Reservoir survey for invasive and native aquatic plants species within the Pat Harrison Waterways District

Wilfredo Robles, Victor Maddox, and John D. Madsen
GeoResources Institute, Mississippi State University
wr40@msstate.edu

The Pat Harrison Waterway is composed of nine water parks for recreational use (e. g. boating and fishing) located south Mississippi along the Pascagoula River Basin. Invasive aquatic plant species has been reported in some of these water bodies. Because recent information is lacking on the occurrence of native and invasive aquatic plant species in these systems, we were asked to perform surveys on six of the reservoirs in the system. Species occurrence information is important as a baseline to select and implement management methods on this water bodies. Aquatic vegetation surveys were conducted during the year 2007 over six Pat Harrison's water bodies using point-intercept method. This survey method consists in navigating to point locations covering the entire lake assisted by global positioning system (GPS). For all six water bodies, many native plant species were found and only four exotic plant species: *Myriophyllum aquaticum*, *Najas minor*, *Alternanthera philoxeroides*, and *Panicum repens*. The submersed *N. minor* was commonly found composing benthic aquatic vegetation. Emergent species *A. philoxeroides*, *P. repens*, and *M. aquaticum*, were found along shorelines and boat ramps. Chemical control using spot treatments of herbicides along with a monitoring program were recommended. The implementation of a monitoring program is the least expensive management approach to these nuisance plants because rapid response to the first detection of a new species' occurrence may prevent its further spread.

Keywords: Invasive Species, Ecology, Wetlands

Introduction

Invasive aquatic plants have been responsible for a variety of problems in water bodies worldwide. The introduction and growth of invasive aquatic plant species may impede boat traffic, increase susceptibility to flooding, and reduce biodiversity. Management of aquatic weeds costs over $100M each year in the United States (Pimentel et al. 2005). The least expensive approach to management of nuisance plants is to prevent their introduction through education, and respond rapidly to the first detection of their introduction. The Pat Harrison Waterways District is composed of nine water parks for recreational (e. g. boating and fishing) use located along the Pascagoula River Basin. Recreational use of water bodies is a significant vector in the introduction and movement of nonnative aquatic plant species (EPA 2007). For example, fragments of aquatic plants may tangle in boat propellers, allowing its spread between and within a water body. An aquatic plant inventory performed in 1993 found that Najas minor and Chara braunii were commonly found in two of their water parks, Archusa Creek, and Little Black Creek (Wooten 1993). To date, limited information on aquatic plants exists for these water bodies, which limits producing informed recommendations for managing these lakes. Some resource managers have suggested adding fertilizer to enhance the fisheries within each water park. However, lakes within the Pat Harrison Waterway are already eutrophic (MDEQ 2006). Adding more nutrients may lead to increased algal blooms, reduced water clarity, unsafe swimming conditions, increased taste and odor of the water and fish, and reduction of "ecosystem stability" (Wetzel 2001). In 2007, GeoResources Institute at Mississippi State University was contracted to survey six water bodies administered by the Pat Harrison Waterway District. The following aquatic plant survey was intended to inventory exotic invasive and native aquatic plants species that help to provide recommendations for lake management.

Methodology

Survey location description

The Pat Harrison Waterway is composed of nine man-

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made lakes for recreational use. All are impounded by a dam and located along the Pascagoula River Basin. Only six were surveyed (Figure 1) during growing season of 2007. Geographic coordinates and area cover for each lake are reported in Table 1 along with the total of points surveyed.

Aquatic vegetation surveys

One lake-wide survey of each water body was conducted using a point-intercept sampling method (Madsen 1999). Using ArcGIS software (ESRI 2005), a grid of points was placed over each entire lake. For the purpose of this document, only Archusa Creek was selected as an example to show the grid of points placed over the entire lake (Figure 2). A summary of lake size and survey point spacing is provided in Table 1. Each lake boundary with its respect grid of points was transferred into a hand-held personal digital assistant (PDA). Once the survey point information is in the PDA, Farm Works® Farm Site Mate software is used to load survey point information. A global positioning system (GPS) receiver was used with the PDA to provide geographic coordinate (latitude and longitude) information for each survey point and navigate sequentially to each point. Aquatic plant species present at each survey point were recorded with the PDA in the following format: 1 when the species was present and 0 when the species was absent. The following formula was used to determine the percent (%) of aquatic plant species frequency occurrence in the survey:

% Frequency occurrence = (number of points present / total points surveyed) * 100.

Results and Discussion

Lake-wide aquatic plant survey

In Maynor Creek Water Park; approximately 50% of the original points were actually surveyed due to low water. A total of 29 aquatic plant species, including the two macrophytic algae Chara sp. and Nitella sp., were found among all six lakes surveyed (Table 2). Among the 29 species found, only Alternanthera philoxeroides, Myriophyllum aquaticum, Panicum repens and Najas minor were invasive species. Although none of these exotic invasive species are listed on the federal or state noxious weed list, a management plan should be developed that is designed to avoid further spread. The following is a brief description of each water body surveyed.

Archusa Creek Water Park. The most common species found was the macrophytic alga, Nitella sp., followed by the exotic Najas minor (Table 2). Neither of these species were topped out nor posed a nuisance problem at the time of the survey. Another less frequent exotic found was Myriophyllum aquaticum growing among dense stands of the native Panicum hemitomon. Both invasive aquatic species found were previously reported to the Pat Harrison Waterway District in 1989 (Eubanks 1989).

Flint Creek Water Park. The most common species found was the native Eleocharis vivipara (Table 2). The exotic, Alternanthera philoxeroides was found at the boat ramp located in the northeastern portion of the lake. Although this location was not part of the lake-wide survey it was reported immediately due its threat of spread facilitated by boat movement within the water body. The native, Bacopa caroliniana was found covering entire coves in the northwestern portion of the lake.

Turkey Creek Water Park. The most common species found were the native floating-leaved species, Brasenia schreberi and Nymphaea odorata (Table 2). The exotic submersed, Najas minor was found at a low frequency occurrence of 2.44 % (Table 2).

Big Creek Water Park. The most common species found was the macrophytic alga, Chara sp. (Table 2). The native Eleocharis vivipara and the exotic Alternanthera philoxeroides both had a 8 % frequency of occurrence (Table 2). Most of the aquatic plant species in this lake were components of the shoreline vegetation with the exception of Chara sp. which composed benthic vegetation.

Maynor Creek Water Park. This lake was severely affected by the extreme drought of 2007 in the southern states. Administrative personnel of this lake indicated that the water was 8 feet below the normal level in the month of August. Consequently, most of the shoreline vegetation died due to the lack of water. Also, most survey point locations in areas with water were not reached because the area was too shallow to navigate with a boat. At the end of the survey, no aquatic vegetation was recorded although the presence of many aquatic species were previously reported (Eubanks 1989).

Little Black Creek Water Park. The most common species found was the native Myriophyllum pinnatum (Table 2). This species was very common and topped out in coves throughout the lake. The exotic, Panicum repens was commonly found on lake margins as part of shoreline vegetation. Najas minor, another invasive plant, was found at a low frequency of occurrence (Table 2).

Conclusions and Recommendations

It is concluded that only 4 exotic invasive aquatic plant species occurs at the surveyed water bodies. Brittle naiad was the most commonly occurring exotic but do not pose nuisance problems at the time of the survey. Spot treatments with herbicides for exotic aquatic plant control are recommended in all locations to avoid further spread. Applications must be done in spring or early summer during active plant growth for better efficacy. Repeat treatments when necessary.

The addition of nutrients to the water body would not be beneficial because these lakes are already eutrophic, meaning that the system has a high nutrient loading rate. The addition of more nutrients may lead to excessive algal blooms that consequentially promote bad odor and high turbidity in the systems. Water clarity in some of these lakes is already marginal for safe swimming, boating, or water skiing according to some state and U.S. Environmental Protection Agency standards (Madsen et al. 1999).

Aquatic plant assemblages at the discussed water bodies are considered diverse; composed by numerous native species and none where observed to form monotypic cultures. This means that all six water bodies may provide suitable habitat for fish spawning and shelter which consequentially sustain their populations. Aquatic plants provide habitat for fish and fish spawning. Loss of aquatic plants may lead to long-term degradation in water quality.

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Water body	County	Latitude	Longitude	Size (A)	Point spacing (m)	Total points surveyed
Archusa	Clarke	32.0338	-88.7140	430	150	72
Big	Jones	31.6859	-89.3423	70	50	64
Flint	Stone	30.8842	-89.1301	530	200	53
Little Black	Lamar	31.0883	-89.4958	516	150	87
Maynor	Wayne	31.6543	-88.7165	381	150	31
Turkey	Newton	32.4088	-89.1615	225	100	82

Table 1. Lake location and size reported in acres (A) with respective survey point intensity in meters (m).

Table 2. Aquatic plant species present in the Pat Harrison Waterways District with their respective frequency of occurrence. Growth forms are represented by: FL = floating-leaved, FF = free-floating, S = submerged, E = emergent. * = species present at boat ramp

			Water body				
Species	**Growth form**	**Native or Exotic**	**Archusa**	**Flint**	**Turkey**	**Little Black**	**Big**
	Frequency occurence (%)						
Nymphaea odorata Ait.	FL	Native	1	0	21	1	0
Potamogeton diversifolius Raf.	FL	Native	21	0	1	4	0
Myriophyllum aquaticum (Vell.) Verdc.	E/S	Exotic	1	0	0	0	0
Panicum hemitomon Schult.	E	Native	1	0	0	0	0
Najas minor All.	S	Exotic	35	0	2	1	0
Ceratophyllum demersum L.	S	Native	7	0	0	10	0
Hydrocotyle ranunculoides L. f.	E	Native	1	0	0	0	0
Brasenia schreberi Gmel.	FL	Native	3	0	18	11	0
Nitella sp.	S	Native	36	0	0	2	0
Potamogeton pusillus L.	FL	Native	18	2	0	0	0
Eleocharis vivipara Link	E/S	Native	4	21	0	37	8
Juncus repens Michx	E/S	Native	1	6	0	0	0
Juncus effusus L	E	Native	1	0	0	1	0
Alternanthera philoxeroides (Mart.) Griseb.	E	Exotic	0	*	0	0	8
Bacopa caroliniana (Walt.) Robins.	E/S	Native	0	6	0	0	0
Chara sp.	S	Native	0	0	10	0	55
Nelumbo lutea (Wild.) Pers.	FL	Native	0	0	2	0	0
Myriophyllum pinnatum (Walt.) BSP	S	Native	0	0	0	54	0
Scirpus cyperinus (L.) Kunth	E	Native	0	0	0	1	0
Utricularia macrorhiza Leconte	S	Native	0	0	0	22	0
Panicum repens L.	E	Exotic	0	0	0	7	0
Peltandra virginica (L.) Schott & Endl.	E	Native	0	0	0	2	0
Saccharum giganteum (Walter) Pers.	E	Native	0	0	0	1	0
Ludwigia peploides (HBK) Raven	E	Native	0	0	0	0	6
Sagittaria platyphylla Engelm.	E	Native	0	0	0	0	3
Hydrolea uniflora Raf.	E	Native	0	0	0	0	2
Pluchea camphorata (L.) DC.	E	Native	0	0	0	0	2
Cephalanthus occidentalis L.	E	Native	0	0	0	0	2
Sacciolepis striata (L.) Nash	E	Native	0	0	0	0	2

Figure 1. Reference locations of the six waterbodies surveyed within the Pat Harrison Waterway District in the state of Mississippi.

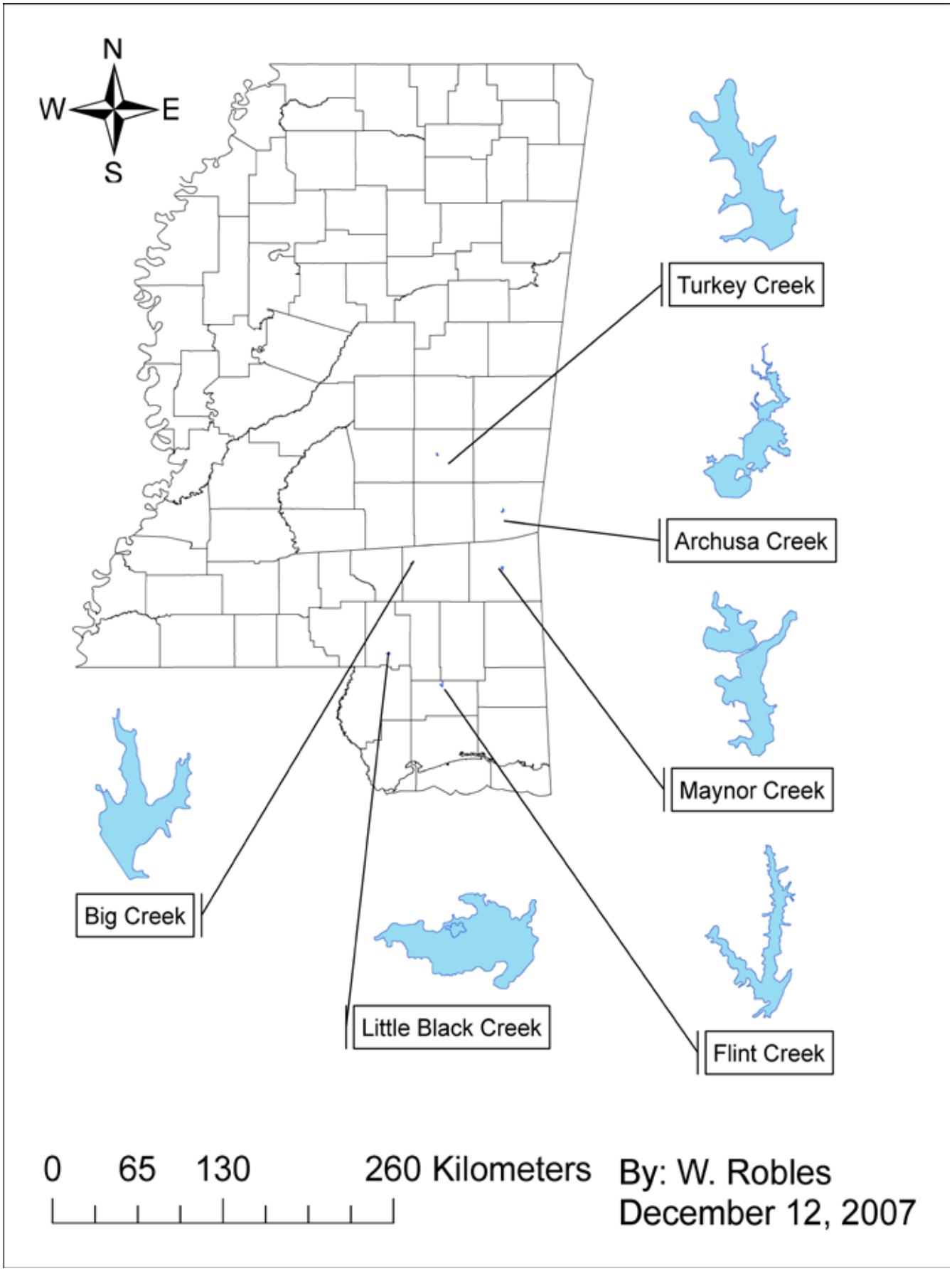

Figure 2. Point-intercept survey locations in Archusa Creek Water Park, MS.