Distribution and Management of Invasive Plant Species in the Ross Barnett Reservoir

Michael C. Cox, Ryan M. Wersal, and John D. Madsen
Ross Barnett Reservoir

- A 33,000 acre (13,400 hectare) freshwater impoundment
- Primary potable water source for City of Jackson, MS
- Encompassed by extensive community development and economic growth (over 4,600 residential homes)
- Surrounded by over 15,000 acres of forested land (private and Pearl River WMA)
Point intercept surveys began in 2005 for mapping distribution of aquatic plants.

Surveys reduced from entire reservoir to littoral zone (depth of 3 m or less) based on favorable light conditions and plant distribution (21% light transmittance usually required) (Chambers and Kalff 1895, Dodds 2002).

26 aquatic and riparian plant species recorded in littoral zone of reservoir.

Waterhyacinth, alligatorweed, and hydrilla were of main concerns. (Wersal et al. 2008)
Objectives

- Monitor and map invasive aquatic plant populations
- Record long term changes in the plant community of the Ross Barnett Reservoir
- Assess management effectiveness of invasive plant species
Ross Barnett Reservoir

- Point intercept method
- Presence/absence of plant species at each point
- 300m grid system for Ross Barnett Reservoir
- Points assigned at regularly spaced, defined locations
- Introduced to aquatic plant management in 1999 (Madsen 1999)
Ross Barnett Reservoir

Equipment

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

- Farmworks Site Mate®
- Designed for in-field geographic and attribute data collection
- Displays site specific geographic and attribute data
American lotus (*Nelumbo lutea* Willd.) is dominant native species, covering 26.9% of the littoral zone.

Alligatorweed (*Alternanthera philoxeroides* (Mart.) Griseb.) distribution had declined from 21.2% to 7.3% (2005–2008), then increased to 14.9% in 2009.

Waterhyacinth (*Eichhornia crassipes* (Mart.) Solms) distribution had declined from 4.9% to 4% (2005–2008), then increased to 8.6% in 2009.

Hydrilla (*Hydrilla verticillata* (L.f.) Royle) distribution had declined from 1.2% to 0.6% (2007–2008), then increased to 0.8% in 2009.

Large, healthy populations (alligatorweed) and scattered plants that move with waterflow (waterhyacinth and hydrilla) contribute to difficulties in management of these species.
Ross Barnett Reservoir

Hydrilla
(*Hydrilla verticillata*)

Alligatorweed
(*Alternanthera philoxeroides*)

Waterhyacinth
(*Eichhornia crassipes*)
### Percent Frequency of Occurrence of all observed plant species 2005–2009

<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>21.1a</td>
<td>3.9</td>
<td>4.0</td>
<td>7.3</td>
<td>14.9</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>
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<td>0.5</td>
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<tr>
<td>Cabomba caroliniana</td>
<td>fanwort</td>
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<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>3.6</td>
</tr>
<tr>
<td>Colocasia esculenta</td>
<td>wild taro</td>
<td>E I</td>
<td>0.0a</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>4.9a</td>
<td>2.9</td>
<td>1.2</td>
<td>4.0a</td>
<td>8.6</td>
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<tr>
<td>Hydrilla verticillata</td>
<td>hydrilla</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>6.4a</td>
<td>0.5</td>
<td>1.4</td>
<td>2.8a</td>
<td>1.3</td>
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<tr>
<td>Juncus effuses</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>14.8</td>
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<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>
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<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>Nymphaea 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>Nymphoides 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>0.0a</td>
<td>1.8</td>
<td>0.8</td>
<td>0.3a</td>
<td>2.3</td>
</tr>
<tr>
<td>Scirpus validus</td>
<td>softstem bulrush</td>
<td>N</td>
<td>1.2a</td>
<td>0.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Spirodela 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>
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<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>7.1</td>
</tr>
<tr>
<td>Utricularia vulgaris</td>
<td>bladderwort</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>1.5a</td>
<td>3.5</td>
<td>1.9a</td>
<td>4.1</td>
<td>10.4</td>
</tr>
</tbody>
</table>
## Estimated acreage of plant species occurrence and treated acres 2005–2008

<table>
<thead>
<tr>
<th></th>
<th></th>
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<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>
</tr>
<tr>
<td>Brittle naiad</td>
<td>0</td>
<td>0</td>
<td>178</td>
<td>111</td>
<td></td>
</tr>
<tr>
<td>Hydrilla</td>
<td>120</td>
<td>67</td>
<td>111</td>
<td>89</td>
<td>275</td>
</tr>
<tr>
<td>Parrotfeather</td>
<td>111</td>
<td>111</td>
<td>22</td>
<td>133</td>
<td></td>
</tr>
<tr>
<td>Waterhyacinth</td>
<td>733</td>
<td>333</td>
<td>111</td>
<td>555</td>
<td>167</td>
</tr>
</tbody>
</table>

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

(Wersal et al. 2008)
Ross Barnett Reservoir

Sample Locations During June 2005 Survey

- 1,423 points surveyed

Wersal et al. 2006
Ross Barnett Reservoir

Sample Locations During October 2006 Survey

- 508 points surveyed

Wersal et al. 2006)
Ross Barnett Reservoir

Sample Locations During the 2007 Survey

- Middle Reservoir 5
- Middle Reservoir 4
- Lower Reservoir 3
- Lower Reservoir 2
- Lower Reservoir 1
- Pelahatchie Bay
- Upper Reservoir

423 points surveyed

Wersal et al. 2008)
Ross Barnett Reservoir

2008 Sample Locations, July 2-3, 2008

- Middle Reservoir 5
- Middle Reservoir 4
- Lower Reservoir 3
- Lower Reservoir 2
- Lower Reservoir 1
- Pelahatchie Bay
- Upper Reservoir

627 points surveyed

Wersal et al. 2008)
Ross Barnett Reservoir

Sample Locations During July 2009 Survey

• 695 points surveyed
Ross Barnett Reservoir

Alligatorweed Locations During June 2005

Alligatorweed Locations During October 2006

Alligatorweed Locations During the 2007 Survey


Alligatorweed Locations During July 2009 Survey
Ross Barnett Reservoir

Waterhyacinth Locations During June 2005

Waterhyacinth Locations During October 2006

Waterhyacinth Locations During the 2007 Survey


Waterhyacinth Locations During July 2009 Survey
Hydrilla

- Has been under active management since 2005
- 12 monitored sites in the Reservoir
- Copper–Reward applications for growing plants
- Granular Fluridone applications in spring
Ross Barnett Reservoir
Hydrilla

- Very few hydrilla tubers have been found to date during annual tuber surveys
- Low tuber densities may be attributed to Fluridone treatments
- Possible overwintering and growing by healthy root crowns
Conclusions

- Herbicide treatments appear to be effective on hydrilla populations in the Reservoir
- At least 4 sites have been eliminated since 2005, but 1 new site has been discovered
- All current sites should continue to be monitored and aggressively managed to ensure control of hydrilla in the Reservoir
Future Management

- Continue monitoring invasive plant distribution and population changes
- Continue monitoring hydrilla populations and herbicide application effectiveness
- Assess herbicide treatment effectiveness on all other invasive species, especially alligatorweed and waterhyacinth
- Utilize remote sensing techniques (analysis of satellite imagery) to accurately estimate invasive species (i.e. waterhyacinth and alligatorweed) coverage in the Reservoir
Acknowledgements

- Project supported by the Pearl River Valley Water Supply District
- Josh Yerby and AquaServices
- Assistance in field work:
  - Ryan Wersal
  - Jimmy Peeples
  - Amanda Fernandez