Aquatic Vegetation Diversity in Lake Columbus, Lowndes County, MS

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Successful management of water bodies requires monitoring aquatic vegetation diversity and abundance. Lake Columbus was surveyed in July 2005 using a point intercept sampling method to determine the presence and distribution of aquatic plants. Using ArcGIS software, Lake Columbus was divided into a 400m x 400m grid in which each survey point was located with GPS using UTM coordinates. Aquatic plant species presence was recorded by deploying a plant rake. A GPS unit was used to navigate sequentially through each point location. A total of 72 points were surveyed resulting in 27 vegetated points and 45 unvegetated points. Eichhornia crassipes was the most common aquatic species observed (77.7%). Other nonnative aquatic plants observed were Hydrilla verticillata, Myriophyllum spicatum, Ludwigia uruguayensis, and Nelumbo nucifera. Native emergent aquatic plants observed were Justicia americana and Nelumbo lutea. The native submersed plant Ceratophyllum demersum was observed at 3.7% of vegetated points. Nonnative aquatic plants dominated the vegetation of Lake Columbus, indicating the need for aquatic plant management. Survey information incorporated into GIS layers is useful for management of invasive aquatic plants, biodiversity, and fish and wildlife resources.

Keywords: Invasive species, Ecology, Wetlands

Introduction

For years, invasive species have been a worldwide concern. Invasive species exhibit negative effects on the environment. Aquatic invaders disrupt many bodies of water affecting ecological interactions, disrupting water supply, and impeding boat traffic. Successful colonization within the water body may be attributed to their rapid growth rates by means of vegetative reproduction.

In the US, invasive aquatic plants cost an estimated $110M annually through losses, damage, and management expenses for weeds such as *Hydrilla verticillata* (hydrilla), *Salvinia molesta* (giant salvinia), and *Eichhornia crassipes* (waterhyacinth) (Pimentel et al. 2000). Large populations of waterhyacinth reduce phytoplankton production by competing for light (McVea and Boyd 1975). Invasive weeds such as hydrilla out compete and displace native submersed flora such as *Vallisneria americana* (Van et al. 1998). Human diseases such as malaria, encephalitis and schistosomiasis and oxygen depletion have been related with waterhyacinth and giant salvinia (Barrett 1989, Oliver 1993). Therefore, the importance of monitoring and management cannot be overlooked.

The point intercept method is a ground-truth sampling method that involves detection of the presence or absence of aquatic plants on an evenly spaced grid. As a result, surveys can be performed to provide estimates of the percent frequency occurrence of aquatic plants as well as establishing relationships between water depth and plant occurrence (Wersal et al. 2006, Case and Madsen 2004). Point intercept sampling efficiently and effectively provides information about the occurrence of plant species and their spatial distribution throughout a given area. The objective of this study is to determine and document native and non-native aquatic plant species occurrence in Lake Columbus.

Methods

Point intercept sampling method

Studies were conducted in Lake Columbus, Columbus, MS in 2005. Lake Columbus is 1,208 ha in size and belongs to the Tennessee-Tombigbee Waterway System. A grid of points placed in a 400m x 400m array was constructed over the lake using ArcGIS software. At the center of each grid, one point location was established, resulting in 72 total points in the survey. Point locations were numbered in order to navigate sequentially on the lake (Figure 1).

A Trimble® XRS GPS system, which has estimated 1m accuracy, was used to navigate to each point location using Universal Transverse Mercator (UTM) coordinates, datum WGS 84. The GPS was set up before hand with a template of aquatic species names. The presence of each species was recorded for each point. The survey was conducted on July 8, 2005, when water temperature was 30 °C.

Documenting diversity of aquatic vegetation

Survey point locations and lake boundary file were added to ArcGIS-ArcMap. Points with aquatic plant species presence labeled as 1 were selected. This selection allows determining the total vegetated points in the survey. Once vegetated points were determined, an additional selection by each plant species was performed. The following formula was used to determine % of plant species occurrence in the survey:

% Occurrence = (number of points present/ total vegetated points in the survey) * 100.

Table 1. Aquatic plant species occurrence on Lake Columbus, Lowndes County, MS.

Plant Species	Common Name	Native or Nonnative	% Frequency of Occurence
Ceratophyllum demersum L.	coontail	Native	3.7
Eichhornia crassipes (Mart.) Solms	waterhyacinth	Nonnative	77.7
Hydrilla verticillatia (L.f.) Michx.	hydrilla	Nonnative	3.7
Justicia americana (L.) Vahl	waterwillow	Native	11.1
Ludwigia uruguayensis (Camb.) Hara	waterprimrose	Nonnative	3.7
Myriophyllum spicatum L.	Eurasian watermilfoil	Nonnative	3.7
Nulumbo nucifera Gaertn.	sacred lotus	Nonnative	3.7
Nelumbo lutea Willd.	American lotus	Native	7.4

Results and Discussion

The 72 points surveyed resulted in 27 (37.5 %) vegetated points and 45 (62.5%) unvegetated points or open water. Nonnative plant species observed were: *Eichhornia crassipes, Hydrilla verticillata, Myriophyllum spicatum, Ludwigia uruguayensis* and *Nelumbo nucifera* (Table 1). However, a few native plants species such as *Justicia americana, Nelumbo lutea* and *Ceratophyllum demersum* also were found (Table 1).

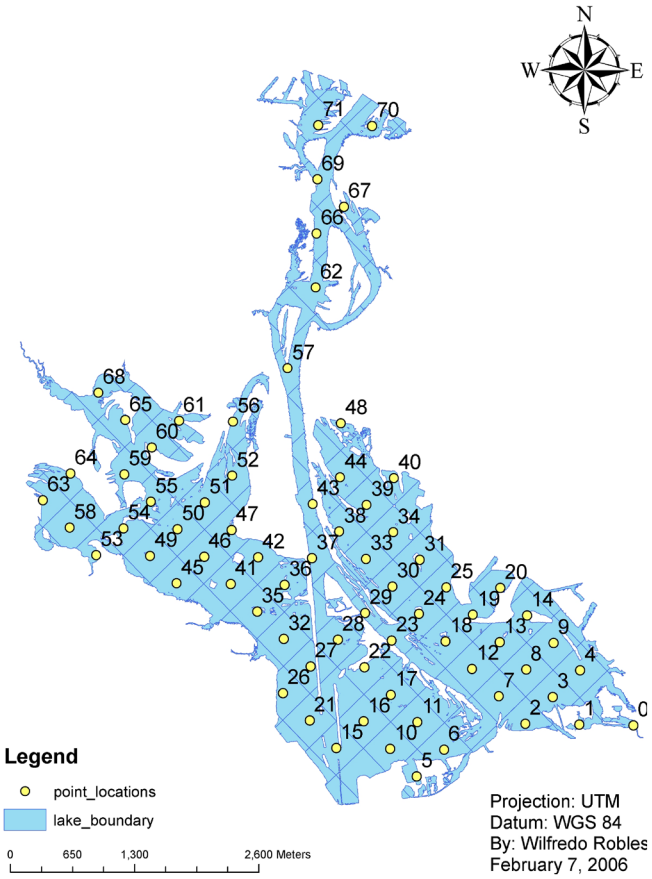

Figure 1. Point intercept survey locations on Lake Columbus, MS.

Two of the vegetated points were found with more than one aquatic plant species. *Eichhornia crassipes* was the most common aquatic plant species observed (77.7%). Similar results were reported by Ferrer-Montaño and Dibble (2002) in Lake Aliceville where *E. crassipes* was the most abundant aquatic plant species. Lake Aliceville is part of the Tennessee-Tombigbee waterway and is located south of Lake Columbus. Submersed nonnative plants such as: *H. verticillata, M. spicatum* and emersed *L. uruguayensis* and *N. nucifera* were also found. Although *H. verticillata* and *M. spicatum* are highly aggressive submersed plants, they were not very common in Lake Columbus. The limited distribution of these two submersed plants may be influenced by waterhyacinth shading at the vegetated points. *L. uruguayensis* and *N. nucifera* were the most dominant aquatic plant species at the points where they were found.

Conclusion

Aquatic plant species in Lake Columbus were dominated by nonnative plants, of which three of them (*E. crassipes, H. verticillata*, and *M. spicatum*) are considered among the most invasive aquatic plant species in United States. The abundance of *E. crassipes* suggests that management is necessary. Although *E. crassipes* was the most abundant species, the growth of *H. verticillata* and *M. spicatum* should be managed to prevent further infestation in the future. The current study may be used as a baseline for further surveys in Lake Columbus for monitoring and detecting changes in aquatic plant diversity.

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