

The Lake Wingra Carp Exclosure: Aquatic invasive species demonstration project

Friends of Lake Wingra & Edgewood College <http://lakewingra.org>
 Madison Fishing Expo <http://www.madfishexpo.com/>
 Dane County Land Conservation Division <http://www.countyofdane.com/landconservation>
 University of Wisconsin-North Temperate Lakes Long Term Ecological Research <http://lter.limnology.wisc.edu/>
 Wisconsin Department of Natural Resources <http://www.dnr.state.wi.us/>
 Dane County-Take A Stake in the Lakes 2010



Carp Tracking

In 2005, DNR fisheries biologists implanted radio transmitters in fourteen carp, and returned them to Lake Wingra. UW-LTER tracked the location of the fish throughout the following year. This established that the fish congregate in the deeper waters of the lake during the winter months, facilitating removal by seining under the ice.



Carp Removal

Commercial fishermen seined 6,306 carp from the lake in March of 2008. Before being taken to market, fish were tallied, sexed and measured. Fin clips from previous captures allowed an accurate estimate of 48% of carp removed from the lake, or a reduction in carp biomass from 327 lbs/acre to 161 lbs/acre.



Cyprinus carpio (AKA common carp) was imported to America in the late 1800s for food. This long-lived bottom dweller forages in the roots of aquatic plants. By disturbing sediment, carp encourage wind-induced turbidity and re-suspension of nutrients that lead to poor water clarity and algal blooms, inhibiting growth of aquatic plants. Reducing the carp population of Lake Wingra is the first step in restoring the lake to its former clear water condition.

The Lake Wingra Carp Exclosure



Lake Wingra carp exclosure July 2007, showing increased water clarity compared to the lake.

Lake Wingra's Water Quality

- Dense summer blue-green algal blooms
- Very poor water clarity
- Aquatic plants dominated by Eurasian water milfoil along shore
- Overabundant carp
- Poor growth and size structure for most sight-feeding fish species
- Other water quality problems (e.g. beaches closed by high bacteria)

Goals for a restored Lake Wingra:

- Good water clarity
- Low densities of blue-green algae resulting in reduced risk of exposure to algal toxins
- Aquatic plants dominated by a diverse community of low-growing native species
- Carp population drastically reduced
- Improved growth and size structure of desirable sight-feeding fish species
- Improvement in overall lake aesthetics

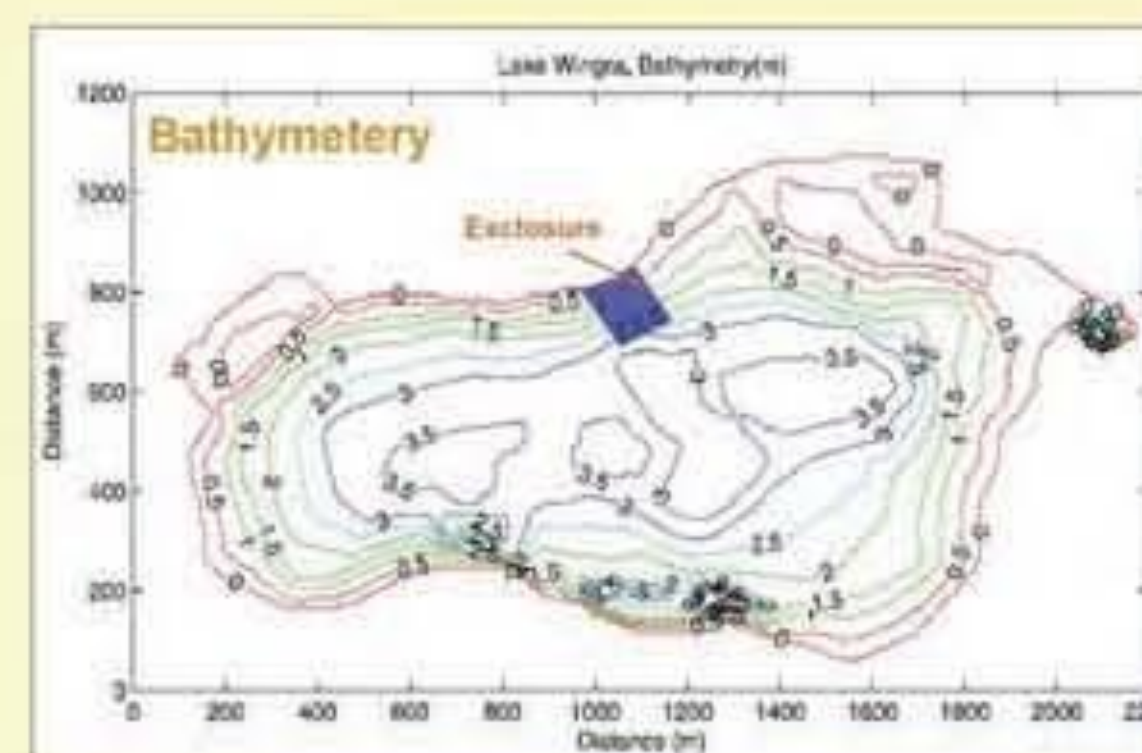
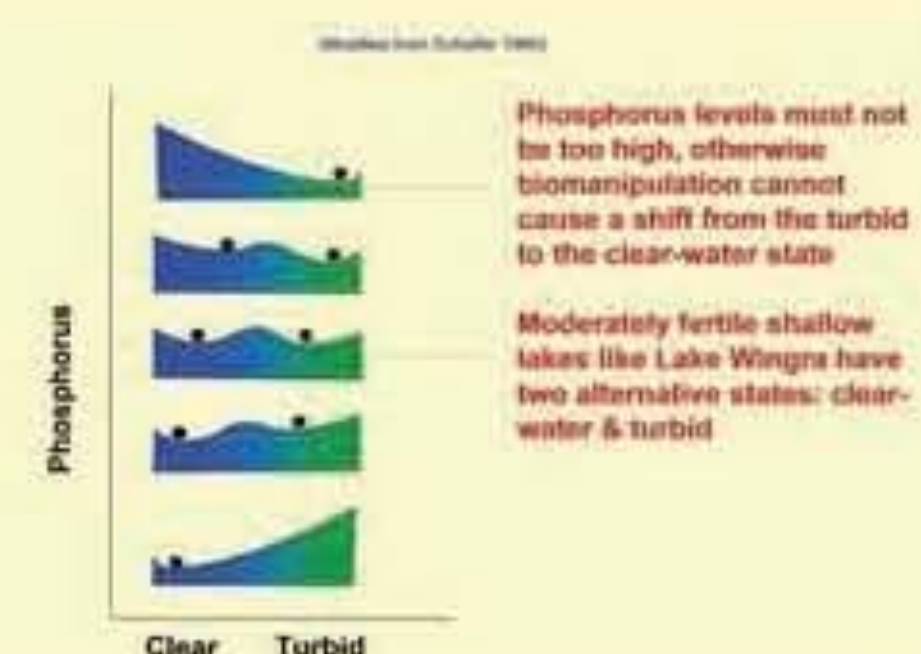
Alternative States of Shallow Lakes

Clear-Water, Aquatic Plant State

- Clear water
- Carp absent/sparse
- Aquatic plants abundant (with high biodiversity?)
- Bottom sediment re-suspension & phosphorus recycling low
- Blue-green algae densities low (Algal toxin concentrations low)

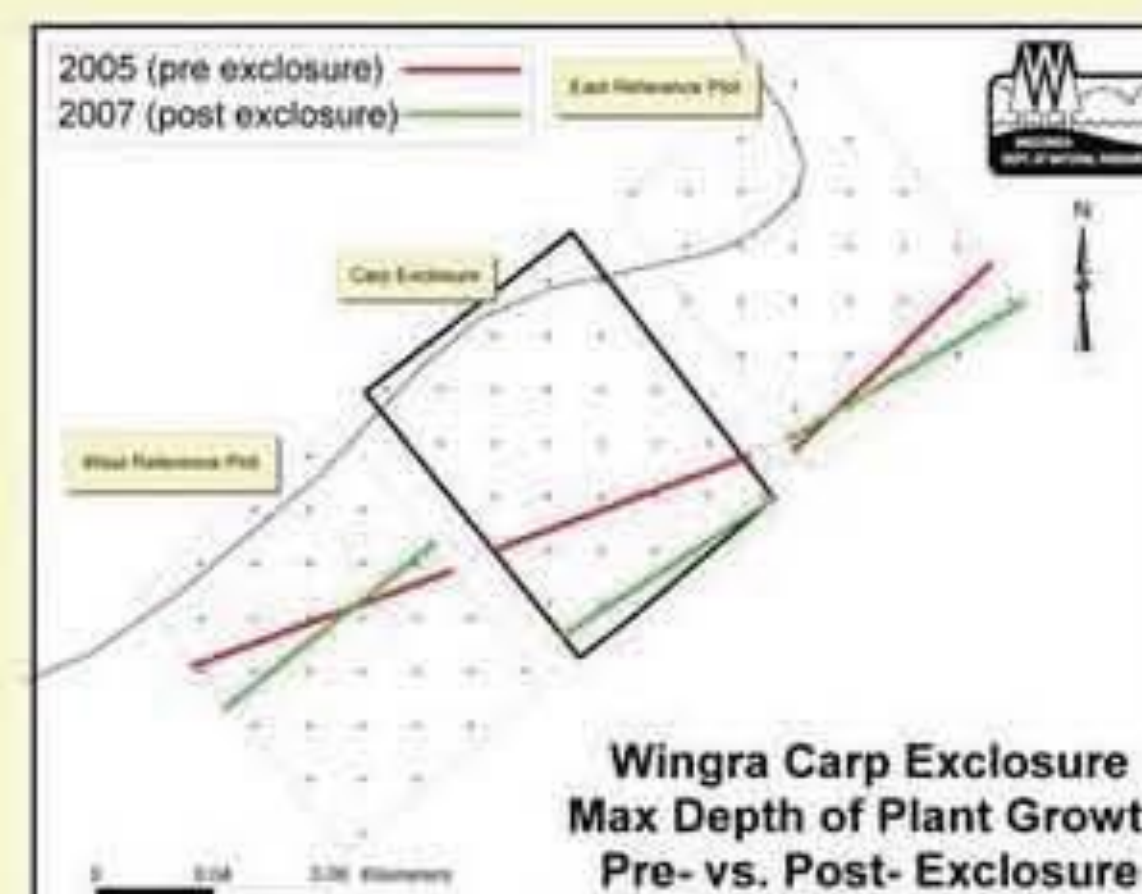
Turbid Algal State

- Turbid green water
- Carp population dense
- Aquatic plants sparse
- Bottom sediment re-suspension & phosphorus recycling high
- Blue-green algae densities high (Algal toxin concentrations high?)



Macrophyte Resurgence

By excluding carp and re-suspended sediment from the open lake, the exclosure improved water clarity. Now, with more sunlight penetration, aquatic plants have moved into deeper water providing additional habitat for fish and invertebrates.



This figure shows how plants moved into deeper water within the exclosure.

Native and Invasive Aquatic Plant Species in Lake Wingra:

- Coontail (*Ceratophyllum demersum*)
- Muskgrass (*Chara* spp.)
- Common waterweed (*Elodea canadensis*)
- Water stargrass (*Heteranthera dubia*)
- Northern water milfoil (*Myriophyllum sibiricum*)
- Eurasian water milfoil (*Myriophyllum spicatum*)
- Slender naiad (*Najas flexilis*)
- Bullhead pond lily (*Nuphar variegata*)
- White water lily (*Nymphaea odorata*)
- Curly leaf pondweed (*Potamogeton crispus*)
- Leafy pondweed (*Potamogeton foliosus*)
- Illinois pondweed (*Potamogeton illinoensis*)
- Floating leaf pondweed (*Potamogeton natans*)
- Richardson's pondweed (*Potamogeton richardsonii*)
- Flat stemmed pondweed (*Potamogeton zosteriformis*)
- Stiff water crowfoot (*Ranunculus longirostris*)
- Softstem bulrush (*Schoenoplectus tabernaemontani*)
- Sago pondweed (*Stuckenia pectinata*)
- Common bladderwort (*Utricularia vulgaris*)
- Wild celery (*Vallisneria spiralis*)
- Horned pondweed (*Zannichellia palustris*)



Side view of the exclosure showing the rubber curtain that excludes carp and lake water.

SUMMARY:

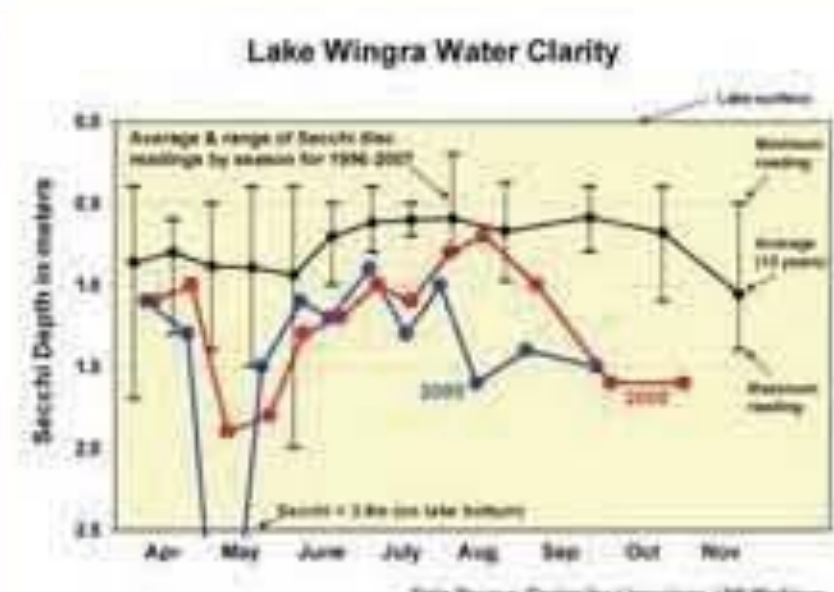
Recovery of aquatic species in lakes supporting populations of invasive macrophytes is thought to be inhibited by the activities of the common carp *Cyprinus carpio*. To test this hypothesis, a one hectare carp exclosure was placed in Lake Wingra (Dane County) for three years.

In the absence of carp, expansion in biomass and depth distribution of macrophytes within the exclosure was documented. While Eurasian milfoil dominated the resurgent biomass in deeper water within the exclosure, we did not see a reduction in native species. This suggests that:

- 1) Carp activity suppresses macrophyte growth.
- 2) There is potential for macrophyte species resurgence following suppression of carp activity.

The demonstration project led to consensus among local stakeholders about the potential benefits of whole lake restoration. Data from the project provides the basis for a more nuanced approach to managing carp populations in small eutrophic lakes.

Results of ongoing UW-Long Term Ecological Research (LTER) program monitoring of fish and macrophyte populations, and water clarity improvement supports using an integrated pest management approach by WI-DNR and local stakeholders for continued management of the carp population.



Measurement with a Secchi Disk shows that the summers of 2008 and 2009 were above average clarity, as compared to the average of the previous ten years.

Community Involvement



The Friends of Lake Wingra's role in developing community consensus for installing the exclosure and removing carp has been essential to the success of this project.

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