Geosystems Research Institute

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

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Presentation to the Board of the Pearl River Valley Water Supply District, April 15, 2010

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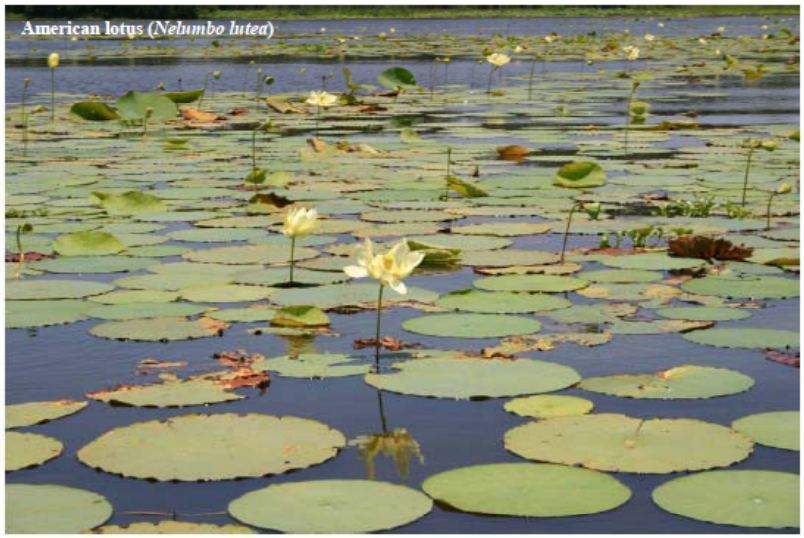
Aquatic Plant Community Assessment within the Littoral Zone of the Ross Barnett Reservoir, MS in 2009: A Five Year Evaluation



An Annual Report to the Pearl River Valley Water Supply District

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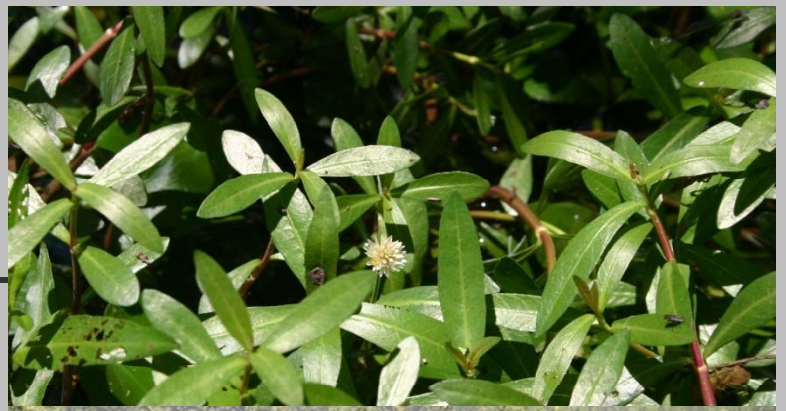
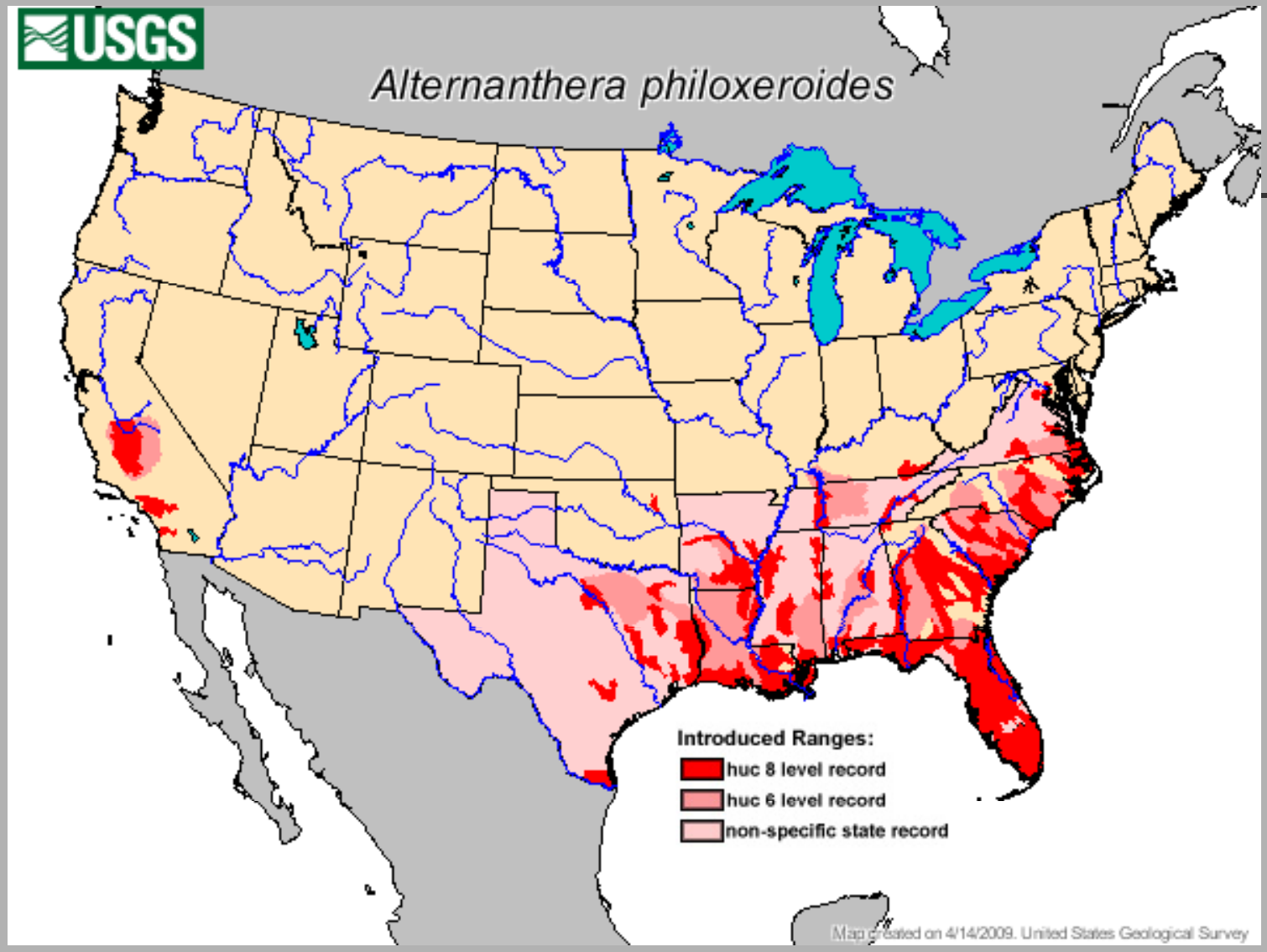
Invasive Plants

- 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



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



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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

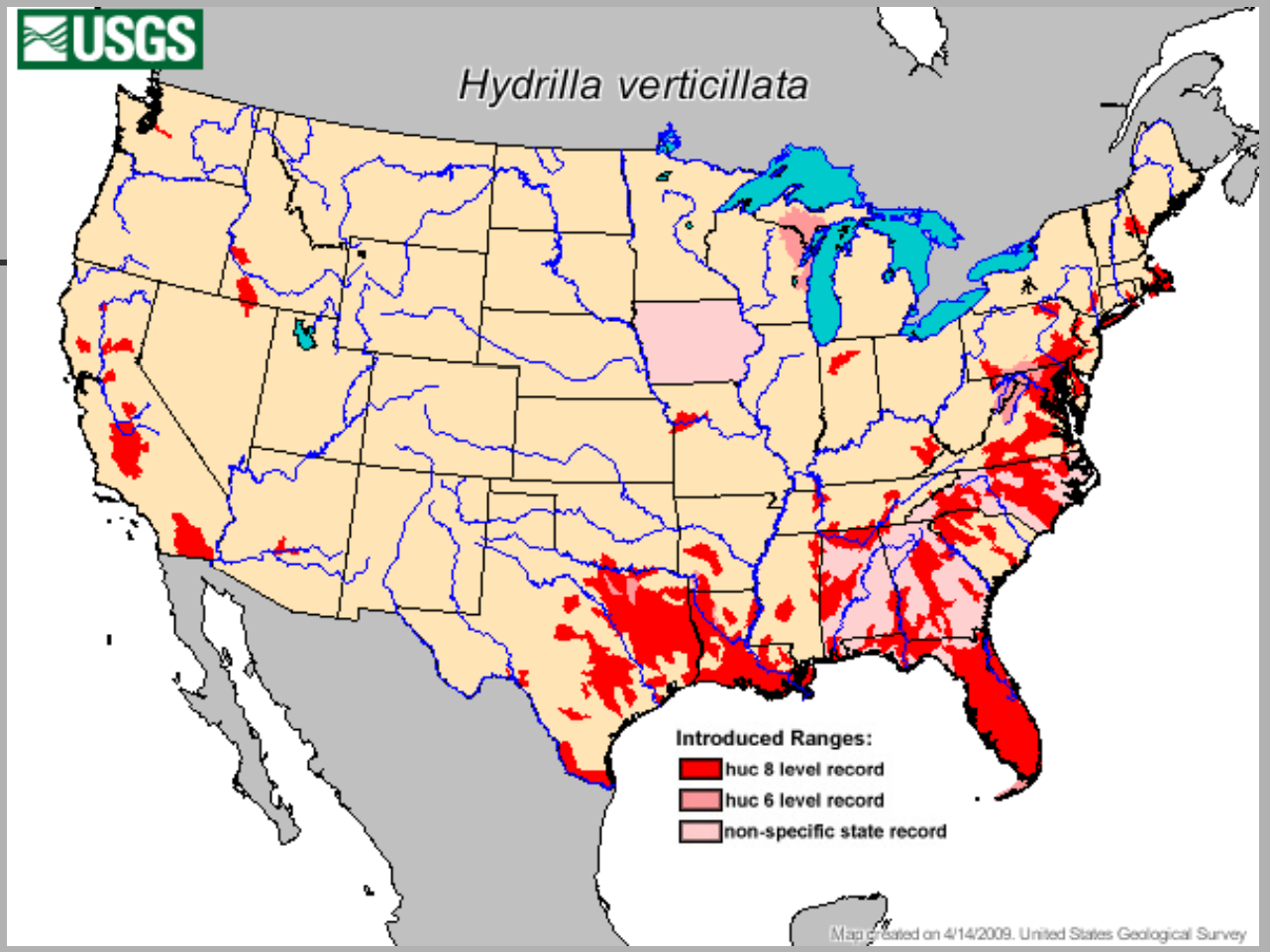
- Hydrilla (*Hydrilla verticillata* (L.f.) Mich.)
- Severe noxious plant in southern US, spreading northward
- Contaminant in commercially-available water lilies
- Spreads by tuber, turion, and fragment
- Two biotypes found in US

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

Hydrilla

Hydrilla verticillata

- Dioecious biotype in southern areas (S CA, 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



Hydrilla Spread

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

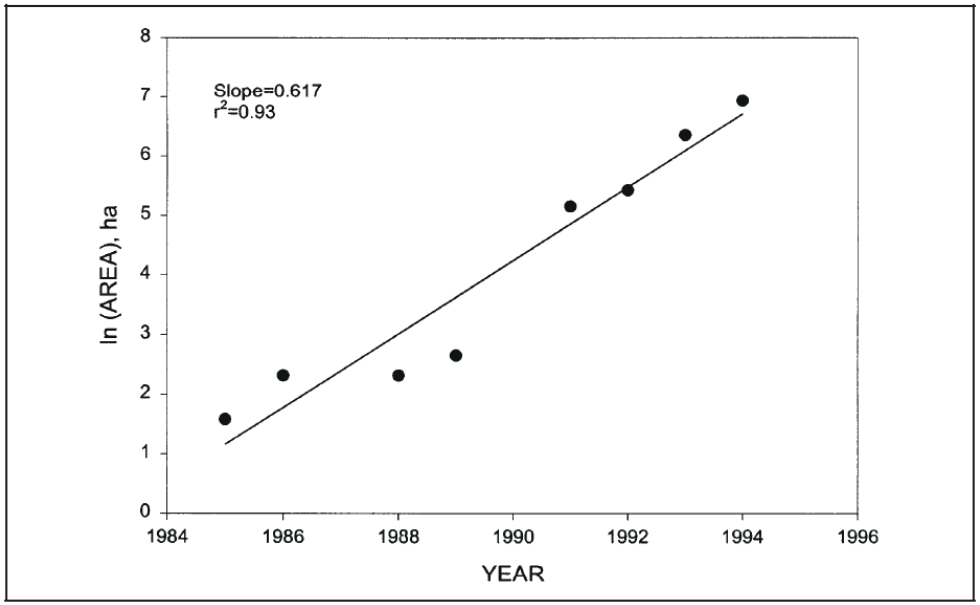


Figure 2. Exponential expansion rate calculated from data on the area of hydrilla versus year, Gaston Lake, NC

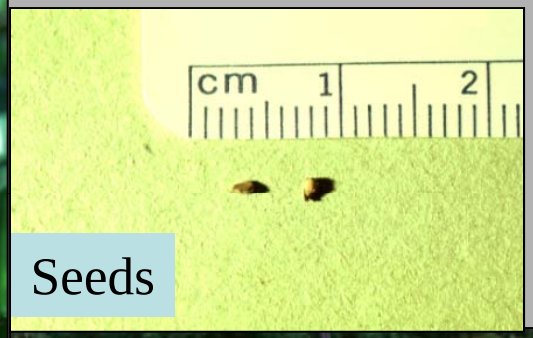
Madsen and Owens 2000

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

Waterhyacinth

Eichhornia crassipes (Mart.) Solms

Inflorescence



Seeds

Seedling

Parent and daughter plant

- 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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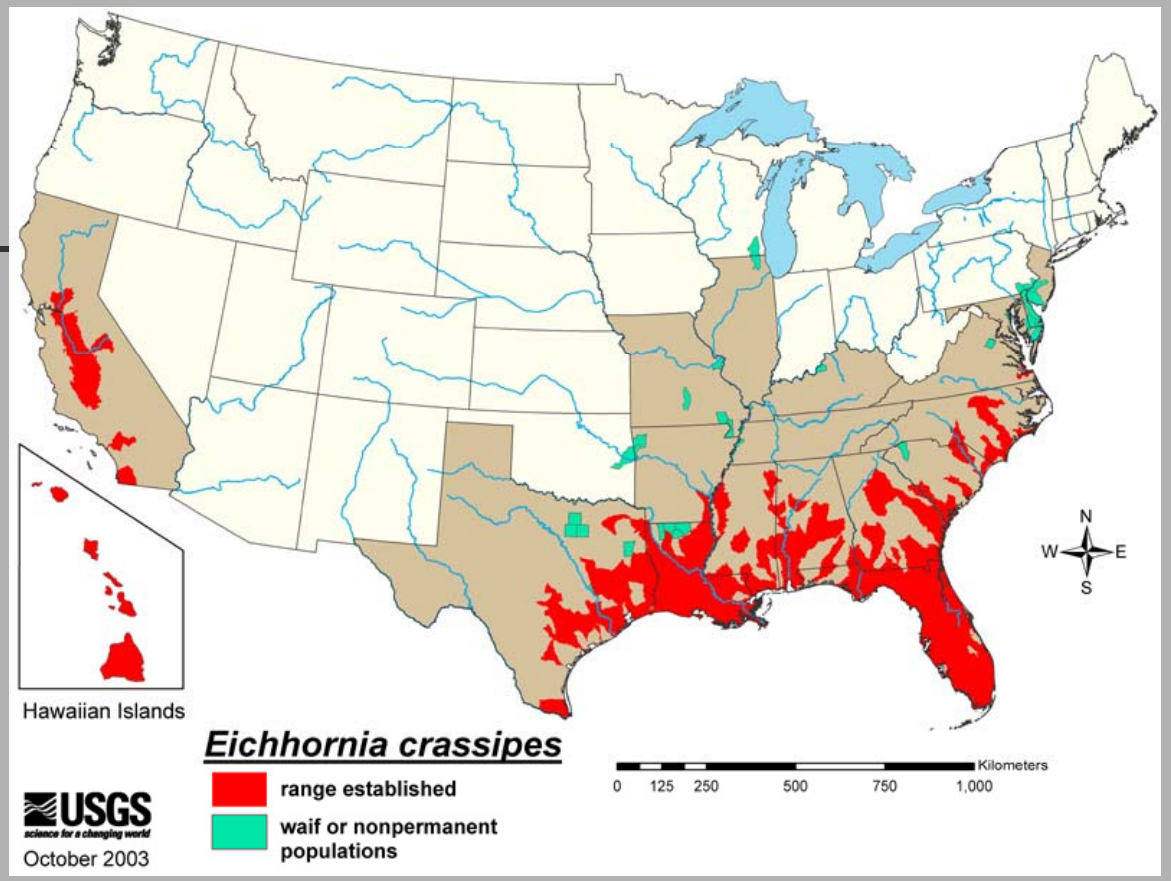
Waterhyacinth *Eichhornia crassipes*

- Gulf and S Atlantic States, CA
- Largely under maintenance management in FL



Ross Barnett Reservoir
Aquatic Plant Study

- Study began in 2005 with a whole reservoir survey
- The survey was intended to map the distribution of aquatic plants
- Particularly, waterhyacinth and allligatorweed
- Hydrilla was observed in the Reservoir in 2005 (MS Dept. Wildlife, Fisheries, Parks)

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Objectives

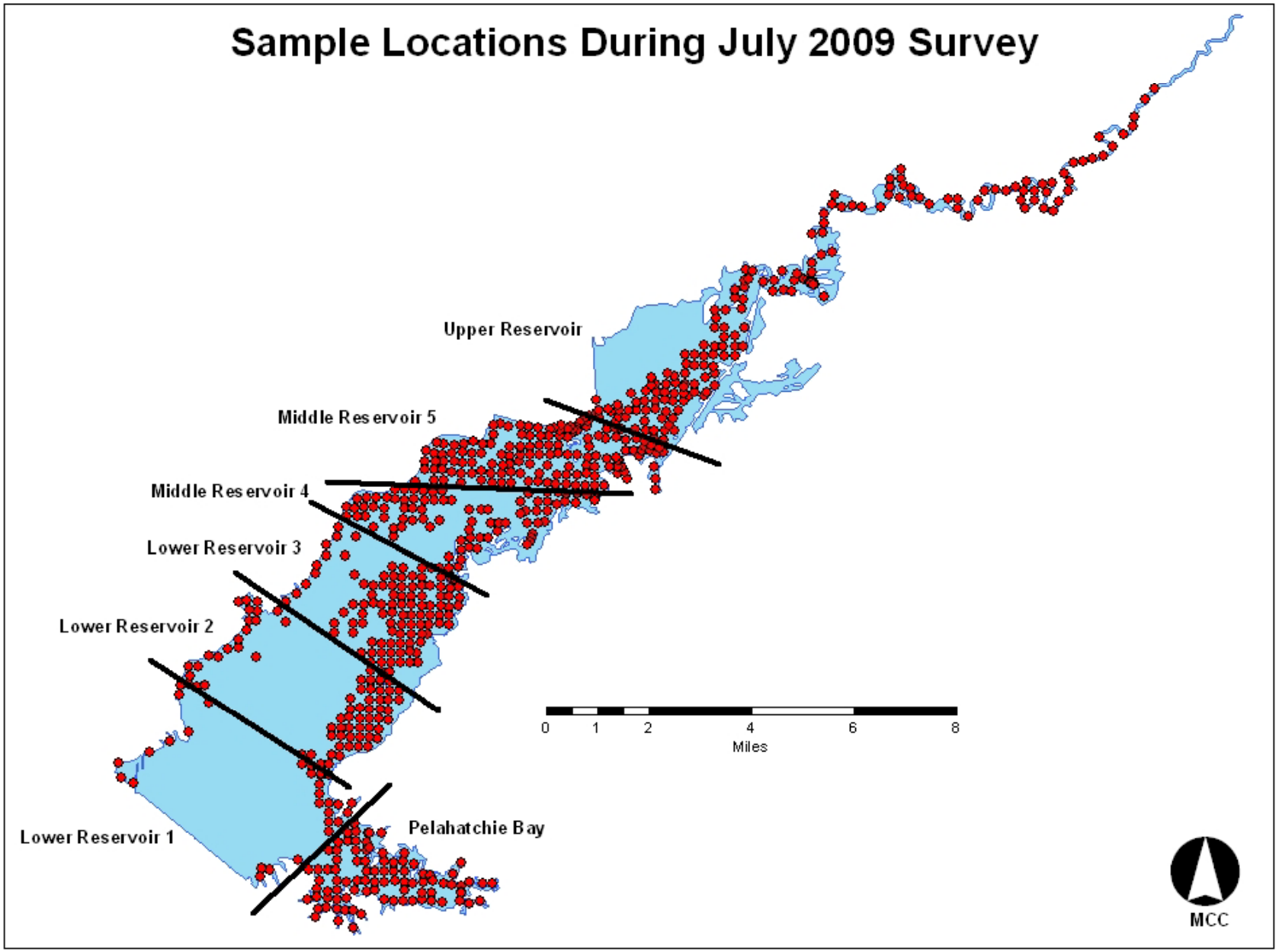
- Monitor the aquatic plants in Ross Barnett Reservoir
  - Locations of invasive plants
  - Monitor native plants as habitat for fish and wildlife
- Assess effectiveness of management activity

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)


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
0 1 2 4 6 8
Miles
MCC

Statistical Analyses

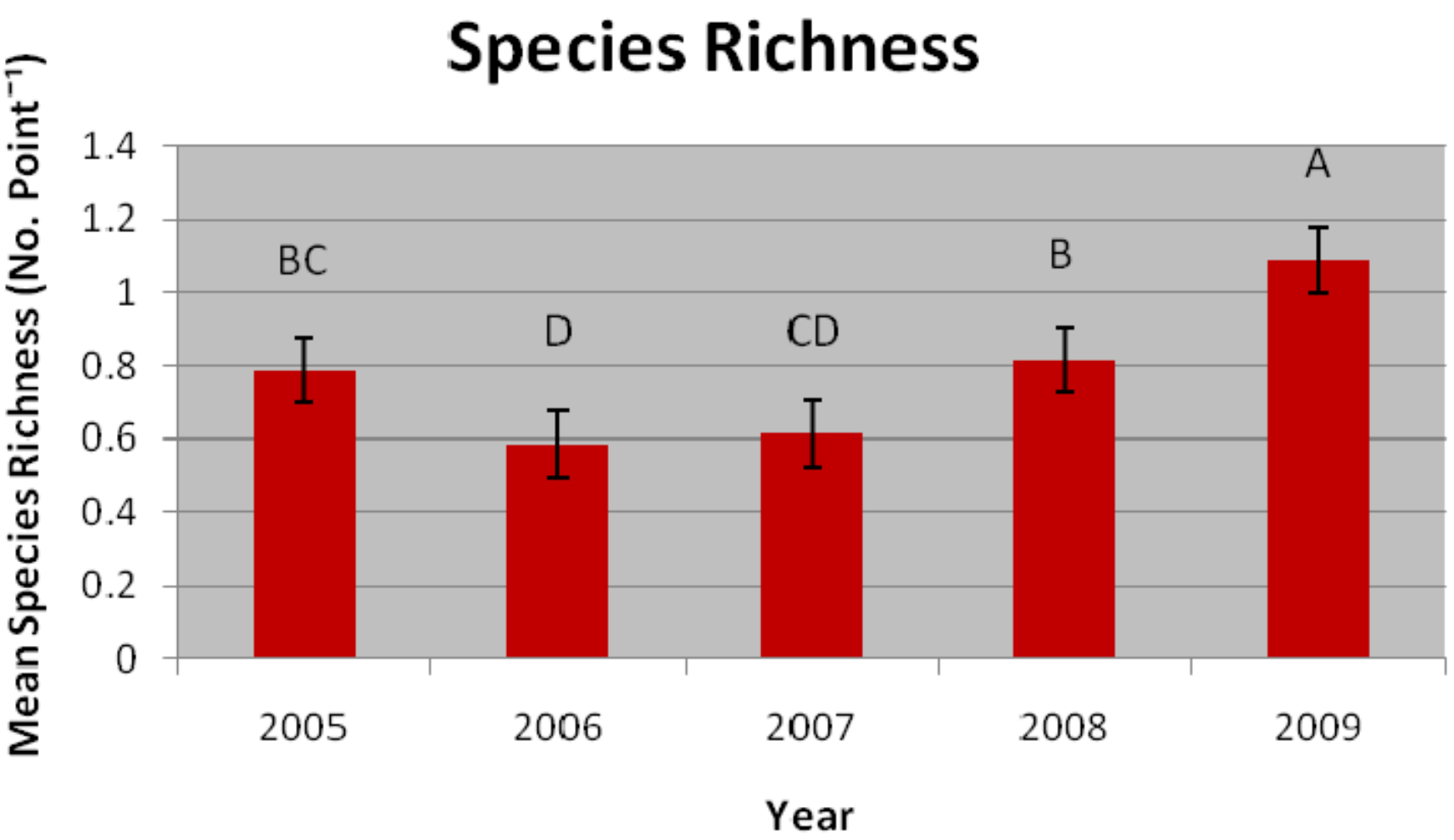
- A pairwise comparison was conducted using the Cochran-Mantel-Haenszel test in SAS to determine changes in species occurrence between years
- A Kruskal-Wallis test was used to determine differences in species richness and water depth between years

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.

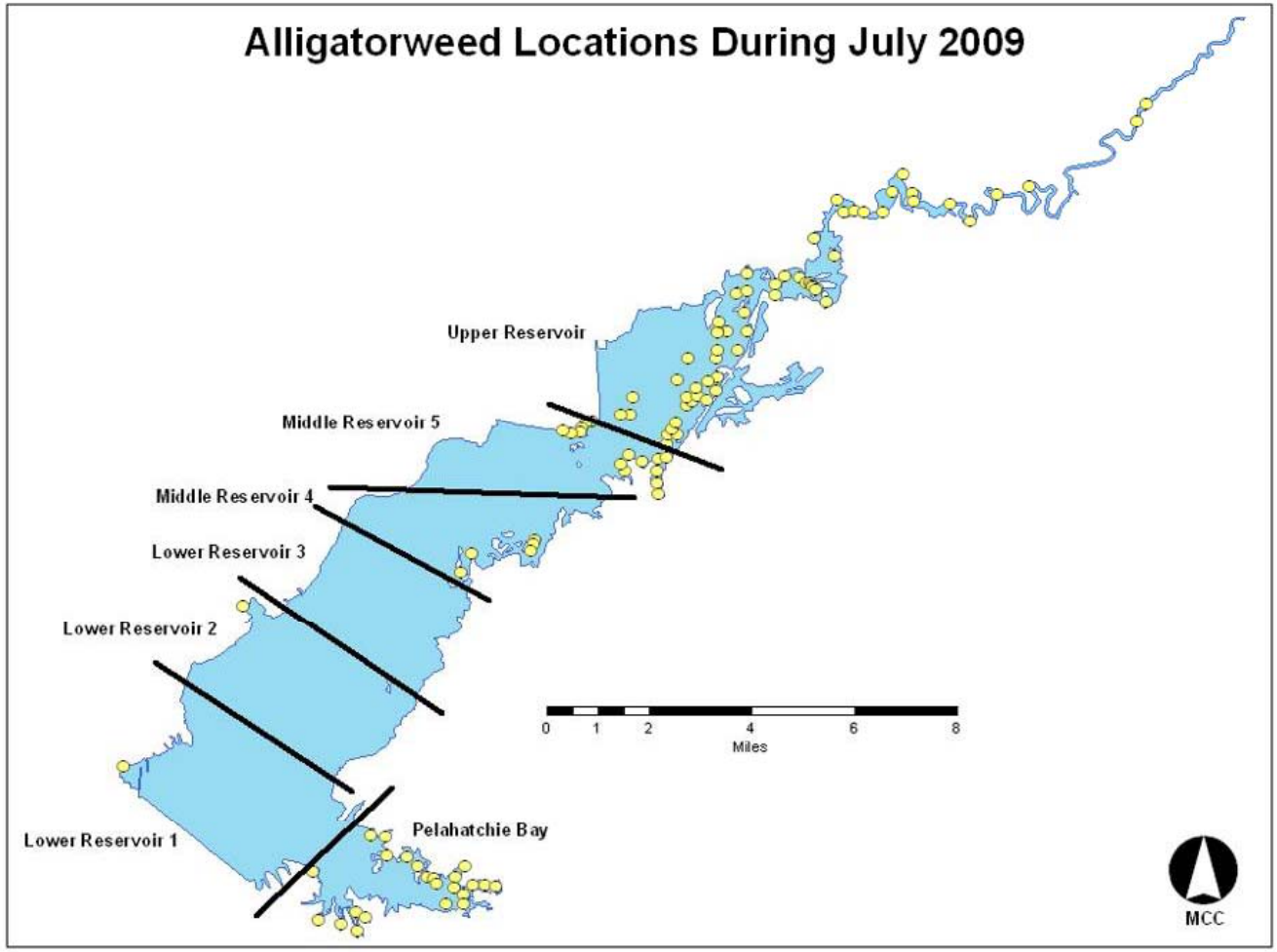
Species Name	Common Name	Native (N) or Exotic (E), Invasive (I)	2005 % Frequency (n=677)	2006 % Frequency (n=508)	2007 % Frequency (n=423)	2008 % Frequency (n=627)	2009 % Frequency (n=695)
Alternanthera philoxeroides	alligatorweed	E I	21.1	3.9	4.0	7.3	14.9a
Azolla caroliniana	mosquito fern	N	0.0	0.2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

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

Species Richness



Alligatorweed



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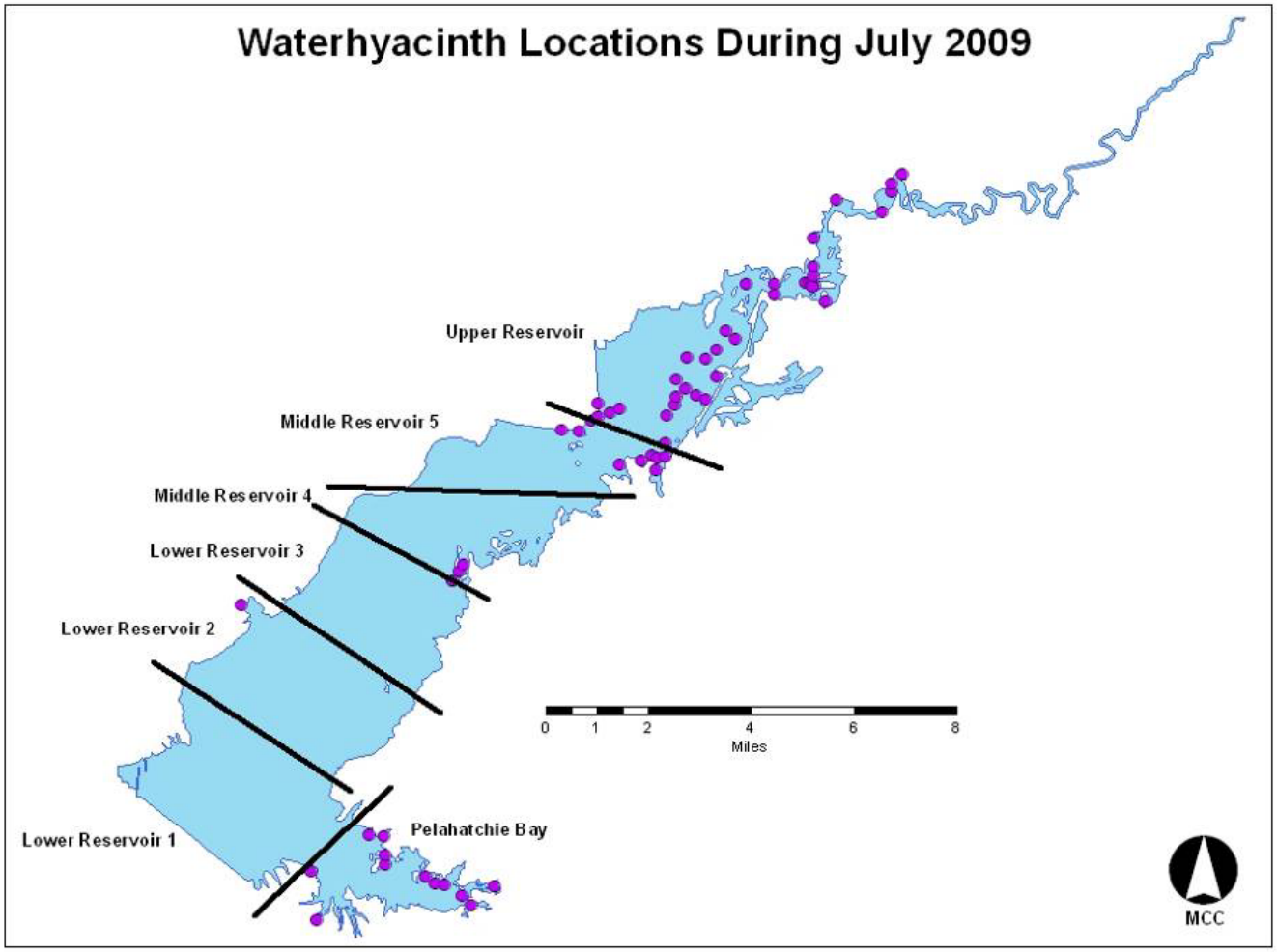
Waterhyacinth



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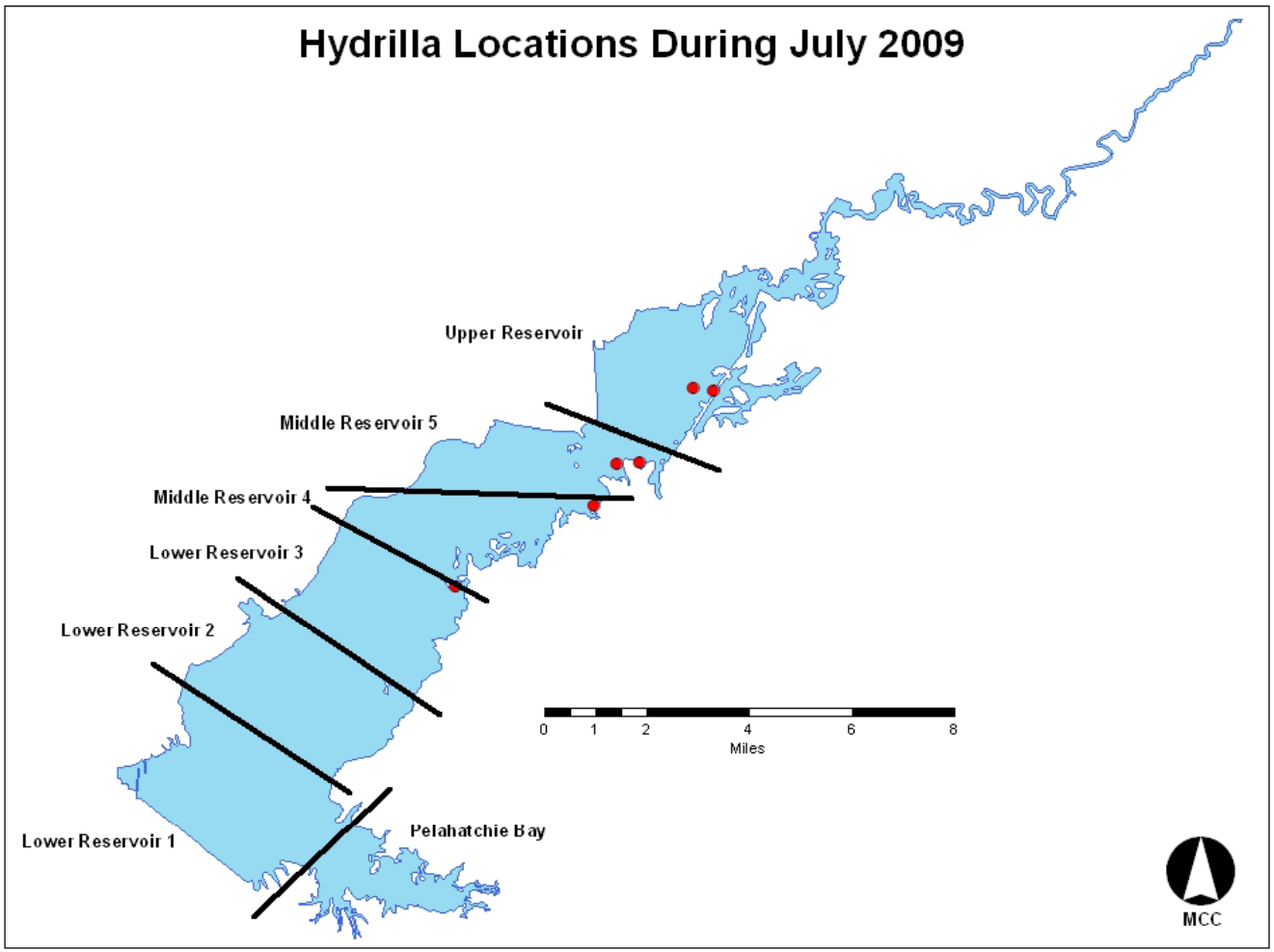
Hydrilla (from point survey)



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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.

Species	2005 Estimated Acreage	2006 Estimated Acreage	2007 Estimated Acreage	2008 Estimated Acreage	2008 Acreage Treated[1]	2009 Estimated Acreage	2009 Acreage Treated[1]
Alligatorweed	3175	444	377	1021	339	2309	307
Brittle naiad	0	0	178	111		44	
Hydrilla	120	67	111	89	275	133	155
Parrotfeather	111	111	22	133		67	
Waterhyacinth	733	333	111	555	167	1332	561
Waterlettuce*							5*
Cuban bulrush*							51*

[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.

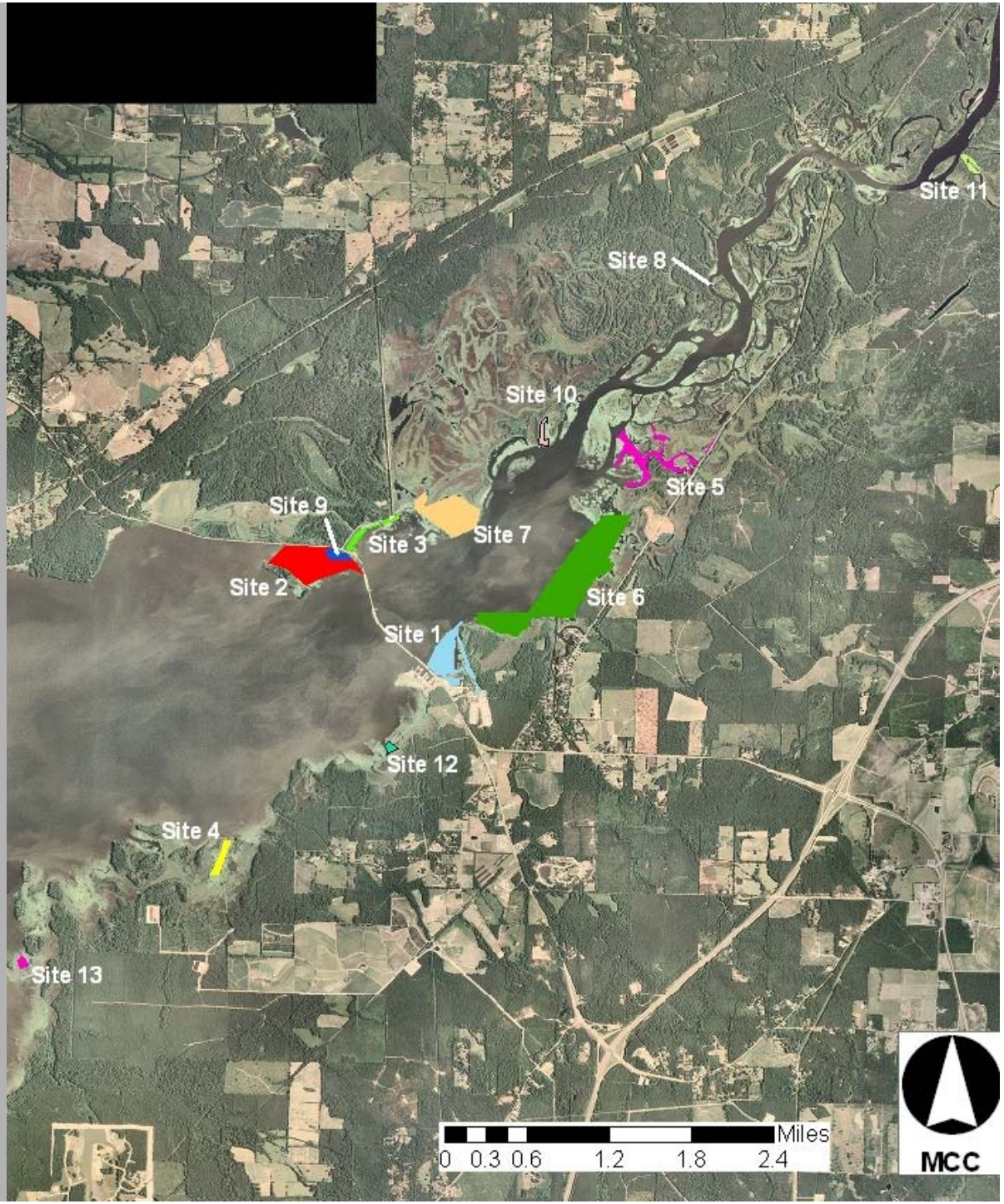
Herbicides and rates of application applied to non-native species in the Ross Barnett Reservoir in 2009.

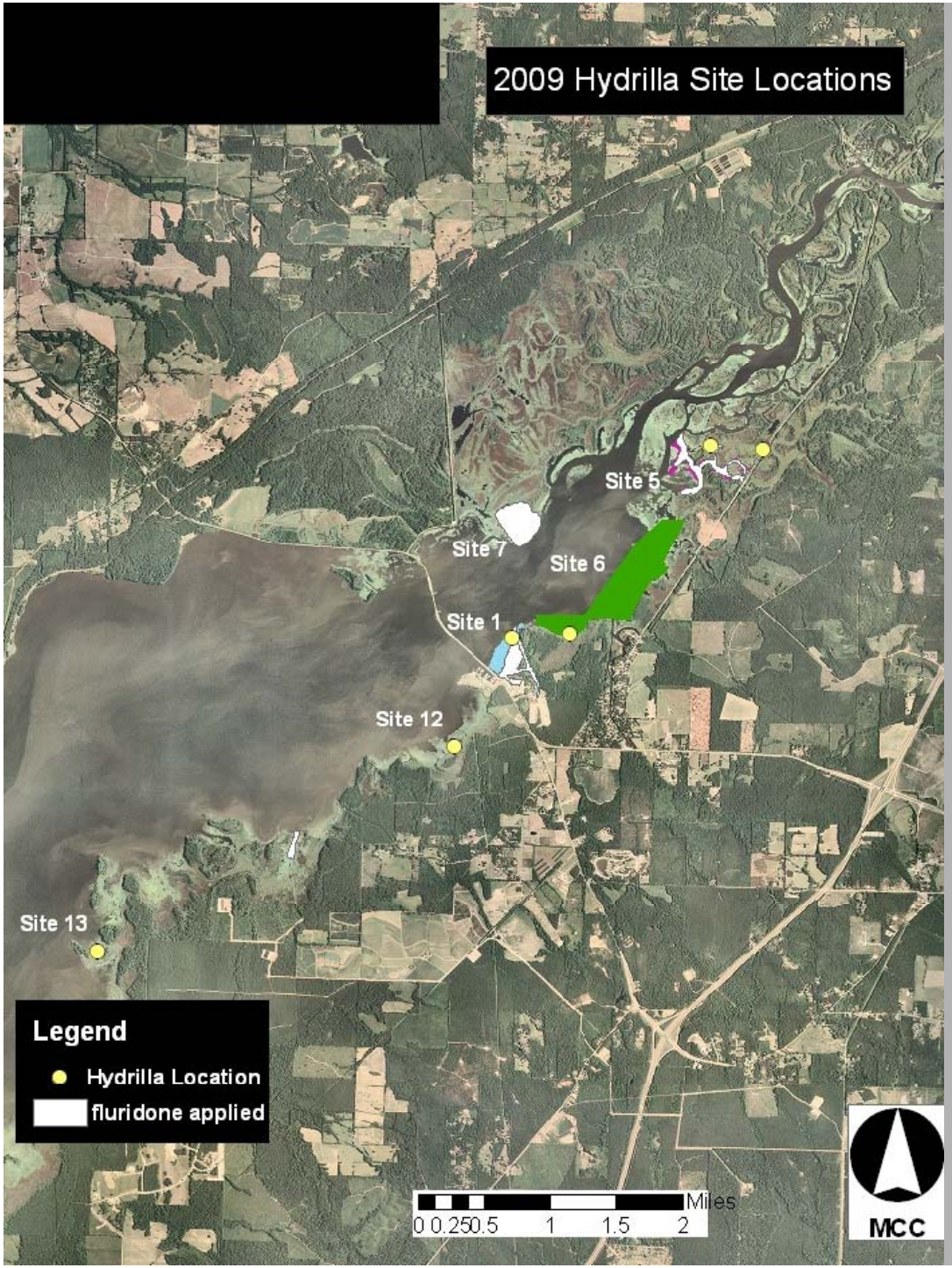
Species	Acres Treated	Herbicide/Rate
Alligatorweed	307	glyphosate/1.5%**
Waterhyacinth	561	2,4-D/1.0%**
Cuban bulrush	51	2,4-D/1.5%, glyphosate/0.5%**
Waterlettuce	5	diquat/2.0%**
Hydrilla	155 surface acres (898 acre/ft)	fluridone (Sonar Q)/0.98 lb per acre/ft
		fluridone (Sonar PR)/1.0 lb per acre/ft

**** 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

- 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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