Aquatic Plant Assessment of the Ross Barnett Reservoir in 2009: A Five Year Evaluation

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Aquatic Plant Community Assessment within the Littoral Zone of the Ross Barnett Reservoir, MS in 2009: A Five Year Evaluation

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Invasive plants are both:
- Plants introduced from another region, country, or continent
- Plants that cause economic or ecological harm, or both

The three to watch in Ross Barnett Reservoir are alligatorweed, hydrilla, and waterhyacinth

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Alligatorweed

- Alligatorweed (*Alternanthera philoxeroides* (Mart.) Griseb)

- Emersed or submersed perennial, leaves opposite and simple, flowering head of small white flowers borne in axils.

- Rooted in shallow submersed habitats to moist soil sites; may form floating mats

- Major nuisance to subtropical aquatic sites and wetland areas, especially ditch and stream habitats
Alligatorweed Problems

- Fast-growing weed in margins of ponds, lakes, and streams
- Breaks off to form floating mats
- Obstructs flood water flow

Steele Bayou, MS, summer of 2007

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Hydrilla (*Hydrilla verticillata* (L.f.) Mich.)

- Severe noxious plant in southern US, spreading northward
- Contaminant in commercially-available water lilies
- Spreads by tuber, turion, and fragment
- Two biotypes found in US

Hydrilla (top) and (bottom) topped out in 15’ of water depth, Lake Guntersville, AL
Hydrilla

Hydrilla verticillata

- Dioecious biotype in southern areas (SCA, TX, LA, MS, AL, GA, FL, KY, TN, NC)
- Monoecious biotype in WA, N CA, VA, NC, DE, PA, NJ, CT, MA, ME, WI, IN, MI, MO

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A hydrilla-covered Florida lake
• Stolons can expand a hydrilla colony 2 inches per day
• Hydrilla can cover a Florida lake in 2 years
• Infests 45,000 acres in 199 lakes in Florida
• Florida spends $18M a year just to maintain the current acreage

Madsen and Owens 2000

This is an 80% rate of increase per year, almost doubling acreage each year
Waterhyacinth

*Eichhornia crassipes* (Mart.) Solms

- Floating rosette with showy purple flower
- Vegetative reproduction from daughter plants on stolons; some reproduction from seed
- Native to Central and South America
- Worldwide #1 aquatic weed

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Waterhyacinth
*Eichhornia crassipes*

- Gulf and S Atlantic States, CA
- Largely under maintenance management in FL
Study began in 2005 with a whole reservoir survey

The survey was intended to map the distribution of aquatic plants

Particularly, waterhyacinth and alligatorweed

Hydrilla was observed in the Reservoir in 2005 (MS Dept. Wildlife, Fisheries, Parks)

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Objectives

- Monitor the aquatic plants in Ross Barnett Reservoir
  - Locations of invasive plants
  - Monitor native plants as habitat for fish and wildlife
- Assess effectiveness of management activity

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Methods

- **Point Intercept Survey** (Madsen 1999)
- Presence/Absence technique
- Conducted on a 300 yd grid of regularly spaced points
Equipment

- Panasonic Toughbook
- Trimble AgGPS 106
- HP 2110 IPaq Hand Held Computer
- Holux GPS Ultra Receiver (GR-271)

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Sample Locations During July 2009 Survey

Upper Reservoir
Middle Reservoir 5
Middle Reservoir 4
Lower Reservoir 3
Lower Reservoir 2
Lower Reservoir 1
Pelahatchie Bay
Statistical Analyses

- A pairwise comparison was conducted using the Cochran-Mantel-Haenszel test in SAS to determine changes in species occurrence between years.

- A Kruskal-Wallis test was used to determine differences in species richness and water depth between years.
Percent frequency of occurrence for aquatic plant species observed in the littoral zone during the Ross Barnett Reservoir Surveys 2005-2009. The letter ‘n’ refers to the total number of points sampled in a given year. Letters in a row for a given species denotes a significant difference among years at a p = 0.05 level of significance.

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>Native (N) or Exotic (E), Invasive (I)</th>
<th>2005 % Frequency (n=677)</th>
<th>2006 % Frequency (n=508)</th>
<th>2007 % Frequency (n=423)</th>
<th>2008 % Frequency (n=627)</th>
<th>2009 % Frequency (n=695)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternanthera philoxeroides</td>
<td>alligatorweed</td>
<td>E I</td>
<td>21.1</td>
<td>3.9</td>
<td>4.0</td>
<td>7.3</td>
<td>14.9a</td>
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<tr>
<td>Azolla caroliniana</td>
<td>mosquito fern</td>
<td>N</td>
<td>0.0</td>
<td>0.2</td>
<td>0.4</td>
<td>0.0</td>
<td>0.5</td>
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<tr>
<td>Cabomba caroliniana</td>
<td>fanwort</td>
<td>N</td>
<td>2.2</td>
<td>0.0</td>
<td>0.5</td>
<td>1.3a</td>
<td>0.6</td>
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<tr>
<td>Ceratophyllum demersum</td>
<td>coontail</td>
<td>N</td>
<td>4.4</td>
<td>4.9</td>
<td>3.5</td>
<td>7.6a</td>
<td>3.6a</td>
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<tr>
<td>Colocasia esculenta</td>
<td>wild taro</td>
<td>E I</td>
<td>0</td>
<td>0.9</td>
<td>0.7</td>
<td>2.4a</td>
<td>2.4</td>
</tr>
<tr>
<td>Eichhornia crassipes</td>
<td>waterhyacinth</td>
<td>E I</td>
<td>4.9</td>
<td>2.9</td>
<td>1.2</td>
<td>4.0a</td>
<td>8.6a</td>
</tr>
<tr>
<td>Hydrilla verticillata</td>
<td>hydridla</td>
<td>E I</td>
<td>0.0</td>
<td>0.6a</td>
<td>1.2a</td>
<td>0.6a</td>
<td>0.8</td>
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<tr>
<td>Hydrocotyle ranunculoides</td>
<td>pennywort</td>
<td>N</td>
<td>6.4</td>
<td>0.5</td>
<td>1.4</td>
<td>2.8a</td>
<td>1.3a</td>
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<tr>
<td>Juncus effusus</td>
<td>common rush</td>
<td>N</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.2</td>
<td>1.7</td>
</tr>
<tr>
<td>Lemna minor</td>
<td>common duckweed</td>
<td>N</td>
<td>3.1</td>
<td>2.5</td>
<td>1.9</td>
<td>1.4a</td>
<td>1.3</td>
</tr>
<tr>
<td>Limnobium spongia</td>
<td>American frogbit</td>
<td>N</td>
<td>1.5</td>
<td>0.8</td>
<td>0.7</td>
<td>1.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Ludwigia peploides</td>
<td>waterprimrose</td>
<td>N</td>
<td>4.9</td>
<td>7.4</td>
<td>4.3</td>
<td>10.2a</td>
<td>14.8a</td>
</tr>
<tr>
<td>Myriophyllum aquaticum</td>
<td>parrotfeather</td>
<td>E I</td>
<td>0.7</td>
<td>0.0</td>
<td>0.2</td>
<td>1.0a</td>
<td>0.4</td>
</tr>
<tr>
<td>Najas minor</td>
<td>brittle naiad</td>
<td>E I</td>
<td>0.0</td>
<td>0.0</td>
<td>1.9a</td>
<td>1.0a</td>
<td>0.3</td>
</tr>
<tr>
<td>Nelumbo lutea</td>
<td>American lotus</td>
<td>N</td>
<td>17.1</td>
<td>17.7</td>
<td>21.2</td>
<td>24.8a</td>
<td>26.9</td>
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<tr>
<td>Nitella sp.</td>
<td>stonewort</td>
<td>N</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Nymphaea odorata</td>
<td>white waterlily</td>
<td>N</td>
<td>4.4</td>
<td>3.4</td>
<td>4.9</td>
<td>5.4</td>
<td>5.9</td>
</tr>
<tr>
<td>Potamogeton foliosus</td>
<td>leafy pondweed</td>
<td>N</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Potamogeton nodosus</td>
<td>American pondweed</td>
<td>N</td>
<td>2.7</td>
<td>2.7</td>
<td>2.4</td>
<td>3.0</td>
<td>2.9</td>
</tr>
<tr>
<td>Sagittaria latifolia</td>
<td>broadleaf arrowhead</td>
<td>N</td>
<td>1.0</td>
<td>1.2</td>
<td>0.0a</td>
<td>0.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Sagittaria platyphylla</td>
<td>delta arrowhead</td>
<td>N</td>
<td>0</td>
<td>1.8</td>
<td>0.8</td>
<td>0.3a</td>
<td>2.3a</td>
</tr>
<tr>
<td>Scirpus validus</td>
<td>softstem bulrush</td>
<td>N</td>
<td>1.2</td>
<td>0.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Spirodella polyrhiza</td>
<td>giant duckweed</td>
<td>N</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.16</td>
<td>0.7</td>
</tr>
<tr>
<td>Typha sp.</td>
<td>cattail</td>
<td>N</td>
<td>1.3</td>
<td>2.4a</td>
<td>0.7</td>
<td>1.1</td>
<td>7.1a</td>
</tr>
<tr>
<td>Utricularia vulgaris</td>
<td>bladderwot</td>
<td>N</td>
<td>0.0</td>
<td>0.4</td>
<td>0.0</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Zizaniopsis miliacea</td>
<td>giant cutgrass</td>
<td>N I</td>
<td>1.5</td>
<td>3.5</td>
<td>1.9a</td>
<td>4.1</td>
<td>10.4a</td>
</tr>
</tbody>
</table>

Note: An “a” indicates a statistically significant change in frequency of occurrence from the previous year for the indicated plant species.
Species Richness

Mean Species Richness (No. Point⁻¹)

Year

2005
2006
2007
2008
2009

Species Richness

BC
D
CD
B
A
Alligatorweed Locations During July 2009
Waterhyacinth

Waterhyacinth Locations During July 2009

Upper Reservoir
Middle Reservoir 5
Middle Reservoir 4
Lower Reservoir 3
Lower Reservoir 2
Lower Reservoir 1
Pelahatchie Bay
Hydrilla (from point survey)
Estimated acreage of the non-native aquatic plant species occurring in the Ross Barnett Reservoir from 2005 to 2008. Acreage was calculated based on the total number of points for which a given species was observed. Each point of the survey represents approximately 22.2 acres.

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alligatorweed</td>
<td>3175</td>
<td>444</td>
<td>377</td>
<td>1021</td>
<td>339</td>
<td>2309</td>
<td>307</td>
</tr>
<tr>
<td>Brittle naiad</td>
<td>0</td>
<td>0</td>
<td>178</td>
<td>111</td>
<td>44</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td>Hydrilla</td>
<td>120</td>
<td>67</td>
<td>111</td>
<td>89</td>
<td>275</td>
<td>133</td>
<td>155</td>
</tr>
<tr>
<td>Parrotfeather</td>
<td>111</td>
<td>111</td>
<td>22</td>
<td>133</td>
<td>67</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>Waterhyacinth</td>
<td>733</td>
<td>333</td>
<td>111</td>
<td>555</td>
<td>167</td>
<td>1332</td>
<td>561</td>
</tr>
<tr>
<td>Waterlettuce*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5*</td>
</tr>
<tr>
<td>Cuban bulrush*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>51*</td>
</tr>
</tbody>
</table>

¹ Acreage treated refers to the total surface area of water treated, not necessarily to the extent of plant infestation.

* Denotes first observation in 2009 of indicated plant species.
Herbicides and rates of application applied to non-native species in the Ross Barnett Reservoir in 2009.

<table>
<thead>
<tr>
<th>Species</th>
<th>Acres Treated</th>
<th>Herbicide/Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alligatorweed</td>
<td>307</td>
<td>glyphosate/1.5%**</td>
</tr>
<tr>
<td>Waterhyacinth</td>
<td>561</td>
<td>2,4-D/1.0%**</td>
</tr>
<tr>
<td>Cuban bulrush</td>
<td>51</td>
<td>2,4-D/1.5%, glyphosate/0.5%**</td>
</tr>
<tr>
<td>Waterlettuce</td>
<td>5</td>
<td>diquat/2.0%**</td>
</tr>
<tr>
<td>Hydrilla</td>
<td>155 surface acres (898 acre/ft)</td>
<td>fluridone (Sonar Q)/0.98 lb per acre/ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fluridone (Sonar PR)/1.0 lb per acre/ft</td>
</tr>
</tbody>
</table>

** All foliar applications performed with 0.5% rate of surfactant.
Hydrilla site locations in Ross Barnett Reservoir as of 2009

- Sites are all located in upstream area of reservoir
- Sites 2-5 no longer have hydrilla
Locations of fluridone treatments in Ross Barnett Reservoir
Two New Invaders

- Cuban Bulrush
- Waterlettuce
Cuban Bulrush

- Oxycaryum cubense
- Grows on top of waterhyacinth mats
- Forms a dense fibrous floating mat
- Difficult to control
Waterlettuce

- Waterlettuce
- *Pistia stratiotes*
- Freefloating tropical plant
- Further north than typical range
- Common in water garden trade

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