass (mg/L) in Florida lakes and percent biomass contribution from cyanobacteria (Duarte et al. 1992).

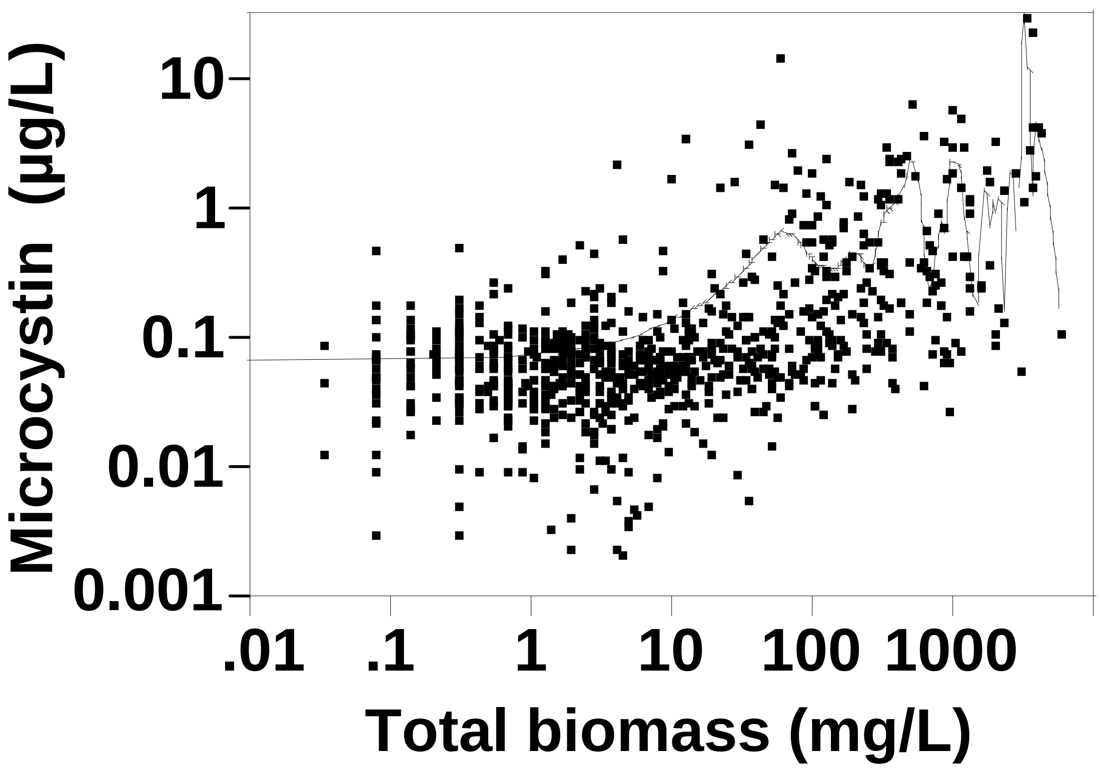


Figure 3-4. Microcystin concentrations compared to total algal biomass (mg/L) for 862 water samples from 187 Florida lakes collected from January-December 2006. Total algal biomass values were calculated from chlorophyll concentrations using an equation specific to Florida (Canfield et al. 1985).

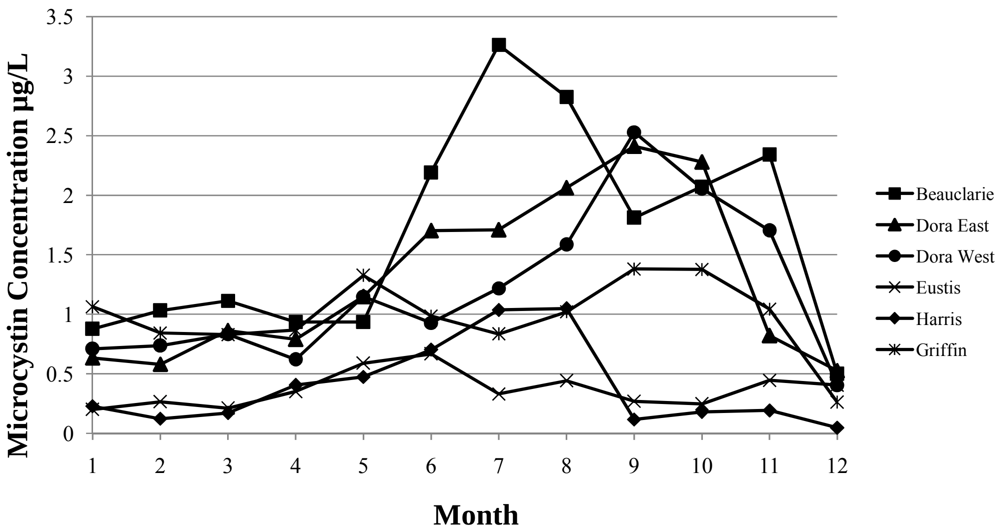
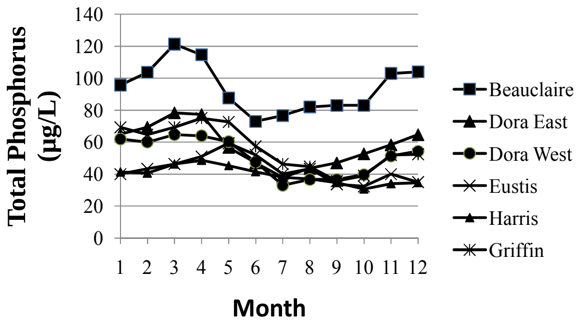
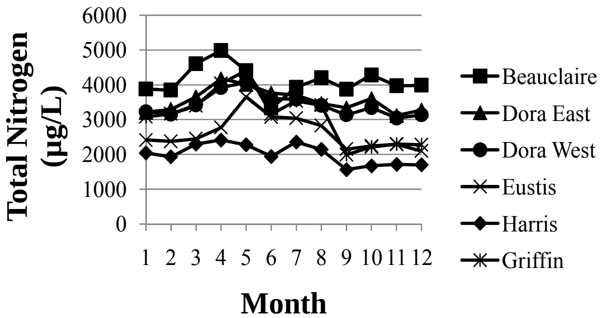


Figure 3-5. Monthly microcystin concentrations (µg/L) for six hypereutrophic Harris Chain of Lakes located in Lake County, Florida sampled during September 2006-August 2007.





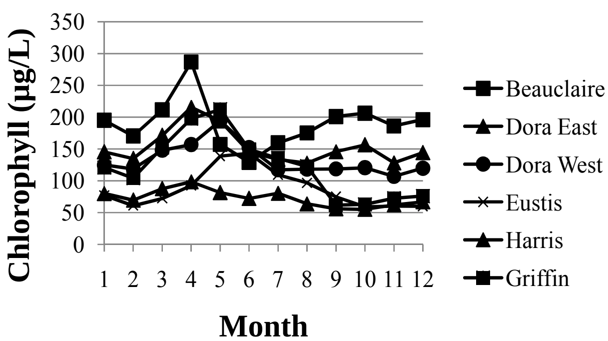


Figure 3-6. Monthly mean nutrient and chlorophyll concentrations (µg/L) for each of the six Harris Chain of Lakes located in Lake County, Florida sampled from September 2006-August 2007.

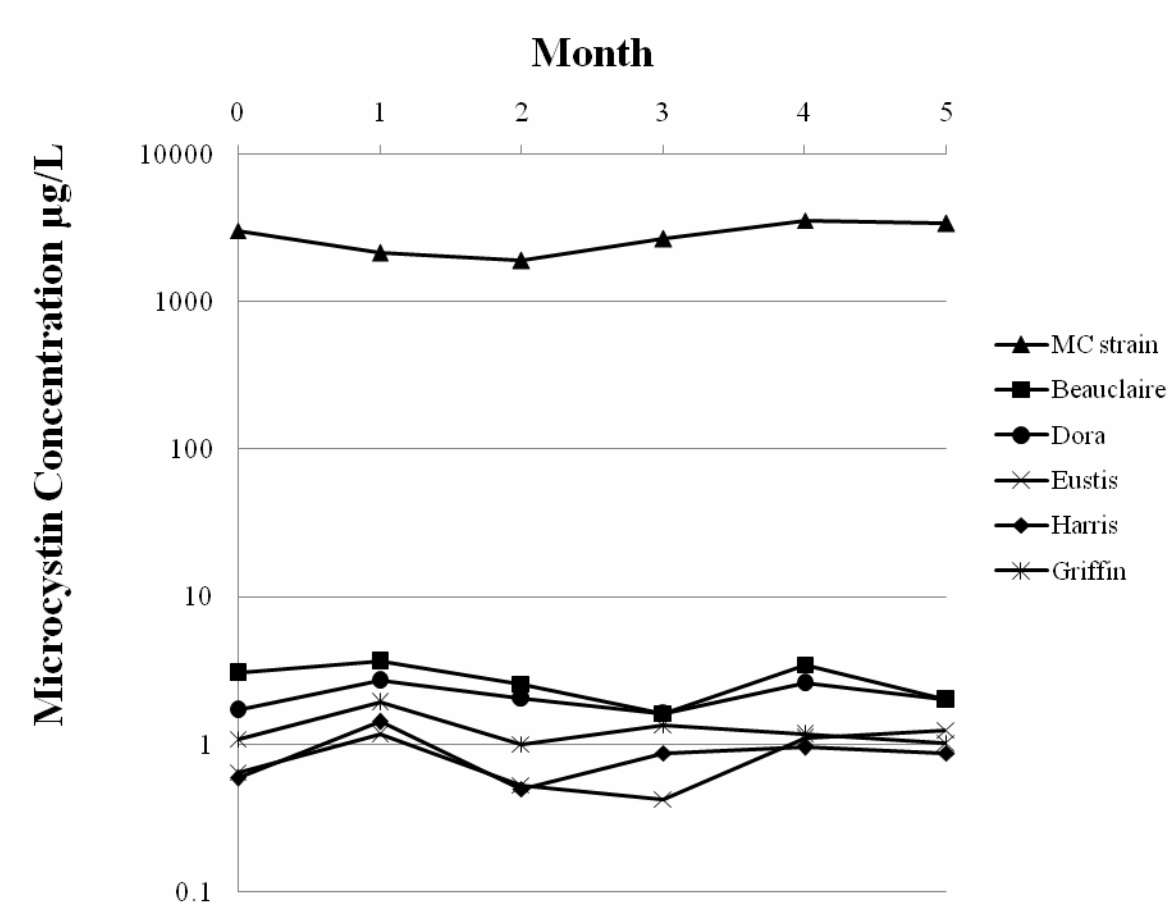


Figure 3-7. Effects of freezing and thawing on measurements of monthly microcystin concentrations (µg/L) for a cultured *Microcystis aeruginosa* strain (PCC 7806) and five lakes. Month 0 represents the fresh sample and acts as the standard for monthly comparison of microcystin concentrations.

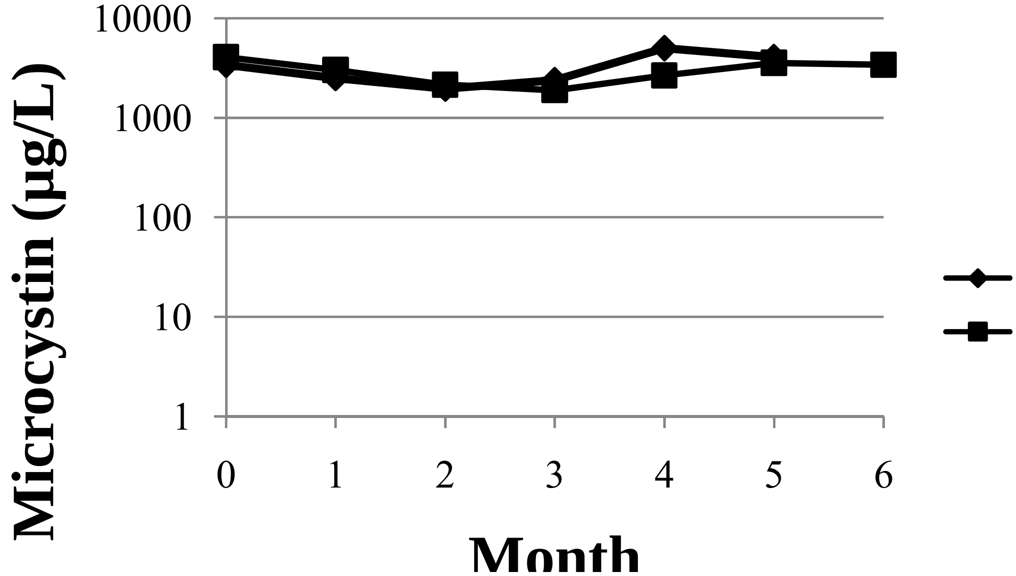


Figure 3-8. Monthly microcystin concentrations (µg/L) of a cultured *Microcystis aeruginosa* strain (PCC 7806) in glass versus plastic (polypropylene) containers among months. Month 0 represents the fresh sample and acts as the standard for monthly comparison of microcystin concentrations.

CHAPTER 4
CONCLUSIONS

In 187 Florida lakes, microcystin concentrations were at detectable limits 29 % of the time and 8 % of lakes were above the drinking water standard of 1 μg/L. No lakes exceeded the recreational standard of 20 μg/L during 2006. At all times during the year, some microcystin concentrations were found above 1 μg/L, but concentrations significantly increased throughout the year, with the highest concentrations occurring during September-December. Individual water samples (862 samples), gave similar results to the mean microcystin concentrations by lake, with 28 % of the individual water samples containing detectable microcystin (≥ 0.1 μg/L) and 7 % above the World Health Organization (WHO) drinking water standard of 1 μg/L. Only three individual samples were above the WHO recreational standard of 20 μg/L. Therefore, if lakes were to be used for drinking water, concerns could arise and additional monitoring would be suggested.

As total cyanobacterial biomass and dominance increased, microcystin concentrations were found to increase with values of 1 μg/L and greater being measured cyanobacterial became 100 % dominant in the phytoplankton community at a total biomass of 100 mg/L. An increase in microcystin concentrations was also associated with an increase in nutrients and chlorophyll concentrations. Eutrophic to hypereutrophic lakes generally had higher microcystin concentrations, but there still is a potential for microcystin to occur in lakes of any trophic state. Within hypereutrophic lakes, microcystin concentrations were found to be consistently around or above 1 μg/L, but concentrations rarely exceeded 20 μg/L. Microcystin and nutrient relationships were weakly correlated, suggesting that other environmental and cellular factors may also be influencing microcystin concentrations in Florida lakes. However, the relationship between total nitrogen and microcystin may be strong in some of the examined lakes.

Despite the earlier cautionary evidence regarding sampling methods, preparation, the slight differences that may be seen in microcystin concentrations are minor when considering the objectives for this study and other future survey or monitoring studies. Currently, there are no mandatory or accepted protocols for sampling, preparation, or analyses for microcystin (Chorus and Bartram 1999). However, given the uncertainty factor associated with the WHO standards, survey and monitoring studies, using available technologies, should work adequately to monitor microcystin concentrations in lakes.

Due to financial, personnel, and time constraints, the well-established Florida LAKEWATCH volunteer program was utilized to collect water samples from the 187 Florida lakes. The Florida LAKWATCH program is a reliable program and produces results equivalent to professionals (Canfield et al. 2002). However, many people criticize using a volunteer program because of concepts such as using frozen water or not implementing an agency certified QA&QC protocol. No comprehensive study exists for microcystin in Florida lakes and working with LAKEWATCH volunteers permitted an opportunity for a large, study evaluating microcystins to be completed. It was suggest the methodologies used might not capture short-duration intense blooms. To address this issue, LAKEWATCH volunteers were notified of the project and, if intense blooms or blooms of concern were observed, they were asked to collect a sample and send it for microcystin analysis. No such samples were received from the 187 study sampled lakes in 2006.

There is a possibility that high microcystin concentrations occur in Florida lakes, especially in eutrophic and hypereutrophic lakes. Microcystins were found more frequently in lakes of higher trophic status and increase in frequency of detection with increasing chlorophyll concentration. The probability that an elevated (≥ 20 μg/L) microcystin concentration will occur in a Florida lake, however, seems to be slim.

Some Florida lakes, of course, do experience frequent blooms of blue-green algae under the right conditions. If a lake has consistently high microcystin concentrations or is used for purposes that require careful attention, such as drinking water, then lake monitoring efforts by professionals would be well warranted. Many lake users and community members, however, are interested in monitoring lakes from a human health perspective, but especially to placate "their" fear of toxic algae. A new method for determining microcystin concentrations in water, a microcystin test strip, became available in 2007 and offers the public the ability to monitor water bodies independently (Abraxis LLC., Warminster, USA). This microcystin test strip allows easy testing of water and reliably detects microcystin concentrations greater than 1 μg/L or greater than 10 μg/L (an overly safe estimate for recreational use for waters according to Abraxis LLC.). Such an option allows lake users to routinely monitor and to measure microcystins in the water when algal blooms of concern appear in their lakes. This would allow people to use their own discretion as to whether the waters are safe to drink or use for recreation.

The cyanobacterial toxin microcystin does not seem to pose the greatest threat to Florida lakes at least during 2006. This statement is a bold statement. However, microcystins represent an poignant issue for a variety of stakeholders (e.g., scientists, community members, medical professionals, and lake managers and users). Scientists strive to present factual, non-bias information to identify and manage lake problems to get policy evaluation and persuade decision makers to implement policies (Bartram et al. 1999). But, often "scientific information is just one element in complex political deliberations" (Lackey 2006). As negative images persuade people more effectively than positive ones (Lackey 2006), no assessment will support the science if it fails to address the perceptions and priorities of the society concerned. In the case of microcystins, many people focus on the possible adverse effects of microcystins. Yet, much ambiguity still exists in understanding the mechanisms, triggers, and adverse effects (uncertainty factors) of microcystins (Chorus and Bartram 1999). Getting the public and concerned stakeholders involved is an integral step to begin breaking down the axioms of ecological policy that, at times, inhibit the decision making process (Lackey 2006).

This study was limited to sampling during 2006. As the axiom number six suggests more calls for additional research would be made (Lacky 2006). Additional research would be beneficial because changes in cyanobacterial abundance depend on the morphology, hydrology, meterology, and geography of a waterbody (Codd et al. 1999), and future years will most likely yield varying microcystin concentrations and bloom events. Continued monitoring of microcystin in Florida lakes could address both the calls for additional research and concerns of the public. The already established LAKEWATCH program, in conjunction with the microcystin test strips, offers a cost-efficient method that involves the scientists and community in long-term monitoring of microcystin concentrations in Florida lakes. In addition to long-term monitoring, volunteers could sample lakes weekly and during observed bloom events. Microcystin data from these frequent monitoring efforts could be entered into an on-line data base and or a website to provide an early warning system to lake users. If the early warning system were available through the University of Florida also, it would allow this “real-time” data to act as both a research and extension tool. Creating an ALGAEWATCH program would greatly benefit and enhance the university’s research, extension agents, and teaching as well as contribute to an understanding of microcystins in Florida lakes.

APPENDIX A
MICROCYSTIN, NUTRIENT, AND CHLOROPHYLL DATA

Table A-1. Microcystin, nutrient, and chlorophyll data for 187 Florida lakes

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Alachua	Alto	2006	1	4	0.08	11.00	773.33	7.67
Alachua	Alto	2006	3	6	0.06	19.00	653.33	8.67
Alachua	Alto	2006	5	4	0.00	18.00	806.67	8.00
Alachua	Alto	2006	7	5	0.04	22.33	820.00	19.67
Alachua	Alto	2006	9	6	0.04	24.00	873.33	28.00
Alachua	Alto	2006	11	8	0.03	15.00	666.67	6.00
Alachua	Bivans Arm	2006	1	17	0.06	194.67	3390.00	197.67
Alachua	Bivans Arm	2006	3	19	0.09	253.00	2446.67	116.00
Alachua	Bivans Arm	2006	5	18	0.11	342.33	4313.33	280.00
Alachua	Bivans Arm	2006	8	21	0.10	179.67	2600.00	98.67
Alachua	Bivans Arm	2006	9	23	0.08	206.33	2690.00	107.67
Alachua	Bivans Arm	2006	11	30	0.07	223.67	2836.67	111.33
Alachua	Little Orange	2006	1	22	0.06	143.67	996.67	4.00
Alachua	Little Orange	2006	3	18	0.07	127.33	1020.00	4.33
Alachua	Little Orange	2006	5	21	0.00	132.33	1030.00	7.33
Alachua	Little Orange	2006	7	30	0.06	131.33	910.00	9.00
Alachua	Little Orange	2006	9	17	0.04	111.67	906.67	10.33
Alachua	Little Santa Fe	2006	2	28	0.11	20.33	920.00	2.00
Alachua	Little Santa Fe	2006	4	26	0.03	14.67	753.33	4.00
Alachua	Little Santa Fe	2006	5	23	0.03	16.33	793.33	11.00
Alachua	Little Santa Fe	2006	7	24	0.03	20.00	686.67	15.33
Alachua	Little Santa Fe	2006	9	20	0.06	13.33	616.67	10.33
Alachua	Little Santa Fe	2006	12	10	0.07	14.67	606.67	6.00
Alachua	Lochloosa	2006	1	24	0.10	87.25	1317.50	17.00
Alachua	Lochloosa	2006	3	20	0.29	117.75	1270.00	22.25
Alachua	Lochloosa	2006	5	18	1.63	148.50	1422.50	26.25
Alachua	Lochloosa	2006	6	27	0.41	149.75	1307.50	62.50
Alachua	Lochloosa	2006	7	26	0.06	149.00	957.50	26.25
Alachua	Lochloosa	2006	9	27	0.20	92.75	1382.50	54.25

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Alachua	Melrose Bay	2006	2	28	0.07	16.67	693.33	8.67
Alachua	Melrose Bay	2006	4	26	0.07	19.00	686.67	4.67
Alachua	Melrose Bay	2006	5	23	0.06	17.00	690.00	11.00
Alachua	Melrose Bay	2006	7	24	0.06	16.67	610.00	18.00
Alachua	Melrose Bay	2006	9	20	0.04	13.67	603.33	12.67
Alachua	Melrose Bay	2006	12	10	0.06	12.67	560.00	6.33
Alachua	Mize	2006	3	14	0.03	19.33	643.33	6.33
Alachua	Mize	2006	8	16	0.03	10.00	396.67	4.00
Alachua	Newnan	2006	1	31	0.23	98.00	1556.67	46.33
Alachua	Newnan	2006	4	14	1.66	158.00	2506.67	153.00
Alachua	Newnan	2006	6	22	0.10	114.33	1786.67	37.33
Alachua	Newnan	2006	7	15	0.41	151.00	2146.67	89.67
Alachua	Newnan	2006	9	19	0.51	154.00	2540.00	97.00
Alachua	Newnan	2006	11	27	1.98	230.33	4110.00	190.67
Alachua	Orange	2006	1	24	0.16	159.75	1632.50	17.25
Alachua	Orange	2006	3	20	0.11	199.50	1520.00	22.25
Alachua	Orange	2006	5	18	0.24	209.25	1772.50	16.75
Alachua	Orange	2006	6	27	0.34	206.50	1612.50	36.50
Alachua	Orange	2006	7	26	0.98	153.75	1410.00	30.75
Alachua	Orange	2006	9	27	2.39	94.75	1910.00	68.25
Alachua	Orange	2006	11	28	0.45	54.75	1507.50	26.00
Alachua	Santa Fe	2006	4	26	0.09	15.33	660.00	6.00
Alachua	Santa Fe	2006	5	23	0.02	15.00	660.00	9.33
Alachua	Santa Fe	2006	7	24	0.04	14.67	626.67	9.67
Alachua	Santa Fe	2006	9	20	0.04	13.67	613.33	10.33
Alachua	Santa Fe	2006	12	10	0.03	12.33	570.00	5.00
Alachua	Wauberg	2006	5	26	4.53	238.00	3180.00	229.67
Alachua	Wauberg	2006	10	25	3.42	141.00	2846.67	161.33
Alachua	Wauberg	2006	12	27	3.13	169.33	3036.67	123.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Bradford	Sampson	2006	2	25	0.11	36.00	903.33	13.33
Bradford	Sampson	2006	3	28	0.04	41.00	940.00	7.33
Bradford	Sampson	2006	5	21	0.01	40.33	883.33	6.67
Bradford	Sampson	2006	7	29	0.05	25.00	706.67	9.00
Bradford	Sampson	2006	9	24	0.03	20.00	680.00	7.00
Bradford	Sampson	2006	11	28	0.05	19.00	533.33	3.00
Broward	Cliff	2006	6	1	0.03	22.67	610.00	6.00
Broward	Cliff	2006	7	1	0.03	42.00	796.67	37.00
Broward	Cliff	2006	9	1	0.05	37.33	873.33	11.67
Broward	Cliff	2006	11	6	0.05	29.67	760.00	2.67
Broward	Delevoe	2006	7	12	0.03	17.67	553.33	6.33
Broward	Helen	2006	5	31	0.02	15.50	525.00	6.00
Broward	Helen	2006	8	31	0.02	22.50	575.00	6.50
Broward	Markham	2006	7	23	0.07	6.33	1210.00	8.33
Broward	North	2006	5	31	0.04	25.50	630.00	10.00
Broward	North	2006	8	31	0.02	20.00	600.00	8.00
Broward	Royal Palm	2006	7	30	0.03	10.00	966.67	7.33
Broward	Windermere	2006	5	28	0.03	5.67	303.33	1.33
Citrus	Floral City	2006	1	14	0.06	20.00	920.00	10.33
Citrus	Floral City	2006	4	14	0.12	25.67	926.67	10.00
Citrus	Floral City	2006	6	14	0.11	29.67	1040.00	18.00
Citrus	Floral City	2006	7	14	0.06	26.00	906.67	13.67
Citrus	Fort Cooper	2006	2	23	0.07	7.33	576.67	1.00
Citrus	Fort Cooper	2006	4	20	0.05	7.33	686.67	1.33
Citrus	Fort Cooper	2006	6	19	0.06	8.33	660.00	1.67
Citrus	Fort Cooper	2006	7	24	0.08	7.67	733.33	2.00
Citrus	Fort Cooper	2006	10	20	0.05	5.67	766.67	3.67
Citrus	Fort Cooper	2006	11	28	0.06	4.67	713.33	1.33
Citrus	Henderson	2006	1	4	0.13	14.00	683.33	6.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Citrus	Henderson	2006	3	28	0.12	16.67	646.67	4.00
Citrus	Henderson	2006	5	19	0.15	19.00	916.67	11.33
Citrus	Henderson	2006	7	19	0.07	17.33	880.00	14.67
Citrus	Henderson	2006	10	27	0.05	24.50	740.00	13.33
Citrus	Henderson	2006	11	13	0.05	20.67	736.67	10.33
Citrus	Small	2006	2	23	0.17	26.50	980.00	2.00
Citrus	Small	2006	7	22	0.06	31.00	1215.00	15.00
Citrus	Tsala Apopka	2006	1	3	0.09	10.67	803.33	4.33
Citrus	Tsala Apopka	2006	4	4	0.10	19.67	930.00	6.33
Citrus	Tsala Apopka	2006	5	4	0.01	17.33	950.00	5.33
Citrus	Tsala Apopka	2006	7	6	0.04	20.33	1006.67	11.00
Citrus	Tsala Apopka	2006	9	9	0.05	21.33	1020.00	21.00
Citrus	Tsala Apopka	2006	12	3	0.09	16.00	1033.33	4.67
Clay	Brooklyn	2006	1	12	0.06	10.50	220.00	2.00
Clay	Brooklyn	2006	5	5	0.02	9.33	236.67	1.33
Clay	Brooklyn	2006	7	7	0.05	8.50	340.00	4.00
Clay	Brooklyn	2006	9	8	0.05	10.50	250.00	3.50
Clay	Brooklyn	2006	11	10	0.06	18.00	320.00	5.00
Clay	Hall	2006	2	22	0.10	5.33	343.33	1.33
Clay	Hall	2006	3	29	0.02	9.67	343.33	1.00
Clay	Hall	2006	5	1	0.01	13.67	493.33	3.00
Clay	Hutchinson	2006	1	1	0.04	10.00	186.67	2.33
Clay	Hutchinson	2006	3	2	0.05	10.33	210.00	2.00
Clay	Hutchinson	2006	6	4	0.05	9.00	310.00	15.33
Clay	Hutchinson	2006	11	11	0.07	11.00	253.33	2.00
Clay	Twin	2006	1	24	0.06	7.33	333.33	1.67
Clay	Twin	2006	3	24	0.13	7.33	346.67	2.00
Clay	Twin	2006	5	21	0.03	9.33	403.33	.
Columbia	Jeffery	2006	1	30	0.10	15.67	660.00	5.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Columbia	Jeffery	2006	5	20	0.06	16.67	620.00	11.33
Columbia	Jeffery	2006	7	8	0.03	16.67	623.33	8.33
Columbia	Jeffery	2006	9	17	0.05	17.00	773.33	15.67
Columbia	Jeffery	2006	11	30	0.05	16.33	750.00	8.67
Duval	Willow	2006	10	1	0.15	40.00	2186.67	108.33
Escambia	Stone	2006	2	6	0.07	36.33	563.33	16.67
Escambia	Stone	2006	4	4	0.06	25.00	860.00	32.67
Escambia	Stone	2006	6	1	0.11	25.00	573.33	13.67
Escambia	Stone	2006	7	6	0.07	38.33	1130.00	38.33
Escambia	Stone	2006	9	7	0.15	45.33	776.67	61.00
Escambia	Stone	2006	12	1	0.18	54.00	1563.33	163.33
Flagler	Disston	2006	1	4	0.11	32.33	1156.67	1.00
Flagler	Disston	2006	4	6	0.01	32.67	786.67	7.00
Flagler	Disston	2006	6	6	0.01	31.67	1043.33	8.00
Flagler	Disston	2006	7	7	0.04	29.67	1383.33	3.00
Flagler	Disston	2006	9	4	0.05	32.67	980.00	7.33
Flagler	Disston	2006	11	5	0.02	30.67	1060.00	4.00
Flagler	Pine Grove	2006	1	20	0.07	65.00	1030.00	12.33
Flagler	Pine Grove	2006	3	16	0.05	100.33	1060.00	9.67
Flagler	Pine Grove	2006	5	17	0.03	142.00	946.67	3.67
Flagler	Pine Grove	2006	7	12	0.07	193.00	986.67	12.67
Flagler	Pine Grove	2006	9	14	0.07	344.00	1253.33	8.00
Flagler	Pine Grove	2006	11	15	0.08	132.33	1006.67	5.00
Flagler	Ribbon North	2006	1	31	0.09	22.67	743.33	9.67
Flagler	Ribbon North	2006	3	31	0.18	22.00	720.00	6.00
Flagler	Ribbon North	2006	5	24	0.02	17.67	530.00	4.00
Flagler	Ribbon North	2006	8	24	0.07	16.33	693.33	7.67
Flagler	Ribbon North	2006	9	25	0.08	16.00	703.33	9.33
Flagler	Ribbon North	2006	11	24	0.08	18.67	766.67	10.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Flagler	Wynnfield	2006	1	3	0.09	84.33	956.67	5.00
Flagler	Wynnfield	2006	3	6	0.07	44.67	666.67	5.00
Flagler	Wynnfield	2006	4	6	0.07	56.67	980.00	10.67
Flagler	Wynnfield	2006	5	31	0.01	63.00	886.67	11.00
Flagler	Wynnfield	2006	8	3	0.04	32.00	1043.33	8.33
Flagler	Wynnfield	2006	9	5	0.06	29.33	530.00	11.00
Flagler	Wynnfield	2006	11	27	0.06	21.67	576.67	2.67
Gadsden	Tallavana	2006	4	15	0.05	147.80	1348.00	70.00
Gadsden	Tallavana	2006	6	17	0.08	164.60	1566.00	105.20
Gadsden	Tallavana	2006	7	15	0.04	163.20	1622.00	71.20
Gadsden	Tallavana	2006	9	23	0.09	310.40	2040.00	160.20
Gadsden	Tallavana	2006	12	16	0.07	105.00	1425.00	106.50
Gadsden	Yvette	2006	1	17	0.03	64.33	673.33	50.33
Gadsden	Yvette	2006	4	15	0.03	37.00	726.67	27.00
Gadsden	Yvette	2006	6	16	0.05	30.67	510.00	13.33
Gadsden	Yvette	2006	7	18	0.07	40.67	580.00	21.33
Gadsden	Yvette	2006	9	15	0.05	32.33	633.33	23.00
Gadsden	Yvette	2006	11	16	0.04	27.67	366.67	15.33
Hamilton	Timber	2006	1	16	3.21	116.67	1800.00	66.67
Hamilton	Timber	2006	4	23	0.45	135.67	2513.33	39.00
Hamilton	Timber	2006	6	20	0.29	68.67	1290.00	20.33
Hamilton	Timber	2006	12	12	2.10	90.67	2236.67	32.00
Hernando	May Prairie	2006	9	20	0.08	36.33	2536.67	97.00
Hernando	May Prairie	2006	11	20	0.08	36.67	2736.67	59.67
Highlands	Byrd	2006	6	25	0.03	5.00	2426.67	1.33
Highlands	Byrd	2006	7	30	0.03	4.33	1876.67	2.00
Highlands	Glenada	2006	1	30	1.61	103.00	1086.67	53.33
Highlands	Glenada	2006	3	21	6.04	111.00	1790.00	114.33
Highlands	Glenada	2006	10	10	0.44	80.00	2093.33	112.33

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Highlands	Huckleberry	2006	1	9	1.73	233.67	1606.67	19.00
Highlands	Huckleberry	2006	5	17	2.45	157.67	1790.00	72.33
Highlands	Huckleberry	2006	7	10	3.30	59.00	1173.33	21.33
Highlands	Huckleberry	2006	9	6	0.48	50.33	883.33	20.67
Highlands	Istokpoga	2006	3	23	0.56	72.00	1533.33	55.33
Highlands	Letta	2006	1	20	0.06	23.00	486.67	7.67
Highlands	Letta	2006	3	20	0.07	24.00	456.67	4.33
Highlands	Letta	2006	5	20	0.03	27.67	546.67	4.33
Highlands	Letta	2006	7	18	0.07	21.00	473.33	4.67
Highlands	Letta	2006	10	19	0.04	18.00	443.33	5.67
Highlands	Letta	2006	11	17	0.03	25.67	493.33	7.00
Highlands	Lotela	2006	1	21	0.21	10.00	426.67	2.00
Highlands	Lotela	2006	3	20	0.11	9.67	483.33	2.00
Highlands	Lotela	2006	5	5	0.07	10.33	443.33	3.00
Highlands	Lotela	2006	7	27	0.07	10.33	393.33	2.67
Highlands	Lotela	2006	10	10	0.03	11.67	363.33	3.67
Highlands	Lotela	2006	11	9	0.03	14.00	443.33	3.00
Highlands	Lynn	2006	1	17	0.10	4.33	2116.67	4.00
Highlands	Lynn	2006	3	17	0.05	4.67	2340.00	1.00
Highlands	Lynn	2006	5	17	0.05	5.00	2190.00	3.00
Highlands	Lynn	2006	7	17	0.08	5.00	1893.33	4.67
Highlands	Lynn	2006	10	18	0.04	5.33	1663.33	11.00
Highlands	Lynn	2006	11	17	0.03	5.67	1746.67	13.67
Highlands	Persimmon	2006	1	19	0.21	38.33	2356.67	62.67
Highlands	Persimmon	2006	3	16	0.24	31.33	2003.33	58.67
Highlands	Persimmon	2006	5	17	0.19	34.00	2816.67	91.00
Highlands	Persimmon	2006	7	18	0.18	36.33	2986.67	102.33
Highlands	Persimmon	2006	10	16	0.31	30.67	2790.00	94.33
Highlands	Persimmon	2006	11	17	0.25	35.33	3146.67	96.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Highlands	Red Beach	2006	1	13	0.07	16.33	1250.00	6.33
Hillsborough	Brant	2006	2	28	0.13	34.00	946.67	6.00
Hillsborough	Brant	2006	4	30	0.15	44.67	1133.33	28.00
Hillsborough	Brant	2006	5	25	0.09	50.00	1296.67	56.33
Hillsborough	Brant	2006	7	28	0.57	37.67	1290.00	34.00
Hillsborough	Brant	2006	9	27	1.53	38.67	1060.00	28.67
Hillsborough	Brant	2006	11	21	4.71	30.33	923.33	23.33
Hillsborough	Dead Lady	2006	4	16	0.14	53.67	923.33	7.00
Hillsborough	Dead Lady	2006	5	20	0.01	46.67	896.67	10.00
Hillsborough	Dead Lady	2006	7	15	0.07	71.33	1083.33	34.00
Hillsborough	Dead Lady	2006	9	13	0.08	71.33	1173.33	44.00
Hillsborough	Dead Lady	2006	11	13	0.08	77.67	1206.67	44.67
Hillsborough	Flynn	2006	5	23	0.01	11.67	1306.67	5.33
Hillsborough	Flynn	2006	7	31	0.09	9.33	1543.33	5.67
Hillsborough	Flynn	2006	9	29	0.04	9.00	906.67	5.67
Hillsborough	Flynn	2006	11	30	0.03	7.33	846.67	6.33
Hillsborough	Noreast	2006	2	20	0.15	32.33	806.67	20.33
Hillsborough	Noreast	2006	3	21	0.05	28.67	713.33	9.33
Hillsborough	Noreast	2006	5	23	0.01	24.00	760.00	7.67
Hillsborough	Noreast	2006	8	23	0.05	24.00	666.67	8.00
Hillsborough	Noreast	2006	9	28	0.06	20.00	570.00	6.00
Hillsborough	Noreast	2006	11	24	0.06	18.33	626.67	5.00
Hillsborough	Osceola	2006	4	18	0.12	13.67	716.67	3.00
Hillsborough	Osceola	2006	5	23	0.05	15.67	763.33	5.00
Hillsborough	Osceola	2006	7	13	0.13	12.00	710.00	3.33
Hillsborough	Osceola	2006	10	14	0.20	13.00	703.33	5.00
Hillsborough	Osceola	2006	11	16	0.35	11.67	653.33	4.00
Hillsborough	Rock	2006	4	13	0.10	31.33	1033.33	20.67
Hillsborough	Rock	2006	5	6	0.02	31.33	1006.67	13.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Hillsborough	Rock	2006	7	4	0.11	27.33	900.00	22.67
Hillsborough	Rock	2006	10	10	0.06	57.67	1220.00	56.67
Hillsborough	Rock	2006	11	12	0.05	32.67	1116.67	28.00
Hillsborough	Sunset	2006	2	1	0.27	30.00	1040.00	27.00
Hillsborough	Sunset	2006	5	1	0.15	25.33	1016.67	20.67
Hillsborough	Sunset	2006	7	4	0.11	18.00	660.00	13.00
Hillsborough	Sunset	2006	9	29	0.07	19.33	830.00	11.67
Hillsborough	Sunset	2006	11	1	0.07	94.00	1083.33	13.00
Hillsborough	Valrico	2006	1	2	0.07	40.33	903.33	5.67
Hillsborough	Valrico	2006	3	6	0.06	55.67	826.67	5.33
Hillsborough	Valrico	2006	5	1	0.00	52.67	790.00	5.00
Hillsborough	Valrico	2006	7	5	0.10	41.67	780.00	9.33
Hillsborough	Valrico	2006	9	4	0.07	41.33	813.33	.
Hillsborough	Valrico	2006	12	4	0.05	21.67	630.00	5.00
Indian River	Blue Cypress	2006	1	2	0.03	98.33	1166.67	4.00
Indian River	Blue Cypress	2006	6	6	0.09	74.67	1106.67	12.67
Indian River	Blue Cypress	2006	7	9	0.07	87.67	1013.33	9.67
Indian River	Blue Cypress	2006	10	4	0.06	131.00	1163.33	6.33
Indian River	Blue Cypress	2006	11	1	0.03	129.00	1183.33	12.33
Indian River	Farm 13	2006	1	9	0.05	169.00	1563.33	20.00
Indian River	Farm 13	2006	3	14	0.05	134.67	1836.67	27.33
Indian River	Farm 13	2006	5	18	0.03	136.67	1426.67	17.33
Indian River	Farm 13	2006	10	26	0.12	167.67	1700.00	40.00
Indian River	Farm 13	2006	11	17	0.16	129.33	1766.67	36.00
Indian River	Stick Marsh	2006	1	9	0.10	167.67	1436.67	37.67
Indian River	Stick Marsh	2006	3	14	0.06	114.00	1530.00	33.33
Indian River	Stick Marsh	2006	5	18	0.01	171.00	1690.00	19.33
Indian River	Stick Marsh	2006	7	26	0.80	182.67	1630.00	33.67
Indian River	Stick Marsh	2006	10	26	0.09	192.00	1773.33	42.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Indian River	Stick Marsh	2006	11	17	0.09	162.00	2033.33	37.33
Jackson	Silver	2006	1	15	0.08	2.00	83.33	1.67
Jackson	Silver	2006	6	11	0.01	3.00	33.33	0.67
Jackson	Silver	2006	7	4	0.06	2.33	133.33	1.00
Jackson	Silver	2006	11	9	0.04	3.50	46.67	1.67
Lake	Beauclaire	2006	1	23	0.31	97.33	2910.00	131.33
Lake	Beauclaire	2006	3	21	0.39	104.00	3320.00	152.33
Lake	Beauclaire	2006	5	24	1.95	71.67	2800.00	74.00
Lake	Beauclaire	2006	7	19	1.16	61.33	3100.00	130.33
Lake	Beauclaire	2006	10	23	1.92	98.00	4610.00	222.00
Lake	Beauclaire	2006	11	27	1.47	94.67	3963.33	171.33
Lake	Bugg Springs	2006	1	13	0.09	75.50	505.00	2.50
Lake	Bugg Springs	2006	3	12	0.08	73.50	490.00	3.50
Lake	Bugg Springs	2006	5	14	0.02	80.00	415.00	6.00
Lake	Bugg Springs	2006	7	15	0.06	68.00	270.00	25.50
Lake	Bugg Springs	2006	10	15	0.05	81.00	515.00	7.50
Lake	Bugg Springs	2006	11	18	0.04	75.50	545.00	7.00
Lake	Clear	2006	3	27	0.04	18.67	620.00	8.00
Lake	Clear	2006	5	21	0.00	12.67	533.33	2.00
Lake	Clear	2006	7	25	0.08	13.67	460.00	2.67
Lake	Clear	2006	9	30	0.07	13.00	546.67	3.33
Lake	Clear	2006	11	20	0.09	15.33	520.00	4.00
Lake	Dora East	2006	1	23	0.33	46.33	2453.33	98.33
Lake	Dora East	2006	3	21	0.44	62.00	2833.33	124.33
Lake	Dora East	2006	5	24	0.27	47.00	2946.67	98.67
Lake	Dora East	2006	10	23	2.10	53.67	3820.00	151.33
Lake	Dora East	2006	11	27	1.52	58.67	3493.33	121.67
Lake	Dora West	2006	1	23	0.55	48.33	2563.33	93.67
Lake	Dora West	2006	3	21	0.46	63.33	2846.67	128.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Dora West	2006	5	24	0.25	45.67	3066.67	131.33
Lake	Dora West	2006	7	19	1.26	33.00	2620.00	131.33
Lake	Dora West	2006	9	19	1.83	38.33	3266.67	107.33
Lake	Dora West	2006	11	27	0.96	51.00	3383.33	101.67
Lake	Dorr	2006	1	13	0.03	17.00	613.33	4.67
Lake	Dorr	2006	3	29	0.11	22.67	633.33	4.67
Lake	Dorr	2006	6	14	0.04	17.00	546.67	6.33
Lake	Dorr	2006	7	19	0.03	12.33	456.67	3.67
Lake	Dorr	2006	12	21	0.03	12.67	390.00	5.67
Lake	East Crooked	2006	1	11	0.20	.	.	.
Lake	East Crooked	2006	3	26	0.17	7.33	793.33	4.00
Lake	East Crooked	2006	6	10	0.05	8.33	503.33	4.67
Lake	East Crooked	2006	7	14	0.07	8.00	486.67	4.33
Lake	East Crooked	2006	10	29	0.05	8.33	660.00	3.67
Lake	Emeralda	2006	3	30	0.20	50.33	2353.33	74.00
Lake	Emeralda	2006	5	1	0.19	39.33	2050.00	43.00
Lake	Emeralda	2006	7	30	0.62	29.67	1820.00	42.00
Lake	Emeralda	2006	10	6	0.90	37.67	2213.33	52.33
Lake	Emeralda	2006	12	11	1.32	60.33	2740.00	54.67
Lake	Emma	2006	1	22	0.06	14.67	1273.33	2.67
Lake	Emma	2006	3	5	0.03	15.67	1260.00	3.00
Lake	Emma	2006	6	18	0.06	14.33	1290.00	4.33
Lake	Emma	2006	7	16	0.18	17.50	1250.00	17.67
Lake	Emma	2006	10	9	0.08	15.67	1210.00	5.00
Lake	Emma	2006	11	19	0.04	14.33	1246.67	3.00
Lake	Erie	2006	1	31	0.09	48.00	1283.33	4.00
Lake	Erie	2006	4	15	0.04	42.67	1190.00	4.67
Lake	Erie	2006	5	24	0.00	42.33	1100.00	7.67
Lake	Erie	2006	7	18	0.05	45.67	1000.00	11.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Erie	2006	10	29	0.05	50.67	1190.00	7.00
Lake	Erie	2006	11	27	0.02	39.33	1123.33	10.00
Lake	Erie	2006	12	6	0.48	.	.	.
Lake	Eustis	2006	1	24	0.19	43.33	1720.00	27.67
Lake	Eustis	2006	3	8	0.05	33.00	1583.33	33.67
Lake	Eustis	2006	6	20	0.03	35.67	1396.67	36.33
Lake	Eustis	2006	7	6	0.14	49.00	1920.00	55.00
Lake	Eustis	2006	10	13	0.41	33.67	2266.67	64.67
Lake	Florence	2006	1	1	0.45	34.67	1186.67	50.00
Lake	Florence	2006	4	1	0.14	28.00	1043.33	12.67
Lake	Florence	2006	7	4	0.12	16.33	943.33	7.67
Lake	Florence	2006	10	7	0.17	19.67	1130.00	33.33
Lake	Florence	2006	11	5	0.15	23.67	1236.67	45.00
Lake	Gertrude	2006	2	23	0.50	11.00	593.33	1.00
Lake	Gertrude	2006	4	17	0.34	12.67	496.67	4.00
Lake	Gertrude	2006	5	22	0.01	9.67	526.67	1.00
Lake	Gertrude	2006	7	31	0.04	7.67	546.67	2.67
Lake	Gertrude	2006	10	31	0.06	8.67	466.67	4.00
Lake	Gertrude	2006	12	31	0.05	7.50	443.33	1.00
Lake	Grasshopper	2006	1	10	0.04	8.67	480.00	4.33
Lake	Grasshopper	2006	3	29	0.12	8.00	400.00	3.67
Lake	Grasshopper	2006	6	14	0.02	10.00	376.67	3.00
Lake	Grasshopper	2006	7	19	0.06	6.33	263.33	2.33
Lake	Grasshopper	2006	12	29	0.03	8.00	250.00	3.33
Lake	Griffin	2006	1	25	0.37	54.33	2543.33	87.33
Lake	Griffin	2006	3	20	0.28	55.33	2636.67	103.67
Lake	Griffin	2006	5	23	0.17	30.00	1710.00	39.33
Lake	Griffin	2006	7	18	0.58	27.00	1716.67	42.33
Lake	Griffin	2006	11	28	1.23	49.00	2473.33	68.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Griffin North	2006	3	30	0.42	48.67	5716.67	80.00
Lake	Griffin North	2006	5	1	0.05	43.67	2096.67	49.33
Lake	Griffin North	2006	7	30	0.78	25.67	1803.33	36.00
Lake	Griffin North	2006	9	18	1.16	39.00	2013.33	40.33
Lake	Griffin North	2006	12	11	1.25	55.33	2526.67	72.00
Lake	Griffin West	2006	1	21	0.10	66.33	1653.33	66.00
Lake	Griffin West	2006	4	14	0.66	65.33	1733.33	54.67
Lake	Griffin West	2006	5	28	0.36	75.33	1780.00	65.00
Lake	Griffin West	2006	7	29	0.10	58.00	1456.67	45.67
Lake	Griffin West	2006	9	24	1.68	54.33	1636.67	48.33
Lake	Griffin West	2006	10	23	1.12	63.33	1946.67	63.67
Lake	Griffin West	2006	11	27	0.59	56.67	1693.33	61.67
Lake	Harris	2006	1	13	0.10	26.67	1220.00	34.67
Lake	Harris	2006	3	22	0.07	29.67	1233.33	35.67
Lake	Harris	2006	4	17	0.16	36.00	1406.67	29.67
Lake	Harris	2006	7	25	0.05	34.67	1210.00	36.67
Lake	Harris	2006	10	24	0.12	34.67	1616.67	62.67
Lake	Harris	2006	12	16	0.17	40.33	1910.00	67.33
Lake	Harris Middle	2006	1	4	0.10	30.67	1260.00	42.67
Lake	Harris Middle	2006	4	10	0.32	33.33	1290.00	40.33
Lake	Harris Middle	2006	7	6	0.09	40.67	1220.00	36.67
Lake	Harris Middle	2006	9	6	0.38	34.67	1656.67	63.67
Lake	Harris Middle	2006	12	10	0.19	45.67	1880.00	74.00
Lake	Harris West	2006	4	17	0.11	27.33	1243.33	41.33
Lake	Harris West	2006	5	22	0.13	31.33	1146.67	28.67
Lake	Harris West	2006	11	15	0.19	36.67	1900.00	64.67
Lake	Hermosa	2006	1	21	0.11	28.00	1333.33	25.00
Lake	Hermosa	2006	3	23	0.08	34.67	1163.33	26.00
Lake	Hermosa	2006	5	20	0.04	25.33	1033.33	22.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Hermosa	2006	7	15	0.03	17.67	950.00	16.67
Lake	Hermosa	2006	9	16	0.05	15.50	955.00	17.00
Lake	Hermosa	2006	11	26	0.18	24.33	1486.67	34.67
Lake	Idamere	2006	4	3	0.01	7.00	370.00	2.00
Lake	Idamere	2006	5	3	0.02	10.67	446.67	3.00
Lake	Idamere	2006	7	6	0.04	9.00	376.67	3.00
Lake	Idamere	2006	10	20	0.04	11.67	373.33	3.00
Lake	Idamere	2006	11	25	0.05	12.00	356.67	3.00
Lake	Jem	2006	1	14	0.22	13.67	566.67	6.00
Lake	Jem	2006	3	25	0.34	12.33	533.33	10.67
Lake	Jem	2006	5	14	0.06	10.67	466.67	5.33
Lake	Jem	2006	6	24	0.04	10.00	416.67	3.00
Lake	Jem	2006	8	13	0.03	14.00	463.33	5.33
Lake	Jem	2006	11	12	0.15	15.33	656.67	9.00
Lake	Joanna	2006	1	21	0.14	4.67	486.67	1.00
Lake	Joanna	2006	3	28	0.10	5.33	496.67	1.33
Lake	Joanna	2006	5	16	0.03	7.00	573.33	2.33
Lake	Joanna	2006	7	1	0.09	5.67	536.67	2.00
Lake	Joanna	2006	9	26	0.13	7.67	606.67	3.00
Lake	Joanna	2006	12	6	0.07	9.00	610.00	2.00
Lake	Little Harris	2006	1	21	0.31	36.67	1380.00	43.00
Lake	Little Harris	2006	3	19	0.16	35.00	1360.00	49.33
Lake	Little Harris	2006	5	20	0.05	47.33	1396.67	51.33
Lake	Little Harris	2006	7	30	0.08	39.67	1336.67	38.00
Lake	Little Harris	2006	9	17	0.11	38.00	1800.00	56.00
Lake	Little Harris	2006	12	24	0.12	39.00	2000.00	79.67
Lake	Lorraine	2006	1	26	0.07	29.33	1776.67	13.33
Lake	Lorraine	2006	4	26	0.05	29.00	1653.33	18.00
Lake	Lorraine	2006	7	22	0.16	26.00	1723.33	12.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Lorraine	2006	10	23	0.05	31.33	1706.67	5.33
Lake	Louisa	2006	1	31	0.08	30.67	1650.00	1.00
Lake	Louisa	2006	3	28	0.13	33.67	1703.33	6.67
Lake	Louisa	2006	5	2	0.02	32.33	1670.00	6.00
Lake	Louisa	2006	8	1	0.04	30.67	1530.00	17.67
Lake	Louisa	2006	9	5	0.03	29.00	1253.33	5.33
Lake	Louisa	2006	12	5	0.03	31.33	1510.00	5.33
Lake	May	2006	2	17	0.15	30.33	943.33	26.33
Lake	May	2006	3	17	0.09	13.67	703.33	2.67
Lake	May	2006	5	9	0.03	14.00	773.33	3.67
Lake	May	2006	7	15	0.12	15.00	800.00	4.67
Lake	May	2006	10	14	0.22	18.67	833.33	7.00
Lake	May	2006	11	24	0.07	19.00	826.67	6.33
Lake	Mirror	2006	1	11	0.06	34.67	880.00	20.33
Lake	Mirror	2006	4	16	0.05	28.33	993.33	12.00
Lake	Mirror	2006	6	20	0.07	22.67	890.00	7.00
Lake	Mirror	2006	8	19	2.30	28.33	956.67	7.33
Lake	Mirror	2006	10	28	0.25	20.33	880.00	5.67
Lake	Peanut Pond	2006	1	13	0.60	23.00	530.00	7.67
Lake	Peanut Pond	2006	3	10	0.10	17.67	446.67	3.67
Lake	Peanut Pond	2006	5	4	0.02	15.67	506.67	2.67
Lake	Peanut Pond	2006	7	7	0.05	14.00	430.00	5.67
Lake	Peanut Pond	2006	9	5	0.10	14.33	423.33	6.00
Lake	Peanut Pond	2006	11	7	0.05	20.33	530.00	7.00
Lake	Picciola	2006	1	25	0.34	62.33	2793.33	92.67
Lake	Picciola	2006	5	23	0.24	33.67	1786.67	42.33
Lake	Picciola	2006	7	18	0.90	30.00	1653.33	38.00
Lake	Picciola	2006	9	20	1.26	40.67	2040.00	62.00
Lake	Picciola	2006	11	28	1.41	48.67	2313.33	65.33

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Sawmill	2006	1	24	3.69	22.67	960.00	12.67
Lake	Sawmill	2006	5	23	0.10	16.00	646.67	4.00
Lake	Sawmill	2006	8	24	0.08	13.00	716.67	7.00
Lake	Sawmill	2006	10	28	0.19	16.00	723.33	12.33
Lake	Sawmill	2006	11	27	0.51	14.33	770.00	10.67
Lake	Sellers	2006	1	10	0.09	8.00	236.67	4.67
Lake	Sellers	2006	3	29	0.08	4.00	173.33	1.33
Lake	Sellers	2006	6	14	0.01	5.67	143.33	6.00
Lake	Sellers	2006	7	19	0.05	3.00	83.33	2.00
Lake	Sellers	2006	12	21	0.03	4.33	96.67	1.33
Lake	Silver	2006	1	28	0.11	22.00	1180.00	1.67
Lake	Silver	2006	3	31	0.06	13.33	1180.00	3.00
Lake	Silver	2006	5	31	0.04	12.00	1310.00	5.67
Lake	Silver	2006	8	23	0.03	14.00	1460.00	7.67
Lake	Silver	2006	10	30	0.10	15.00	1363.33	4.33
Lake	Trout	2006	1	25	0.07	189.00	3400.00	68.67
Lake	Trout	2006	3	15	0.22	301.00	3943.33	44.67
Lake	Trout	2006	5	24	1.36	322.67	1630.00	63.33
Lake	Trout	2006	7	14	4.48	426.67	2813.33	217.67
Lake	Trout	2006	9	13	3.11	217.33	1886.67	113.67
Lake	Trout	2006	11	15	2.01	136.67	2040.00	114.33
Lake	Unity	2006	1	4	0.20	49.33	1226.67	7.00
Lake	Unity	2006	4	15	0.16	38.00	1556.67	80.00
Lake	Unity	2006	7	25	0.03	39.00	853.33	22.33
Lake	Unity	2006	10	6	0.14	31.67	800.00	27.00
Lake	Wildcat	2006	3	29	0.08	6.67	350.00	2.33
Lake	Wildcat	2006	6	14	0.02	8.67	366.67	12.67
Lake	Wildcat	2006	7	20	0.02	8.67	340.00	7.00
Lake	Wildcat	2006	11	28	0.03	7.67	323.33	7.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (μg/L)	Total phosphorus (μg/L)	Total nitrogen (μg/L)	Chlorophyll (μg/L)
Lee	Little Murex	2006	5	18	0.04	20.00	1610.00	10.33
Leon	Diane	2006	1	19	0.07	30.00	510.00	6.33
Leon	Diane	2006	4	27	0.06	16.00	370.00	5.00
Leon	Diane	2006	5	25	0.01	19.00	416.67	.
Leon	Diane	2006	7	26	0.04	17.00	500.00	5.33
Leon	Diane	2006	10	26	0.05	18.00	436.67	3.00
Leon	Diane	2006	11	22	0.04	15.33	416.67	2.00
Leon	Minniehaha	2006	1	31	0.04	16.50	595.00	5.50
Leon	Minniehaha	2006	3	11	0.07	17.00	670.00	16.00
Leon	Minniehaha	2006	5	20	0.00	14.50	580.00	8.50
Leon	Minniehaha	2006	7	17	0.05	10.50	450.00	4.50
Leon	Minniehaha	2006	10	17	0.05	8.50	490.00	2.50
Leon	Silver	2006	2	3	0.14	9.33	270.00	2.33
Leon	Silver	2006	3	10	0.04	6.33	280.00	2.50
Leon	Silver	2006	6	2	0.03	8.00	220.00	2.33
Leon	Silver	2006	7	5	0.08	7.00	256.67	2.67
Leon	Silver	2006	9	5	0.07	7.67	276.67	3.67
Leon	Silver	2006	11	2	0.07	10.00	385.00	4.67
Leon	Summerset	2006	1	2	0.11	66.00	1950.00	160.67
Leon	Summerset	2006	4	23	0.04	34.33	656.67	5.33
Leon	Summerset	2006	5	19	0.02	35.00	683.33	10.67
Leon	Summerset	2006	7	1	0.06	57.67	840.00	30.67
Leon	Summerset	2006	9	2	0.06	70.67	1033.33	43.67
Leon	Summerset	2006	11	10	0.08	41.00	653.33	14.00
Leon	Susan	2006	1	19	3.57	80.67	736.67	12.67
Leon	Susan	2006	4	17	0.56	135.67	800.00	5.33
Leon	Susan	2006	6	24	0.14	203.67	2686.67	174.00
Leon	Susan	2006	7	27	0.28	158.67	1166.67	31.00
Leon	Susan	2006	9	25	6.65	110.33	1506.67	82.33

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Marion	Charles	2006	1	10	0.11	106.00	1750.00	3.00
Marion	Charles	2006	3	13	0.05	66.67	1606.67	3.00
Marion	Charles	2006	6	4	0.02	73.00	1553.33	3.33
Marion	Charles	2006	7	5	0.04	66.67	1516.67	5.33
Marion	DeLancy	2006	3	1	0.05	12.67	556.67	4.00
Marion	Eaton	2006	1	10	0.10	69.67	1266.67	1.67
Marion	Eaton	2006	3	13	0.04	50.00	1343.33	2.33
Marion	Eaton	2006	5	4	0.03	45.67	1153.33	6.67
Marion	Eaton	2006	7	5	0.06	36.00	850.00	12.33
Marion	Halfmoon	2006	1	10	0.09	9.67	970.00	3.00
Marion	Halfmoon	2006	3	13	0.09	10.00	890.00	4.67
Marion	Halfmoon	2006	5	4	0.11	12.33	950.00	5.67
Marion	Halfmoon	2006	7	5	0.26	11.00	863.33	7.67
Marion	Tiger	2006	1	16	0.07	18.67	760.00	19.67
Marion	Tiger	2006	3	5	0.06	18.33	770.00	8.00
Marion	Tiger	2006	7	16	0.08	14.33	660.00	5.67
Marion	Tiger	2006	10	15	0.04	19.67	736.67	9.33
Marion	Tiger	2006	11	12	0.05	19.67	646.67	9.33
Miami-Dade	Colonial	2006	3	11	0.16	7.67	246.67	2.00
Miami-Dade	Colonial	2006	5	14	0.04	5.67	276.67	2.00
Miami-Dade	Highland	2006	2	20	0.05	12.33	470.00	2.67
Miami-Dade	Highland	2006	4	1	0.01	12.67	630.00	1.00
Miami-Dade	Highland	2006	5	30	0.01	10.67	433.33	2.00
Miami-Dade	Highland	2006	7	23	0.09	10.33	383.33	2.67
Miami-Dade	Highland	2006	10	14	0.08	12.33	610.00	3.67
Miami-Dade	Highland	2006	11	26	0.07	14.67	713.33	9.33
Miami-Dade	Persch	2006	1	11	0.08	21.67	1050.00	13.00
Miami-Dade	Persch	2006	4	14	0.10	25.67	1026.67	5.33
Miami-Dade	Persch	2006	5	13	0.01	26.33	1126.67	9.33

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Miami-Dade	Persch	2006	7	7	0.07	21.67	800.00	10.00
Miami-Dade	Persch	2006	10	18	0.07	22.33	933.33	9.00
Miami-Dade	Pineland	2006	3	7	0.04	9.67	210.00	1.00
Miami-Dade	Pineland	2006	7	5	0.05	7.33	456.67	2.00
Miami-Dade	Pineland	2006	10	5	0.05	7.00	296.67	2.67
Miami-Dade	Pineland	2006	11	22	0.05	4.67	283.33	1.00
Monroe	Key West Pond	2006	11	10	0.08	108.50	2065.00	122.00
Okaloosa	Hurricane	2006	1	5	0.47	19.25	375.00	6.00
Okaloosa	Hurricane	2006	4	5	0.10	24.75	375.00	12.50
Okaloosa	Hurricane	2006	6	5	0.25	22.25	572.50	16.00
Okaloosa	Hurricane	2006	7	6	0.89	26.50	895.00	30.00
Okaloosa	Hurricane	2006	10	3	2.90	31.75	782.50	30.50
Okaloosa	Hurricane	2006	11	6	1.52	30.50	685.00	16.75
Okaloosa	Karick	2006	1	5	0.06	23.33	376.67	6.00
Okaloosa	Karick	2006	4	5	0.04	48.33	396.67	7.67
Okaloosa	Karick	2006	6	2	0.06	26.00	513.33	25.00
Okaloosa	Karick	2006	7	10	0.12	38.33	683.33	17.67
Okaloosa	Karick	2006	10	3	0.09	42.33	750.00	15.67
Okaloosa	Karick	2006	11	6	0.10	31.00	650.00	21.00
Orange	Carlton	2006	1	9	0.77	58.33	2600.00	107.00
Orange	Carlton	2006	4	5	0.17	55.33	3000.00	130.00
Orange	Carlton	2006	5	9	0.25	56.33	3406.67	143.33
Orange	Carlton	2006	7	12	0.99	45.33	3290.00	130.00
Orange	Carlton	2006	10	12	1.18	63.00	3906.67	202.00
Orange	Carlton	2006	12	2	1.53	86.33	4056.67	219.33
Orange	Giles	2006	2	19	0.18	41.67	693.33	15.33
Orange	Giles	2006	4	22	0.07	28.67	493.33	10.33
Orange	Giles	2006	5	20	0.01	27.67	610.00	21.33
Orange	Giles	2006	7	8	0.09	32.00	980.00	46.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Orange	Giles	2006	10	8	0.09	24.33	670.00	26.33
Orange	Giles	2006	11	11	15.55	25.00	876.67	27.67
Orange	Holden	2006	4	14	0.05	17.00	700.00	10.00
Orange	Holden	2006	5	19	0.01	15.33	623.33	7.33
Orange	Holden	2006	7	20	0.03	25.33	740.00	24.00
Orange	Holden	2006	9	11	0.06	19.00	793.33	22.67
Orange	Holden	2006	11	11	0.07	15.67	733.33	18.33
Orange	Ivanhoe East	2006	4	18	0.09	18.00	493.33	3.67
Orange	Ivanhoe East	2006	8	4	0.06	19.33	553.33	7.00
Orange	Ivanhoe Middle	2006	4	18	0.03	19.33	470.00	3.00
Orange	Ivanhoe Middle	2006	8	4	0.08	29.67	1260.00	47.33
Orange	Ivanhoe West	2006	4	18	0.06	16.67	473.33	3.00
Orange	Ivanhoe West	2006	8	4	0.14	23.33	743.33	14.67
Orange	Johio	2006	10	13	0.07	5.67	406.67	2.00
Orange	Johio	2006	11	14	0.06	5.00	380.00	2.00
Orange	Little Fairview	2006	1	11	0.16	22.67	546.67	10.00
Orange	Little Fairview	2006	4	4	0.06	19.33	470.00	3.33
Orange	Little Fairview	2006	5	3	0.05	14.67	410.00	2.67
Orange	Little Fairview	2006	7	6	0.04	14.33	500.00	4.00
Orange	Little Fairview	2006	9	7	0.04	13.33	513.33	8.00
Orange	Little Fairview	2006	11	15	0.06	16.67	506.67	4.33
Orange	Lurna	2006	1	13	0.28	72.67	1020.00	56.00
Orange	Lurna	2006	4	16	0.16	77.00	1033.33	38.00
Orange	Lurna	2006	5	6	0.16	57.33	946.67	38.00
Orange	Lurna	2006	7	20	0.35	55.00	676.67	40.67
Orange	Lurna	2006	10	12	1.32	50.33	690.00	38.33
Orange	Lurna	2006	11	26	0.23	47.33	670.00	28.67
Orange	Susannah	2006	1	29	0.14	12.33	660.00	6.00
Orange	Susannah	2006	4	21	0.19	14.67	406.67	2.33

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Orange	Susannah	2006	5	21	0.02	14.67	426.67	5.67
Orange	Susannah	2006	7	25	0.09	17.00	483.33	6.00
Orange	Susannah	2006	9	16	0.05	17.67	500.00	7.33
Orange	Susannah	2006	11	14	0.06	19.00	590.00	8.00
Orange	Waumpi	2006	1	7	0.08	42.67	810.00	22.00
Orange	Waumpi	2006	3	12	0.05	88.33	1066.67	25.67
Orange	Waumpi	2006	5	14	0.05	92.00	1073.33	42.33
Orange	Waumpi	2006	7	16	0.05	45.33	1200.00	38.67
Orange	Waumpi	2006	9	10	0.13	41.00	820.00	19.33
Orange	Waumpi	2006	11	15	0.09	97.00	1440.00	69.67
Osceola	Alligator	2006	1	26	0.08	19.40	994.00	3.80
Osceola	Alligator	2006	4	20	0.03	20.00	984.00	3.00
Osceola	Alligator	2006	6	24	0.04	18.00	982.00	4.00
Osceola	Brick	2006	2	22	0.05	26.67	940.00	5.00
Osceola	Cypress	2006	5	14	2.57	102.00	1756.67	73.67
Osceola	Cypress	2006	7	13	1.86	124.00	1963.33	84.33
Osceola	Tohopekaliga East	2006	4	15	0.04	18.33	663.33	4.33
Osceola	Tohopekaliga East	2006	5	18	0.03	17.00	630.00	4.33
Osceola	Tohopekaliga East	2006	10	19	0.04	13.33	576.67	3.33
Osceola	Tohopekaliga East	2006	11	17	0.10	15.33	570.00	4.00
Osceola	Tohopekaliga-Middle	2006	1	5	0.09	32.00	850.00	18.67
Osceola	Tohopekaliga-Middle	2006	3	19	0.13	50.33	1226.67	38.67
Osceola	Tohopekaliga-Middle	2006	5	27	0.74	69.00	1553.33	46.00
Osceola	Tohopekaliga-North	2006	1	5	0.10	44.67	800.00	9.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Osceola	Tohopekaliga-North	2006	3	19	0.04	60.33	903.33	26.00
Osceola	Tohopekaliga-North	2006	5	27	0.15	97.67	1450.00	53.67
Osceola	Tohopekaliga-North	2006	7	27	0.58	93.00	1450.00	57.67
Osceola	Tohopekaliga-North	2006	10	6	0.34	72.00	1336.67	47.67
Osceola	Tohopekaliga-North	2006	11	3	0.31	62.00	1206.67	35.33
Osceola	Trout	2006	1	15	0.10	13.33	1080.00	4.00
Osceola	Trout	2006	3	17	0.09	17.67	1233.33	4.33
Palm Beach	Charleston West	2006	1	29	0.17	23.00	560.00	8.00
Palm Beach	Charleston West	2006	3	18	0.07	13.33	503.33	4.67
Palm Beach	Charleston West	2006	5	27	0.01	13.00	466.67	3.33
Palm Beach	Charleston West	2006	10	7	0.07	19.67	296.67	10.33
Palm Beach	Charleston West	2006	11	12	0.05	23.33	633.33	11.00
Pasco	Bird	2006	1	27	0.07	20.67	1003.33	4.33
Pasco	Bird	2006	3	17	0.05	24.33	796.67	8.33
Pasco	Bird	2006	6	1	0.01	28.33	906.67	15.67
Pasco	Bird	2006	10	4	0.05	23.00	926.67	7.50
Pasco	Bird	2006	11	26	0.07	19.33	900.00	5.33
Pasco	Crews	2006	1	16	0.11	13.33	1100.00	3.33
Pasco	Crews	2006	3	8	0.25	21.67	1350.00	6.33
Pasco	Crews	2006	5	14	0.55	44.33	2313.33	41.67
Pasco	Jovita	2006	2	18	0.07	28.00	560.00	4.00
Pasco	Jovita	2006	4	14	0.08	31.33	693.33	11.33
Pasco	Jovita	2006	6	18	0.13	20.67	593.33	6.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Pasco	Jovita	2006	7	15	0.11	22.00	600.00	6.00
Pasco	Jovita	2006	10	15	0.09	11.33	480.00	6.67
Pasco	Jovita	2006	11	17	0.05	22.00	563.33	9.33
Pasco	Karney	2006	1	8	0.07	33.00	1200.00	9.67
Pasco	Karney	2006	4	4	0.13	31.67	1136.67	11.67
Pasco	Karney	2006	7	6	0.06	35.67	1150.00	11.67
Pasco	Karney	2006	10	3	0.06	16.00	1016.67	10.00
Pasco	Karney	2006	11	9	0.04	15.67	966.67	8.00
Pasco	Little Black	2006	1	13	0.05	32.33	956.67	13.33
Pasco	Little Black	2006	3	15	0.05	31.33	946.67	14.33
Pasco	Little Black	2006	5	19	0.00	29.00	830.00	8.33
Pasco	Little Black	2006	7	15	0.08	30.33	970.00	12.00
Pasco	Little Black	2006	9	15	0.06	25.67	853.33	9.33
Pasco	Little Black	2006	11	15	0.08	24.33	960.00	14.67
Pasco	Saxon North	2006	1	31	0.09	17.00	643.33	2.67
Pasco	Saxon North	2006	3	28	0.08	18.00	633.33	2.00
Pasco	Saxon South	2006	1	31	0.08	16.00	640.00	5.67
Pasco	Saxon South	2006	3	28	0.04	18.67	723.33	3.00
Pinellas	Alligator	2006	10	23	0.05	133.33	870.00	30.00
Pinellas	Maggiore	2006	1	26	0.26	125.67	3490.00	145.00
Pinellas	Maggiore	2006	4	20	0.19	167.00	4083.33	104.00
Pinellas	Maggiore	2006	6	27	0.04	78.67	2446.67	90.67
Pinellas	Maggiore	2006	7	20	0.03	69.33	2660.00	109.67
Pinellas	Placid	2006	1	12	0.17	51.67	1830.00	15.67
Pinellas	Placid	2006	4	14	0.41	61.00	1506.67	47.33
Pinellas	Placid	2006	10	14	2.57	32.00	1733.33	40.67
Pinellas	Placid	2006	11	14	2.01	52.00	1520.00	36.00
Polk	Belle East	2006	1	28	0.13	40.00	1020.00	13.00
Polk	Belle East	2006	4	1	0.12	54.33	843.33	26.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Polk	Belle East	2006	5	1	0.02	46.00	923.33	25.67
Polk	Belle East	2006	7	29	0.08	20.33	713.33	9.33
Polk	Belle East	2006	12	23	0.03	40.00	1020.00	24.67
Polk	Belle West	2006	1	28	0.09	38.67	1060.00	17.33
Polk	Belle West	2006	4	1	0.08	50.00	826.67	25.67
Polk	Belle West	2006	5	1	0.06	46.67	920.00	24.00
Polk	Belle West	2006	7	29	0.04	19.33	676.67	9.00
Polk	Belle West	2006	9	30	0.05	23.33	680.00	10.67
Polk	Belle West	2006	12	23	0.03	45.33	1066.67	39.33
Polk	Dexter	2006	3	14	0.19	10.00	400.00	1.00
Polk	Dexter	2006	5	21	0.03	10.00	413.33	1.00
Polk	Dexter	2006	7	29	0.12	8.33	393.33	1.67
Polk	Dexter	2006	9	24	0.07	11.33	460.00	1.67
Polk	Dexter	2006	11	19	0.06	11.00	440.00	1.67
Polk	Gaskin's Cut	2006	1	24	1.37	182.00	1663.33	34.00
Polk	Gaskin's Cut	2006	3	27	4.08	375.67	3016.67	234.33
Polk	Gaskin's Cut	2006	7	19	3.76	277.33	2023.33	89.00
Polk	Gaskin's Cut	2006	10	18	5.28	285.00	2253.33	122.33
Polk	Gaskin's Cut	2006	11	15	2.74	297.00	2300.00	77.67
Polk	Hunter	2006	3	30	3.45	172.00	2346.67	106.00
Polk	Hunter	2006	9	6	21.29	127.67	2140.00	.
Polk	Wales	2006	1	10	0.62	30.00	590.00	24.00
Polk	Wales	2006	5	10	0.04	25.00	666.67	5.33
Polk	Wales	2006	7	10	0.09	16.00	510.00	7.00
Polk	Wales	2006	10	9	0.08	21.00	560.00	21.00
Polk	Wales	2006	11	8	0.11	25.33	680.00	26.33
Polk	Weohyakapka	2006	1	23	0.11	19.67	630.00	10.33
Polk	Weohyakapka	2006	3	27	0.12	31.00	786.67	13.33
Putnam	Annie	2006	2	17	0.19	7.33	413.33	1.33

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Putnam	Annie	2006	3	19	0.25	7.33	410.00	3.00
Putnam	Annie	2006	5	20	0.53	5.00	376.67	2.00
Putnam	Annie	2006	7	18	0.03	4.00	370.00	2.00
Putnam	Annie	2006	9	16	0.08	7.33	453.33	5.00
Putnam	Annie	2006	11	19	0.05	8.67	430.00	7.00
Putnam	Ashley	2006	1	30	0.06	18.00	343.33	6.67
Putnam	Ashley	2006	3	27	0.05	22.33	423.33	10.00
Putnam	Ashley	2006	5	30	0.02	15.00	320.00	7.00
Putnam	Ashley	2006	7	23	0.08	17.33	293.33	5.33
Putnam	Ashley	2006	9	16	0.08	19.33	366.67	7.00
Putnam	Ashley	2006	11	29	0.05	15.33	413.33	4.67
Putnam	Barco	2006	1	12	0.07	2.67	146.67	1.33
Putnam	Barco	2006	5	16	0.02	3.67	83.33	1.00
Putnam	Barco	2006	7	24	0.03	4.00	116.67	2.00
Putnam	Barco	2006	9	22	0.03	6.67	250.00	2.00
Putnam	Barco	2006	11	22	0.08	3.33	136.67	2.00
Putnam	Broward	2006	1	31	0.11	5.33	356.67	1.33
Putnam	Broward	2006	4	30	0.28	7.33	270.00	2.67
Putnam	Broward	2006	5	30	0.08	6.67	270.00	2.00
Putnam	Broward	2006	7	14	0.04	3.00	220.00	2.67
Putnam	Broward	2006	9	28	0.08	8.00	330.00	4.67
Putnam	Broward	2006	11	29	0.11	4.33	273.33	1.67
Putnam	George South	2006	4	25	0.09	40.00	936.67	23.33
Putnam	George South	2006	5	24	0.08	25.67	450.00	19.67
Putnam	George South	2006	7	26	0.31	32.33	870.00	21.67
Putnam	McCloud	2006	1	17	0.07	4.33	466.67	3.00
Putnam	McCloud	2006	4	17	0.07	4.33	433.33	1.00
Putnam	McCloud	2006	6	23	0.02	6.00	433.33	1.67
Putnam	McCloud	2006	7	25	0.02	6.67	430.00	3.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Putnam	McCloud	2006	9	16	0.03	6.67	380.00	3.00
Putnam	McCloud	2006	11	25	0.04	9.67	433.33	1.33
Putnam	Punchbowl	2006	2	9	0.05	17.33	806.67	4.00
Putnam	Punchbowl	2006	4	5	0.09	19.33	676.67	6.33
Putnam	Punchbowl	2006	5	5	0.04	15.33	726.67	3.67
Putnam	Punchbowl	2006	11	13	0.04	17.00	630.00	7.00
Putnam	Suggs	2006	1	5	0.07	133.33	1363.33	1.67
Putnam	Suggs	2006	4	4	0.04	79.67	1266.67	3.00
Putnam	Suggs	2006	5	2	0.03	69.33	1313.33	4.67
Putnam	Suggs	2006	7	23	0.02	59.67	1183.33	10.67
Putnam	Suggs	2006	9	23	0.03	76.00	1156.67	11.67
Putnam	Suggs	2006	11	22	0.04	71.33	1073.33	7.00
Putnam	Winnott	2006	2	18	0.11	21.67	763.33	5.00
Putnam	Winnott	2006	3	11	1.76	22.00	826.67	11.33
Putnam	Winnott	2006	5	16	0.08	23.00	803.33	8.00
Putnam	Winnott	2006	9	6	0.06	23.33	773.33	12.33
Putnam	Winnott	2006	11	13	0.10	11.00	680.00	5.00
Santa Rosa	Bear	2006	1	4	0.08	20.67	346.67	12.33
Santa Rosa	Bear	2006	4	4	0.08	24.33	280.00	6.33
Santa Rosa	Bear	2006	6	7	0.02	25.33	330.00	14.67
Santa Rosa	Bear	2006	7	6	0.15	31.67	676.67	18.67
Santa Rosa	Bear	2006	10	2	0.06	41.33	553.33	21.67
Santa Rosa	Bear	2006	11	3	0.08	44.33	470.00	23.00
Santa Rosa	Ski Watch	2006	1	15	0.08	4.20	56.00	1.60
Santa Rosa	Ski Watch	2006	3	18	0.10	6.80	96.00	2.80
Santa Rosa	Ski Watch	2006	5	16	0.00	9.20	144.00	4.20
Santa Rosa	Ski Watch	2006	7	19	0.07	8.20	76.00	4.00
Santa Rosa	Ski Watch	2006	10	15	0.04	5.50	70.00	4.20
Santa Rosa	Ski Watch	2006	11	16	0.05	7.20	117.50	3.40

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Seminole	Concord	2006	1	31	0.05	50.33	810.00	31.00
Seminole	Island Pond	2006	2	28	0.09	6.33	546.67	0.67
Seminole	Island Pond	2006	3	31	0.15	5.67	500.00	1.00
Seminole	Island Pond	2006	5	31	0.00	4.67	446.67	1.00
Seminole	Jesup North	2006	1	15	0.70	144.00	2146.67	91.33
Seminole	Jesup North	2006	4	15	2.57	86.67	2166.67	67.33
Seminole	Jesup North	2006	5	14	0.32	122.00	2143.33	67.00
Seminole	Jesup North	2006	7	16	3.01	153.67	4463.33	215.00
Seminole	Jesup North	2006	10	9	23.77	163.67	3950.00	216.67
Seminole	Jesup North	2006	11	11	31.99	157.00	3883.33	211.33
Seminole	Little Bear	2006	2	28	0.12	13.33	536.67	2.00
Seminole	Little Bear	2006	3	19	0.14	15.33	540.00	2.00
Seminole	Little Bear	2006	5	21	0.02	19.00	626.67	6.00
Seminole	Little Bear	2006	7	9	0.07	17.67	590.00	7.00
Seminole	Little Bear	2006	10	21	0.08	16.00	673.33	8.67
Seminole	Little Bear	2006	12	31	0.10	21.00	666.67	5.67
Seminole	Monroe West	2006	3	4	0.12	48.33	1340.00	1.33
Seminole	Monroe West	2006	6	10	0.21	68.67	1333.33	40.00
Seminole	Orienta East	2006	1	30	0.36	36.00	926.67	36.00
Seminole	Orienta East	2006	4	30	0.09	38.67	1596.67	61.67
Seminole	Orienta East	2006	5	31	0.09	28.67	1056.67	36.33
Seminole	Orienta East	2006	7	31	0.04	29.33	986.67	30.00
Seminole	Orienta East	2006	10	30	0.37	41.33	1103.33	57.33
Seminole	Orienta East	2006	11	30	0.83	39.33	1050.00	46.00
Seminole	Secret	2006	1	31	0.06	35.00	613.33	17.33
St Lucie	De Witt	2006	1	23	0.12	115.33	1273.33	24.33
St Lucie	De Witt	2006	4	25	0.04	50.67	1233.33	21.67
St Lucie	De Witt	2006	5	15	0.00	38.33	1076.67	8.00
St Lucie	De Witt	2006	7	17	0.06	33.33	1050.00	11.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
St Lucie	De Witt	2006	10	9	0.06	59.33	1270.00	30.33
St Lucie	De Witt	2006	11	25	0.06	43.00	1156.67	30.67
St Lucie	Margaret	2006	3	27	0.04	14.67	850.00	3.00
St Lucie	Margaret	2006	5	20	0.01	15.33	943.33	3.67
St Lucie	Margaret	2006	7	23	0.08	15.00	803.33	5.00
St Lucie	Margaret	2006	9	19	0.05	21.33	783.33	6.67
Sumter	Panasoffkee	2006	7	21	0.08	32.33	1020.00	24.00
Volusia	Ashby	2006	1	1	0.07	94.33	1013.33	10.33
Volusia	Ashby	2006	4	1	0.09	117.67	1186.67	4.00
Volusia	Ashby	2006	5	2	0.02	134.33	1226.67	4.00
Volusia	Ashby	2006	7	1	0.02	135.67	1263.33	10.00
Volusia	Ashby	2006	9	4	0.05	83.00	816.67	7.67
Volusia	Ashby	2006	11	11	0.05	62.00	713.33	5.67
Volusia	Beresford	2006	1	23	0.12	49.67	1023.33	33.00
Volusia	Beresford	2006	3	29	0.15	44.67	776.67	21.33
Volusia	Beresford	2006	5	8	0.57	69.00	1136.67	36.00
Volusia	Beresford	2006	8	17	0.80	59.00	1396.67	46.33
Volusia	Beresford	2006	9	19	0.61	54.00	1280.00	39.67
Volusia	Bethel	2006	1	29	0.10	69.33	1066.67	41.33
Volusia	Bethel	2006	4	15	0.09	65.00	1306.67	30.00
Volusia	Bethel	2006	7	4	0.08	62.00	1780.00	63.33
Volusia	Bethel	2006	10	21	0.25	52.67	1643.33	54.00
Volusia	Gemini Springs	2006	3	7	0.05	65.67	1246.67	0.33
Volusia	Gemini Springs	2006	5	3	0.05	63.00	1173.33	0.67
Volusia	Gemini Springs	2006	9	27	0.03	57.33	1046.67	0.33
Volusia	Gemini Springs	2006	11	4	0.03	63.00	1186.67	0.33
Volusia	Theresa	2006	3	10	0.07	11.00	566.67	3.00
Volusia	Theresa	2006	6	4	0.03	9.00	633.33	2.33
Volusia	Winnemissett	2006	1	1	0.10	12.00	460.00	15.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Volusia	Winnemissett	2006	4	13	0.16	12.00	426.67	2.33
Volusia	Winnemissett	2006	5	6	0.05	9.67	446.67	2.00
Volusia	Winnemissett	2006	7	9	0.03	7.67	433.33	2.00
Volusia	Winnemissett	2006	10	21	0.05	8.33	453.33	3.00
Wakulla	Otter	2006	2	2	0.03	42.00	566.67	13.00
Wakulla	Otter	2006	3	13	0.04	40.67	663.33	6.33
Wakulla	Otter	2006	5	8	0.02	46.33	546.67	5.67
Wakulla	Otter	2006	7	6	0.43	26.33	560.00	4.67
Wakulla	Otter	2006	9	8	0.23	21.33	696.67	2.67
Wakulla	Otter	2006	12	13	0.07	85.33	870.00	9.00
Walton	Alligator	2006	1	5	0.09	7.00	453.33	2.00
Walton	Alligator	2006	4	18	0.11	10.67	413.33	2.67
Walton	Alligator	2006	5	27	0.00	13.00	440.00	5.00
Walton	Alligator	2006	7	8	0.08	31.33	583.33	15.67
Walton	Alligator	2006	9	9	0.06	15.67	620.00	12.67
Walton	Alligator	2006	10	29	0.03	10.67	783.33	2.67
Walton	Alligator	2006	12	3	0.04	7.33	563.33	3.00
Walton	Campbell	2006	1	5	0.07	5.33	406.67	1.00
Walton	Campbell	2006	4	18	0.05	7.00	463.33	1.67
Walton	Campbell	2006	5	9	0.05	8.67	320.00	1.33
Walton	Campbell	2006	7	6	0.03	7.67	693.33	3.00
Walton	Campbell	2006	9	8	0.05	6.00	470.00	4.00
Walton	Campbell	2006	11	9	0.04	4.33	326.67	1.00
Walton	Deer	2006	2	24	0.06	6.67	353.33	3.00
Walton	Deer	2006	3	17	0.02	8.33	396.67	3.67
Walton	Deer	2006	6	30	0.01	9.00	420.00	3.33
Walton	Deer	2006	7	28	0.04	12.67	433.33	4.33
Walton	Deer	2006	9	30	0.04	12.00	446.67	3.67
Walton	Deer	2006	12	7	0.03	5.33	310.00	3.00

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (µg/L)	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Chlorophyll (µg/L)
Walton	Eastern	2006	1	25	0.06	10.33	176.67	3.00
Walton	Eastern	2006	3	28	0.04	15.67	290.00	3.00
Walton	Eastern	2006	5	30	0.03	18.00	260.00	6.67
Walton	Eastern	2006	8	22	0.05	18.00	260.00	10.33
Walton	Eastern	2006	9	26	0.06	16.00	270.00	9.33
Walton	Eastern	2006	11	23	0.10	12.67	276.67	13.00
Walton	Little Red Fish	2006	1	5	0.14	11.67	530.00	1.33
Walton	Little Red Fish	2006	3	20	0.23	14.00	463.33	6.00
Walton	Little Red Fish	2006	6	22	0.08	34.33	476.67	10.67
Walton	Little Red Fish	2006	7	21	0.34	63.33	813.33	15.67
Walton	Little Red Fish	2006	9	28	0.07	28.33	673.33	17.00
Walton	Little Red Fish	2006	11	26	0.04	22.67	563.33	11.67
Washington	Gap	2006	1	22	0.09	7.00	323.33	1.67
Washington	Gap	2006	4	18	0.12	6.33	326.67	2.00
Washington	Gap	2006	5	12	0.01	4.33	373.33	2.33
Washington	Gap	2006	7	22	0.10	3.33	266.67	2.33
Washington	Gap	2006	9	17	0.04	7.33	290.00	3.00
Washington	Gap	2006	11	14	0.06	3.67	330.00	2.33
Washington	Gin	2006	1	22	0.08	4.00	283.33	1.33
Washington	Gin	2006	4	18	0.06	5.67	296.67	2.00
Washington	Gin	2006	5	12	0.03	5.00	343.33	5.00
Washington	Gin	2006	7	22	0.02	3.33	283.33	2.00
Washington	Gin	2006	8	17	0.05	8.67	323.33	3.00
Washington	Gin	2006	9	17	0.04	8.33	320.00	2.33
Washington	Gin	2006	11	14	0.05	2.00	276.67	2.00
Washington	Little River	2006	1	22	0.09	7.33	376.67	3.00
Washington	Little River	2006	4	18	0.13	10.67	440.00	5.67
Washington	Little River	2006	5	12	0.01	10.67	503.33	6.33
Washington	Little River	2006	7	22	0.09	12.33	483.33	8.67

Table A-1. Continued

County	Lake	Year	Month	Day	Microcystin concentration (μg/L)	Total phosphorus (μg/L)	Total nitrogen (μg/L)	Chlorophyll (μg/L)
Washington	Little River	2006	8	17	0.07	18.33	540.00	13.00
Washington	Little River	2006	9	17	0.06	20.33	630.00	21.67

Table A-2. Microcystin, nutrient, and chlorophyll data for Harris Chain of Lakes in Lake County, Florida.

County	Lake	Station	Month	Day	Year	Microcystin Concentration (µg/L)	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Beauclaire	1	9	13	2006	1.54	83.00	3930.00	208.60
Lake	Beauclaire	2	9	13	2006	1.94	80.00	3920.00	208.50
Lake	Beauclaire	3	9	13	2006	1.95	86.00	3760.00	185.70
Lake	Dora East	1	9	13	2006	2.88	47.00	3330.00	151.90
Lake	Dora East	2	9	13	2006	2.43	46.00	3350.00	147.20
Lake	Dora East	3	9	13	2006	1.93	48.00	3330.00	138.20
Lake	Dora West	1	9	13	2006	2.39	34.00	3110.00	119.80
Lake	Dora West	2	9	13	2006	2.85	36.00	3110.00	119.80
Lake	Dora West	3	9	13	2006	2.35	40.00	3190.00	116.20
Lake	Eustis	1	9	13	2006	0.29	36.00	2220.00	73.00
Lake	Eustis	2	9	13	2006	0.26	33.00	2120.00	75.50
Lake	Eustis	3	9	13	2006	0.26	32.00	2110.00	76.70
Lake	Griffin	1	9	13	2006	1.53	37.00	1970.00	62.50
Lake	Griffin	2	9	13	2006	1.12	35.00	2080.00	64.00
Lake	Griffin	3	9	13	2006	1.49	35.00	1930.00	59.10
Lake	Harris	1	9	13	2006	0.09	36.00	1560.00	58.40
Lake	Harris	2	9	13	2006	0.13	35.00	1600.00	54.60
Lake	Harris	3	9	13	2006	0.13	33.00	1530.00	55.80
Lake	Beauclaire	1	10	11	2006	2.37	84.00	4370.00	213.10
Lake	Beauclaire	2	10	11	2006	2.51	81.00	4210.00	213.40
Lake	Beauclaire	3	10	11	2006	1.34	84.00	4260.00	192.10
Lake	Dora East	1	10	11	2006	1.30	58.00	3610.00	159.40
Lake	Dora East	2	10	11	2006	1.94	50.00	3620.00	154.40
Lake	Dora East	3	10	11	2006	3.59	50.00	3580.00	155.50
Lake	Dora West	1	10	11	2006	2.35	38.00	3440.00	122.90
Lake	Dora West	2	10	11	2006	1.75	39.00	3260.00	120.90

Table.A-2. Continued

County	Lake	Station	Month	Day	Year	Microcystin Concentration (µg/L)	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Dora West	3	10	11	2006	2.07	42.00	3330.00	117.90
Lake	Eustis	1	10	11	2006	0.25	34.00	2340.00	60.10
Lake	Eustis	2	10	11	2006	0.37	33.00	2210.00	60.30
Lake	Eustis	3	10	11	2006	0.12	30.00	2170.00	57.50
Lake	Griffin	1	10	11	2006	1.50	39.00	2210.00	63.10
Lake	Griffin	2	10	11	2006	1.60	40.00	2250.00	65.80
Lake	Griffin	3	10	11	2006	1.03	38.00	2180.00	60.30
Lake	Harris	1	10	11	2006	0.19	32.00	1670.00	52.80
Lake	Harris	2	10	11	2006	0.23	31.00	1690.00	56.30
Lake	Harris	3	10	11	2006	0.12	29.00	1660.00	56.50
Lake	Beauclaire	1	11	29	2006	1.91	101.00	3930.00	200.00
Lake	Beauclaire	2	11	29	2006	2.26	100.00	4190.00	192.50
Lake	Beauclaire	3	11	29	2006	2.85	108.00	3790.00	165.80
Lake	Dora East	1	11	29	2006	0.20	58.00	3020.00	131.70
Lake	Dora East	2	11	29	2006	1.21	57.00	3150.00	120.50
Lake	Dora East	3	11	29	2006	1.04	60.00	3170.00	132.70
Lake	Dora West	1	11	29	2006	1.78	48.00	2820.00	102.40
Lake	Dora West	2	11	29	2006	1.84	52.00	3010.00	107.30
Lake	Dora West	3	11	29	2006	1.49	54.00	3300.00	110.90
Lake	Eustis	1	11	29	2006	0.80	42.00	2300.00	59.20
Lake	Eustis	2	11	29	2006	0.26	40.00	2240.00	62.60
Lake	Eustis	3	11	29	2006	0.27	38.00	2330.00	59.40
Lake	Griffin	1	11	29	2006	0.81	51.00	2230.00	71.90
Lake	Griffin	2	11	29	2006	1.45	52.00	2130.00	75.00
Lake	Griffin	3	11	29	2006	0.87	53.00	2530.00	71.00
Lake	Harris	1	11	29	2006	0.21	36.00	1770.00	61.00
Lake	Harris	2	11	29	2006	0.24	34.00	1660.00	62.90

Table.A-2. Continued

County	Lake	Station	Month	Day	Year	Microcystin Concentration (µg/L)	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Harris	3	11	29	2006	0.12	32.00	1700.00	62.90
Lake	Beauclaire	1	12	14	2006	0.39	101.00	4050.00	192.40
Lake	Beauclaire	2	12	14	2006	0.59	111.00	3960.00	202.30
Lake	Beauclaire	3	12	14	2006	0.52	100.00	3950.00	193.60
Lake	Dora East	1	12	14	2006	0.63	66.00	3320.00	139.00
Lake	Dora East	2	12	14	2006	0.57	66.00	3250.00	147.30
Lake	Dora East	3	12	14	2006	0.38	62.00	3250.00	146.20
Lake	Dora West	1	12	14	2006	0.52	57.00	3170.00	125.50
Lake	Dora West	2	12	14	2006	0.47	52.00	3120.00	118.80
Lake	Dora West	3	12	14	2006	0.23	54.00	3120.00	115.20
Lake	Eustis	1	12	14	2006	0.03	35.00	2190.00	60.80
Lake	Eustis	2	12	14	2006	0.04	37.00	2080.00	61.70
Lake	Eustis	3	12	14	2006	0.05	33.00	2010.00	57.80
Lake	Griffin	1	12	14	2006	0.27	53.00	2350.00	77.60
Lake	Griffin	2	12	14	2006	0.35	53.00	2270.00	78.40
Lake	Griffin	3	12	14	2006	0.16	51.00	2210.00	72.10
Lake	Harris	1	12	14	2006	0.08	37.00	1700.00	69.90
Lake	Harris	2	12	14	2006	0.03	34.00	1730.00	68.20
Lake	Harris	3	12	14	2006	0.04	33.00	1670.00	63.50
Lake	Beauclaire	1	1	23	2007	0.86	99.00	3900.00	191.90
Lake	Beauclaire	2	1	23	2007	0.91	86.00	3880.00	196.40
Lake	Beauclaire	3	1	23	2007	0.86	102.00	3860.00	197.30
Lake	Dora East	1	1	23	2007	0.75	66.00	3250.00	146.20
Lake	Dora East	2	1	23	2007	0.60	66.00	3200.00	145.20
Lake	Dora East	3	1	23	2007	0.55	63.00	3180.00	145.20
Lake	Dora West	1	1	23	2007	0.74	61.00	3190.00	126.00

Table.A-2. Continued

County	Lake	Station	Month	Day	Year	Microcystin Concentration (µg/L)	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Dora West	2	1	23	2007	0.69	62.00	3200.00	124.30
Lake	Dora West	3	1	23	2007	0.70	63.00	3290.00	124.20
Lake	Eustis	1	1	23	2007	0.28	40.00	2510.00	79.50
Lake	Eustis	2	1	23	2007	0.18	39.00	2370.00	74.00
Lake	Eustis	3	1	23	2007	0.14	41.00	2360.00	77.50
Lake	Griffin	1	1	23	2007	1.06	70.00	3020.00	117.80
Lake	Griffin	2	1	23	2007	1.08	72.00	3080.00	125.10
Lake	Griffin	3	1	23	2007	1.04	66.00	3140.00	119.60
Lake	Harris	1	1	23	2007	0.45	44.00	2040.00	77.70
Lake	Harris	2	1	23	2007	0.12	41.00	2000.00	80.20
Lake	Harris	3	1	23	2007	0.12	39.00	2090.00	82.60
Lake	Beauclaire	1	2	27	2007	1.01	100.00	3790.00	170.00
Lake	Beauclaire	2	2	27	2007	1.00	102.00	3870.00	172.80
Lake	Beauclaire	3	2	27	2007	1.08	109.00	3870.00	169.10
Lake	Dora East	1	2	27	2007	0.63	70.00	3292.00	132.50
Lake	Dora East	2	2	27	2007	0.59	70.00	3310.00	138.00
Lake	Dora East	3	2	27	2007	0.52	68.00	3250.00	134.40
Lake	Dora West	1	2	27	2007	0.57	61.00	3090.00	118.90
Lake	Dora West	2	2	27	2007	0.65	59.00	3130.00	118.60
Lake	Dora West	3	2	27	2007	0.99	60.00	3240.00	118.10
Lake	Eustis	1	2	27	2007	0.24	44.00	2350.00	61.20
Lake	Eustis	2	2	27	2007	0.26	41.00	2180.00	60.10
Lake	Eustis	3	2	27	2007	0.30	45.00	2590.00	62.00
Lake	Griffin	1	2	27	2007	0.95	68.00	3270.00	105.00
Lake	Griffin	2	2	27	2007	0.75	64.00	3110.00	106.90
Lake	Griffin	3	2	27	2007	0.83	62.00	3120.00	101.40

Table.A-2. Continued

County	Lake	Station	Month	Day	Year	Microcystin Concentration (µg/L)	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Harris	1	2	27	2007	0.12	37.00	1890.00	67.50
Lake	Harris	2	2	27	2007	0.11	42.00	1960.00	69.10
Lake	Harris	3	2	27	2007	0.14	43.00	1940.00	72.80
Lake	Beauclaire	1	3	27	2007	1.26	117.00	4540.00	213.20
Lake	Beauclaire	2	3	27	2007	0.87	117.00	4580.00	223.10
Lake	Beauclaire	3	3	27	2007	1.22	130.00	4700.00	198.50
Lake	Dora East	1	3	27	2007	1.00	79.00	3570.00	180.40
Lake	Dora East	2	3	27	2007	0.85	80.00	3710.00	170.60
Lake	Dora East	3	3	27	2007	0.75	76.00	3670.00	163.40
Lake	Dora West	1	3	27	2007	1.08	67.00	3430.00	152.20
Lake	Dora West	2	3	27	2007	0.78	64.00	3490.00	141.20
Lake	Dora West	3	3	27	2007	0.63	63.00	3350.00	151.10
Lake	Eustis	1	3	27	2007	0.24	47.00	2530.00	73.80
Lake	Eustis	2	3	27	2007	0.19	46.00	2370.00	71.80
Lake	Eustis	3	3	27	2007	0.20	46.00	2450.00	71.80
Lake	Griffin	1	3	27	2007	0.75	69.00	3310.00	149.70
Lake	Griffin	2	3	27	2007	0.67	64.00	3320.00	146.00
Lake	Griffin	3	3	27	2007	1.07	75.00	3560.00	162.00
Lake	Harris	1	3	27	2007	0.15	48.00	2320.00	84.60
Lake	Harris	2	3	27	2007	0.14	45.00	2290.00	91.10
Lake	Harris	3	3	27	2007	0.22	46.00	2270.00	87.40
Lake	Beauclaire	1	4	24	2007	0.95	103.00	4930.00	273.10
Lake	Beauclaire	2	4	24	2007	0.83	118.00	4980.00	290.30
Lake	Beauclaire	3	4	24	2007	1.03	123.00	5040.00	295.90
Lake	Dora East	1	4	24	2007	0.81	91.00	4450.00	220.40
Lake	Dora East	2	4	24	2007	0.82	69.00	4050.00	216.00
Lake	Dora East	3	4	24	2007	0.74	72.00	4020.00	210.00

Table.A-2. Continued

County	Lake	Station	Month	Day	Year	Microcystin Concentration (µg/L)	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Dora West	1	4	24	2007	0.55	61.00	3880.00	190.80
Lake	Dora West	2	4	24	2007	0.55	63.00	3870.00	183.90
Lake	Dora West	3	4	24	2007	0.76	68.00	4010.00	96.40
Lake	Eustis	1	4	24	2007	0.32	51.00	2810.00	88.00
Lake	Eustis	2	4	24	2007	0.32	52.00	2730.00	95.50
Lake	Eustis	3	4	24	2007	0.41	50.00	2780.00	94.40
Lake	Griffin	1	4	24	2007	0.90	79.00	3990.00	199.70
Lake	Griffin	2	4	24	2007	0.68	71.00	4000.00	190.90
Lake	Griffin	3	4	24	2007	1.03	75.00	4110.00	202.20
Lake	Harris	1	4	24	2007	0.22	49.00	2420.00	100.30
Lake	Harris	2	4	24	2007	0.41	49.00	2390.00	93.90
Lake	Harris	3	4	24	2007	0.58	48.00	2430.00	101.10
Lake	Beauclaire	1	5	30	2007	1.91	85.00	4400.00	161.30
Lake	Beauclaire	2	5	30	2007	2.27	90.00	4460.00	165.10
Lake	Beauclaire	3	5	30	2007	2.39	88.00	4350.00	145.40
Lake	Dora East	1	5	30	2007	1.15	57.00	3890.00	190.00
Lake	Dora East	2	5	30	2007	1.04	53.00	3910.00	193.60
Lake	Dora East	3	5	30	2007	1.01	60.00	4240.00	198.70
Lake	Dora West	1	5	30	2007	0.94	56.00	3980.00	193.70
Lake	Dora West	2	5	30	2007	1.23	62.00	3960.00	192.20
Lake	Dora West	3	5	30	2007	1.28	63.00	4250.00	198.00
Lake	Eustis	1	5	30	2007	0.65	61.00	3600.00	138.00
Lake	Eustis	2	5	30	2007	0.46	58.00	3510.00	137.90
Lake	Eustis	3	5	30	2007	0.65	59.00	3840.00	140.50
Lake	Griffin	1	5	30	2007	1.29	76.00	4510.00	215.50
Lake	Griffin	2	5	30	2007	1.33	70.00	4290.00	225.70

Table.A-2. Continued

County	Lake	Station	Month	Day	Year	Microcystin Concentration (µg/L)	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Griffin	3	5	30	2007	1.37	72.00	4440.00	195.40
Lake	Harris	1	5	30	2007	0.47	48.00	2290.00	83.00
Lake	Harris	2	5	30	2007	0.42	46.00	2280.00	78.50
Lake	Harris	3	5	30	2007	0.54	42.00	2260.00	83.00
Lake	Beauclaire	1	6	26	2007	3.24	66.00	3360.00	124.30
Lake	Beauclaire	2	6	26	2007	3.12	74.00	3180.00	138.30
Lake	Beauclaire	3	6	26	2007	3.42	79.00	3450.00	124.50
Lake	Dora East	1	6	26	2007	1.99	52.00	3770.00	152.00
Lake	Dora East	2	6	26	2007	1.54	47.00	3820.00	138.40
Lake	Dora East	3	6	26	2007	1.58	42.00	3700.00	146.20
Lake	Dora West	1	6	26	2007	0.98	.	.	.
Lake	Dora West	2	6	26	2007	0.92	49.00	3600.00	152.00
Lake	Dora West	3	6	26	2007	0.89	46.00	3600.00	152.20
Lake	Eustis	1	6	26	2007	0.62	.	.	.
Lake	Eustis	2	6	26	2007	0.68	52.00	3000.00	145.20
Lake	Eustis	3	6	26	2007	0.70	52.00	3150.00	141.30
Lake	Griffin	1	6	26	2007	0.66	54.00	2940.00	124.50
Lake	Griffin	2	6	26	2007	1.12	58.00	3210.00	176.10
Lake	Griffin	3	6	26	2007	1.18	60.00	3320.00	147.40
Lake	Harris	1	6	26	2007	0.42	42.00	1980.00	69.10
Lake	Harris	2	6	26	2007	0.79	.	.	.
Lake	Harris	3	6	26	2007	0.91	41.00	1900.00	75.50
Lake	Beauclaire	1	7	25	2007	3.15	80.00	4170.00	176.90
Lake	Beauclaire	2	7	25	2007	3.00	66.00	3880.00	161.20
Lake	Beauclaire	3	7	25	2007	2.33	84.00	3730.00	140.50
Lake	Dora East	1	7	25	2007	1.82	42.00	3850.00	137.10
Lake	Dora East	2	7	25	2007	1.74	36.00	3600.00	130.70

Table.A-2. Continued

County	Lake	Station	Month	Day	Year	Microcystin Concentration (µg/L)	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Dora East	3	7	25	2007	1.57	36.00	3640.00	133.40
Lake	Dora West	1	7	25	2007	1.19	33.00	3530.00	114.30
Lake	Dora West	2	7	25	2007	1.00	33.00	3710.00	114.30
Lake	Dora West	3	7	25	2007	1.46	33.00	3520.00	124.30
Lake	Eustis	1	7	25	2007	0.33	39.00	3020.00	108.70
Lake	Eustis	2	7	25	2007	0.40	43.00	3110.00	115.10
Lake	Eustis	3	7	25	2007	0.26	38.00	2990.00	104.20
Lake	Griffin	1	7	25	2007	0.78	42.00	3450.00	129.10
Lake	Griffin	2	7	25	2007	0.94	49.00	3660.00	148.40
Lake	Griffin	3	7	25	2007	0.79	48.00	3500.00	128.90
Lake	Harris	1	7	25	2007	1.13	41.00	2420.00	84.00
Lake	Harris	2	7	25	2007	1.03	39.00	2320.00	74.80
Lake	Harris	3	7	25	2007	0.95	34.00	2340.00	82.90
Lake	Beauclaire	1	8	21	2007	2.12	80.00	4240.00	180.10
Lake	Beauclaire	2	8	21	2007	2.10	80.00	4200.00	175.50
Lake	Beauclaire	3	8	21	2007	1.96	86.00	4160.00	170.00
Lake	Dora East	1	8	21	2007	1.67	42.00	3480.00	127.20
Lake	Dora East	2	8	21	2007	1.74	44.00	3440.00	126.30
Lake	Dora East	3	8	21	2007	2.79	45.00	3470.00	129.90
Lake	Dora West	1	8	21	2007	2.12	38.00	3420.00	129.30
Lake	Dora West	2	8	21	2007	1.26	36.00	3410.00	114.40
Lake	Dora West	3	8	21	2007	1.38	36.00	3390.00	111.60
Lake	Eustis	1	8	21	2007	0.43	44.00	2810.00	91.20
Lake	Eustis	2	8	21	2007	0.37	43.00	2790.00	99.60
Lake	Eustis	3	8	21	2007	0.53	43.00	2880.00	99.50
Lake	Griffin	1	8	21	2007	0.71	44.00	3440.00	113.20

Table.A-2. Continued

County	Lake	Station	Month	Day	Year	Microcystin Concentration (µg/L)	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Chlorophyll (µg/L)
Lake	Griffin	2	8	21	2007	1.62	46.00	3330.00	134.50
Lake	Griffin	3	8	21	2007	0.72	44.00	3460.00	120.70
Lake	Harris	1	8	21	2007	0.95	39.00	2340.00	.
Lake	Harris	2	8	21	2007	1.05	35.00	2030.00	61.90
Lake	Harris	3	8	21	2007	1.14	37.00	2060.00	65.70

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BIOGRAPHICAL SKETCH

Dana Bigham grew up in snowy Minnesota. She graduated from Edina High School in 2001 with a broad interest in biology. Attending the University of Wisconsin- Madison for her undergraduate degree, Dana was presented with many opportunities, such as being elected and serving on the Wisconsin Alumni Student Organization and working for the Ophthalmology and Visual Sciences Department as a lab technician to understand the molecular mechanisms of melanoma eye cancer. Her broad biological interest narrowed to limnology as she completed an undergraduate research paper on the vegetative preferences of the limnetic and benthic sticklebacks (*Gasterosteus* spp.) in British Columbia. She graduated in 2005 from University of Wisconsin- Madison double majoring in zoology and biological aspects of conservation. Thereafter, Dana worked for the Wisconsin Department of Natural Resources completing Wisconsin statewide projects (1) a survey of Eurasian Watermilfoil (*Myriophyllum spicatum L.*) to better lake management practices and (2) the impact of agriculture and rural development on aquatic macrophyte productivity. Working long hours in the cold waters of the north drove her southward to complete her master's degree with Dr. Daniel E. Canfield, Jr. at the University of Florida Department of Fisheries and Aquatic Sciences. In her spare time, Dana enjoys running, camping, attempting to surf; basically anything that is outside and spending time with family and friends.