Science to support natural resource management of aquatic invasive species

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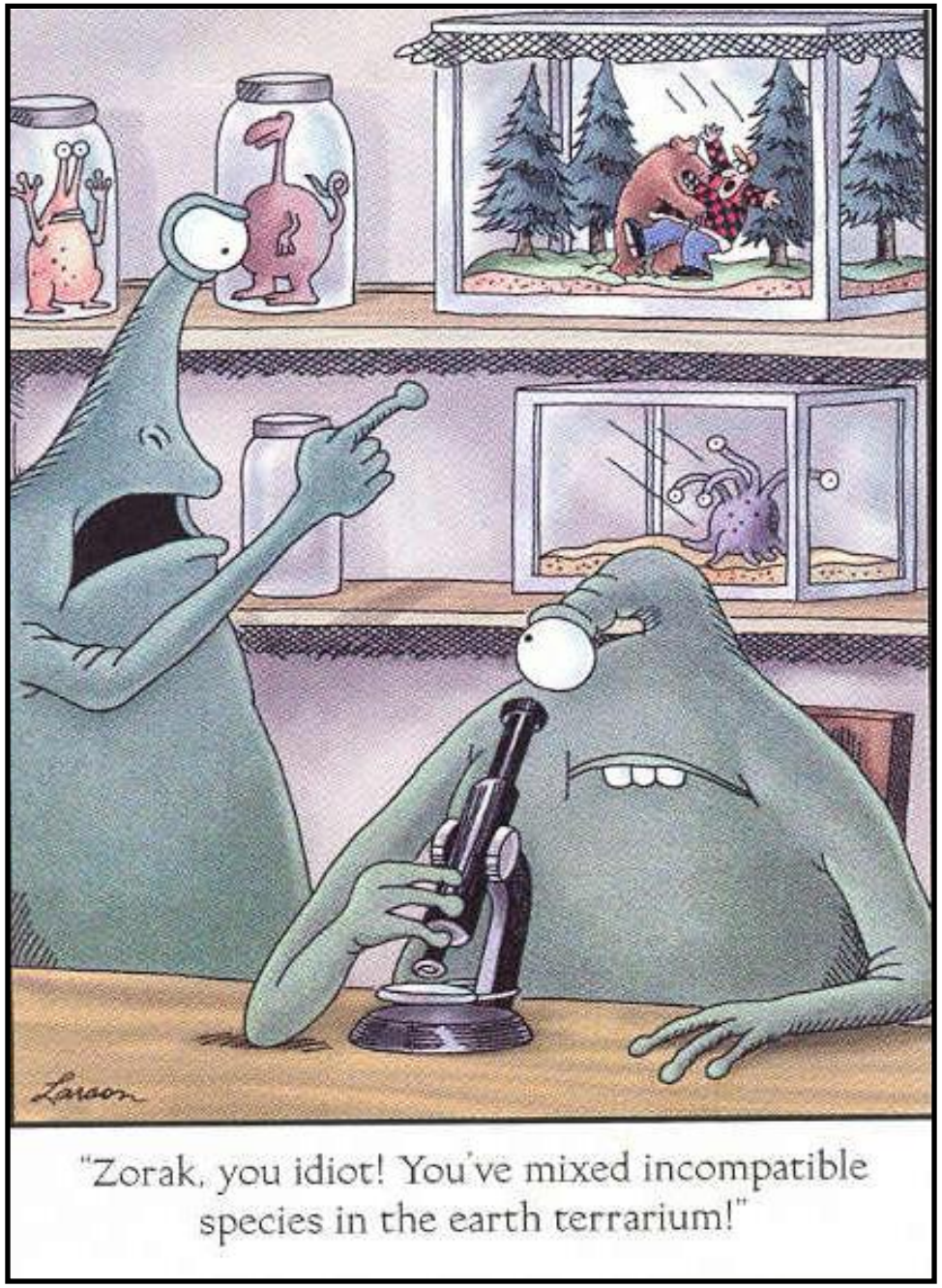
Fisheries and Aquatic Sciences Research program

Susan Knight, Alison Mikulyuk, Michelle Nault, Scott Van Egeren, Martha Balfour, Tim Asplund, and many other colleagues and partners

Photo by M. Nault



Gary Larson – *The Far Side*

Science as a perspective?

Various perspectives to inform decision-making (?):

~~-Scientific~~

-Social

-Economic

-Political

Science as a Tool!

(to understanding this "Earth terrarium" and the consequences of our "mixing" of species across ecosystems)

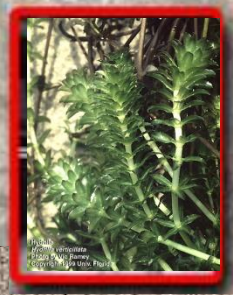
Talk outline

- Introducing… the trouble-makers
- Science to support regulatory options
  - NR 40 - species and pathways
- Science to understand impacts on the environment
  - How invasions happen, predicting vulnerable lakes
  - How much, where, variability across lakes (monitoring)
- Science to inform management options
  - Focus on Eurasian watermilfoil
- Moving forward
  - Important actions
  - The importance of partners


Osama Bin Laden
Murder of U.S. Nationals Outside the United States; Conspiracy to Murder U.S. Nationals Outside the United States; Attack on a Federal Facility Resulting in Death
Jeff Bode
Bob Korth
Earl Cooke
FBI'S 10 Most Wanted fugitives
Pam Toshner
Pat Goggin
Tim Asplund
Tim Hoyman
Sandy Gillum
Laura Herman
www.fbi.gov

Eurasian water-milfoil

Curlyleaf



Hydrilla

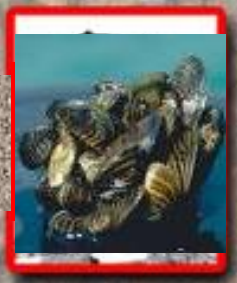
Rock Snot

WDNR's 10 Most UNWanted Invasives

Yellow-floating heart

"Rusty"

Zebra mussel



Red swamper

Round goby

Spiny Waterflea

http://dnr.wi.gov/invasives/

What are some notorious examples of invasive species?

Eurasian watermilfoil (*Myriophyllum spicatum*)

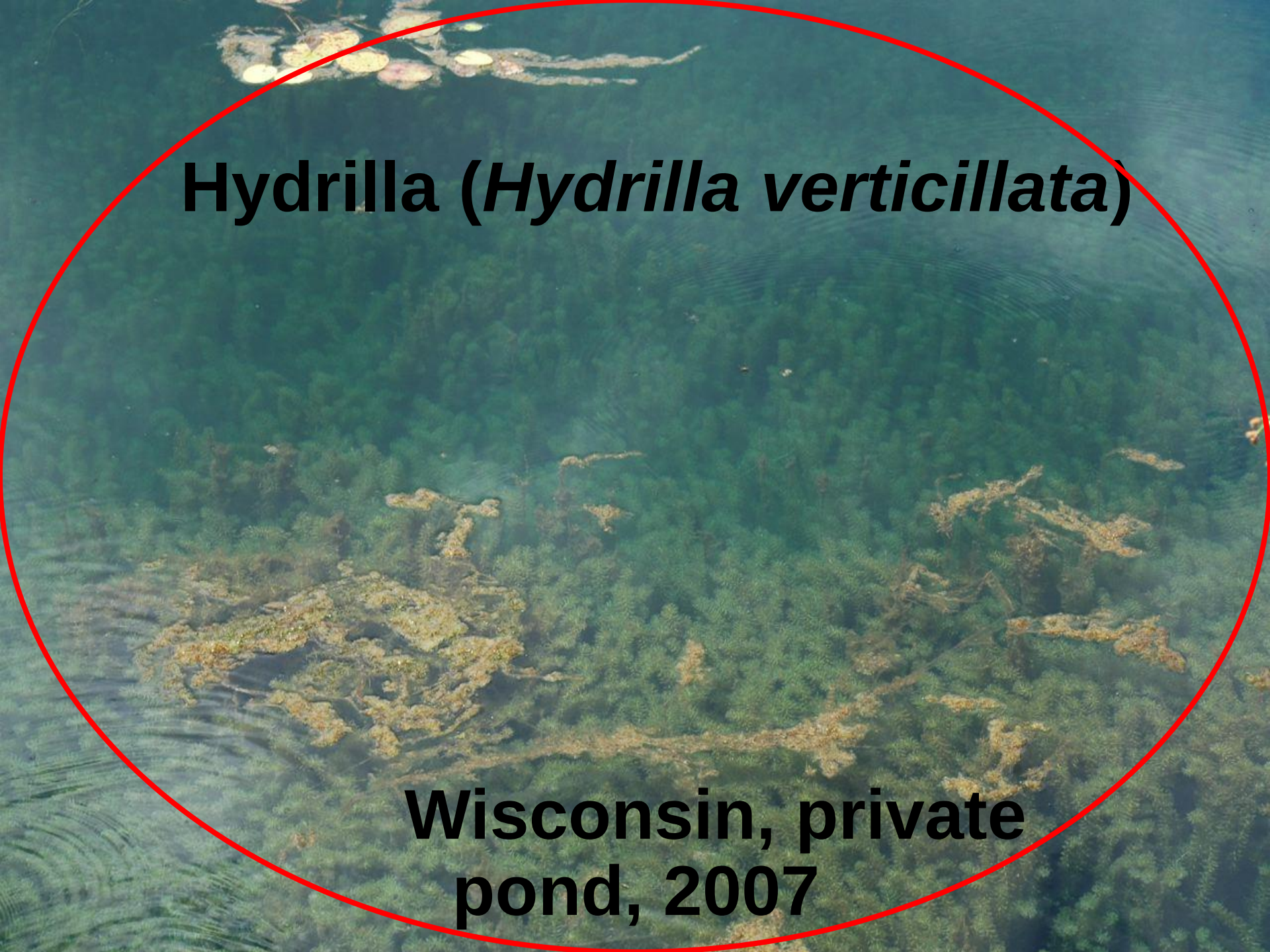
In WI

In WI

Curly leaf pondweed (*Potamogeton crispus*)

Florida


Wisconsin, private pond, 2005


Hydrilla (*Hydrilla verticillata*)
Wisconsin, private pond, 2007

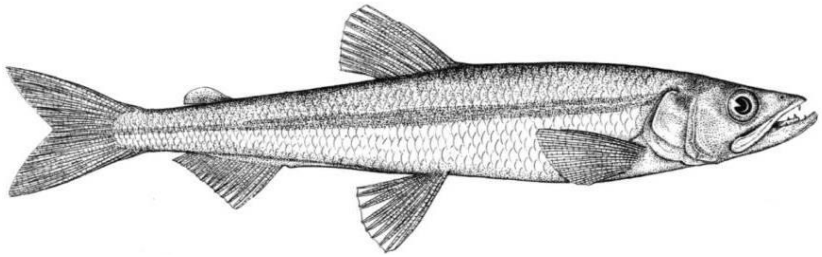
In WI, multiple ponds

Yellow floating Heart (*Nymphoides peltata*)

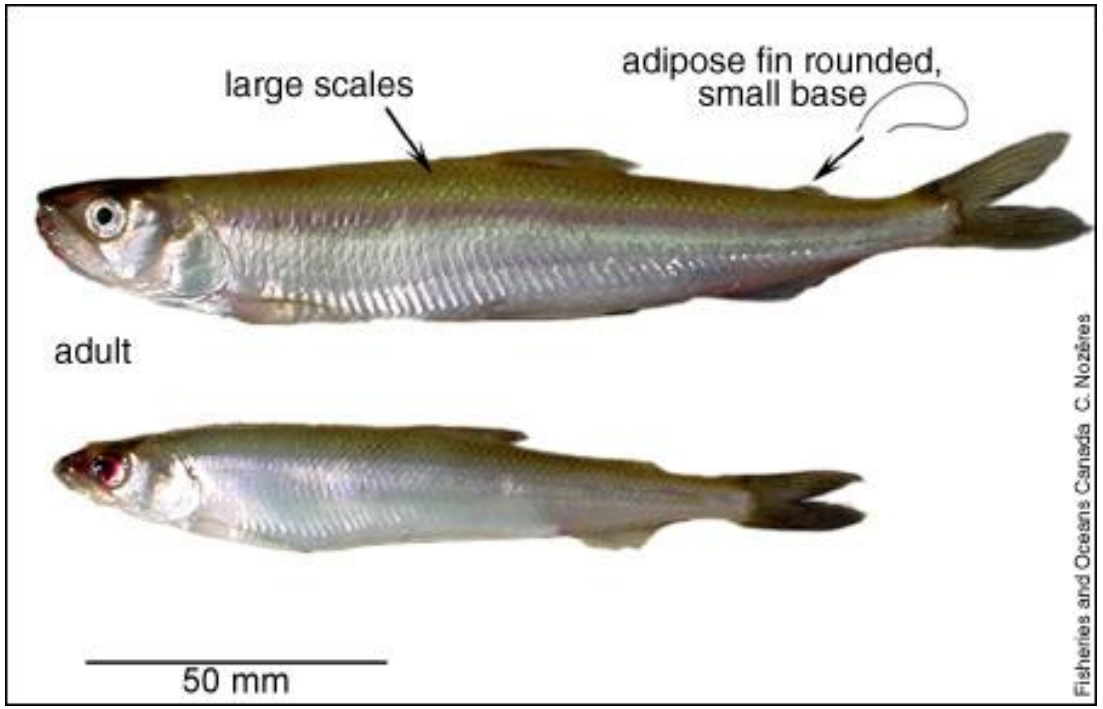
Rock Snot (algae, diatom) (*Dydimosphenia geminata*)

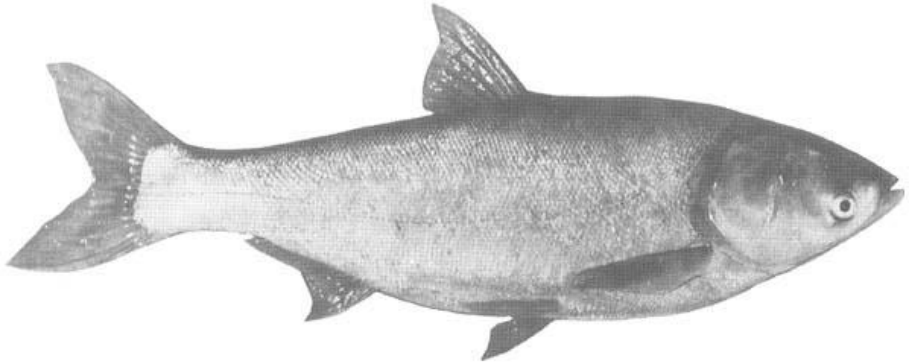
Not in inland systems?
(ND, SD, New England)

Dreissena polymorpha (zebra mussel)



Osmerus mordax (rainbow smelt)



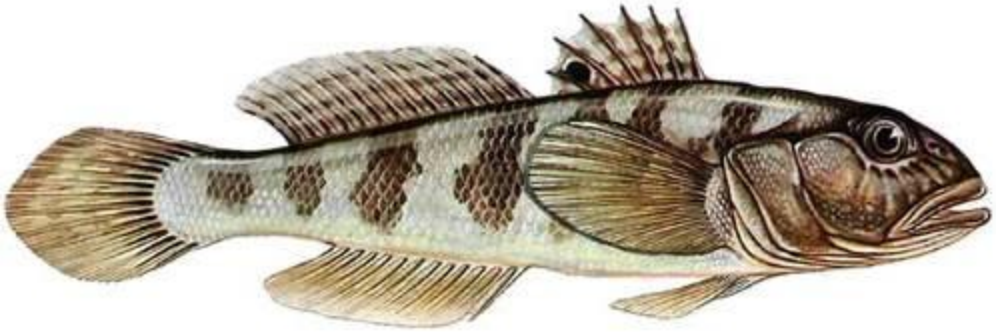


Hypophthalmichthys molitrix (silver carp)

"Asian carp" = Silver, Bighead, Black, Grass

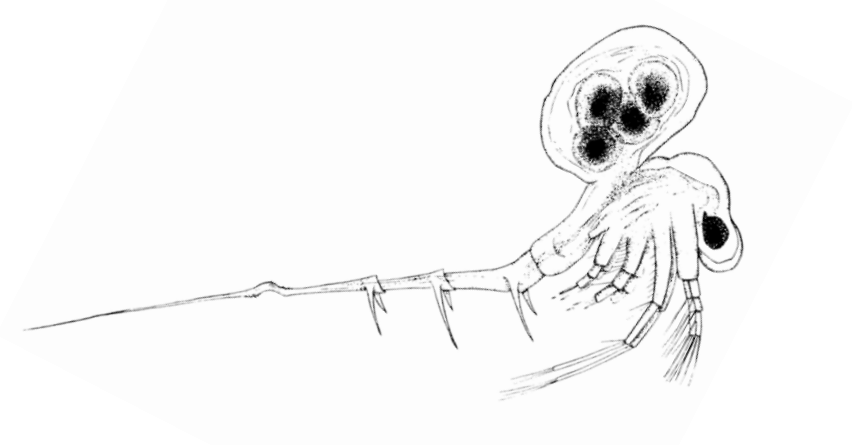
Orconectes rusticus (rusty crayfish)

Procambarus clarkii (red swamp crayfish)

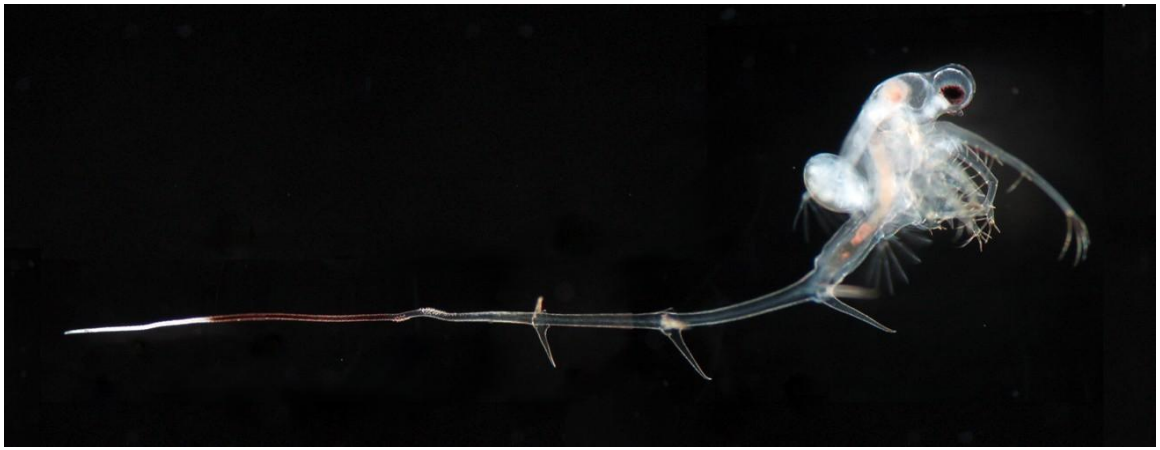


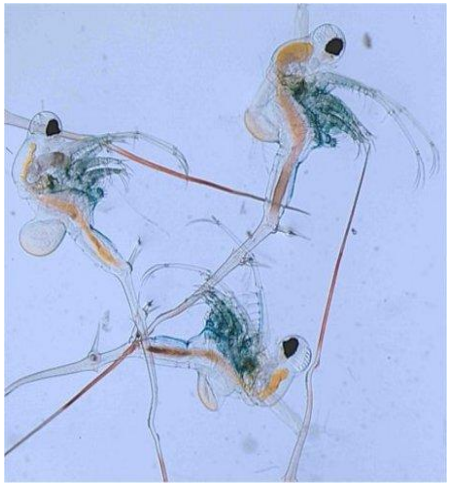
Neogobius melanostomus (round goby)

Cipangopaludina chinensis (Chinese mystery snail)



Bythotrephes longimanus (spiny water flea)





Why worry about invasive species?

- Economic impacts
  - cost of management, tourism / recreational impairment, home values
- Ecological impacts
  - loss of diversity, changes to biological, physical, and biogeochemical features of lake habitats (form and function)
- Aesthetics
  - odors, piles of rotting vegetation
- Health
  - toxic blue-greens, flying carp

How are aquatic invasive species regulated?

- Federal Noxious Weed Act - prohibits importation and interstate transport of listed plants
- NR 109, (Stat 23.24) - designates 3 aquatic plants as invasive, limits intentional introduction; can designate additional species for a water body or group of water bodies.
- Stat 30.715 - illegal to **launch** with any aquatic plants or animals
- Local or county ordinances
- Many good programs to educate on "voluntary" best management practices

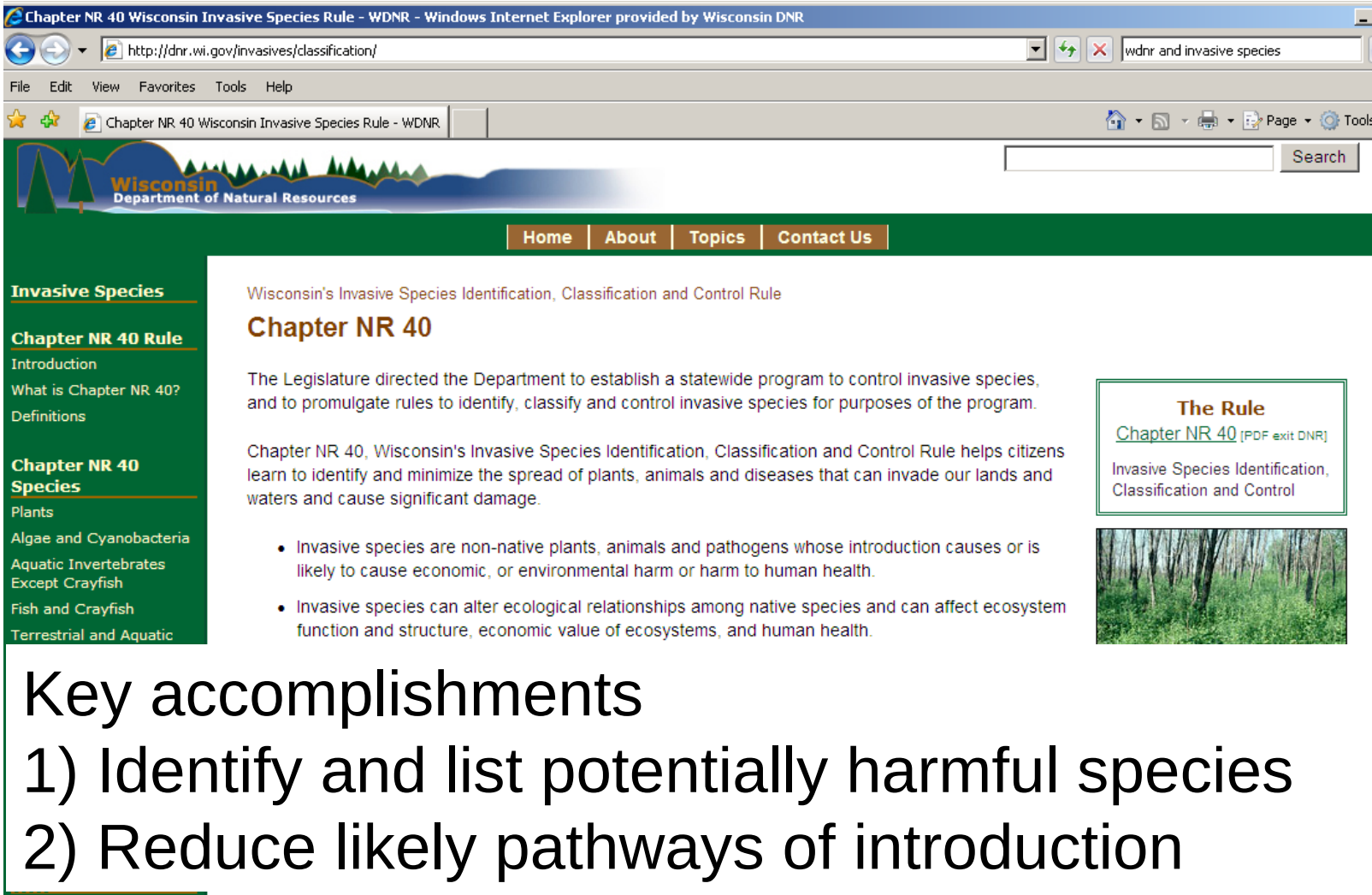
Section 23.22, Wis. Stats., orders DNR to identify, classify and control invasive species – NR 40







http://dnr.wi.gov/invasives/classification/



Key accomplishments

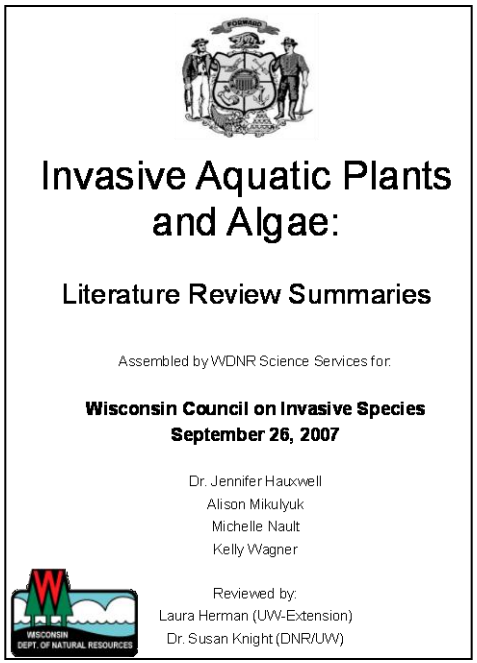
1) Identify and list potentially harmful species

2) Reduce likely pathways of introduction

1) Identification of species and regulated activities

6 Species Assessment Groups

- **Aquatic plants and algae**
- **Aquatic animals** (fish and invertebrates)
- **Woody plants**
- **Herbaceous plants**
- **Terrestrial vertebrates**
- **Terrestrial invertebrates & plant disease-causing microorganisms**



Invasive Aquatic Plants and Algae:

Literature Review Summaries

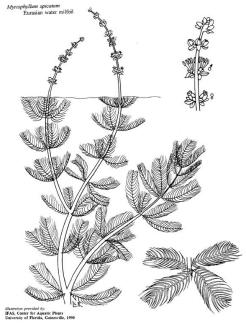
Assembled by WDNR Science Services for:

Wisconsin Council on Invasive Species
September 26, 2007

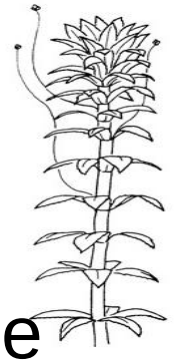
Dr. Jennifer Hauxwell
Alison Mikulyuk
Michelle Nault
Kelly Wagner

Reviewed by:
Laura Herman (UW-Extension)
Dr. Susan Knight (DNR/UW)

Developed lists of harmful species –
Cannot "transfer, transport, introduce, or possess"



In total…



For submergent aquatic plants and algae, we are concerned about:

- 3 established species (EWM, CLP, flowering rush)
- 16 species of plants and algae not yet established statewide (e.g., hydrilla, rock snot)
- 14 “caution” species

Google “WDNR and Invasives”
http://dnr.wi.gov/invasives/classification/

In addition, many species of aquatic animals, and wetland plants

2) Preventive measures

- **Illegal to launch or transport**

AND

- **Immediate removal and drainage required**
  - Vehicle, boat, trailer, **equipment or gear of any type**
  - Visible “Stuff” - All attached aquatic plants or animals
  - Water (algae, early life stages invertebrates)

- **Introduction prohibited**
  - Non-native aquatic plants, algae to public waters







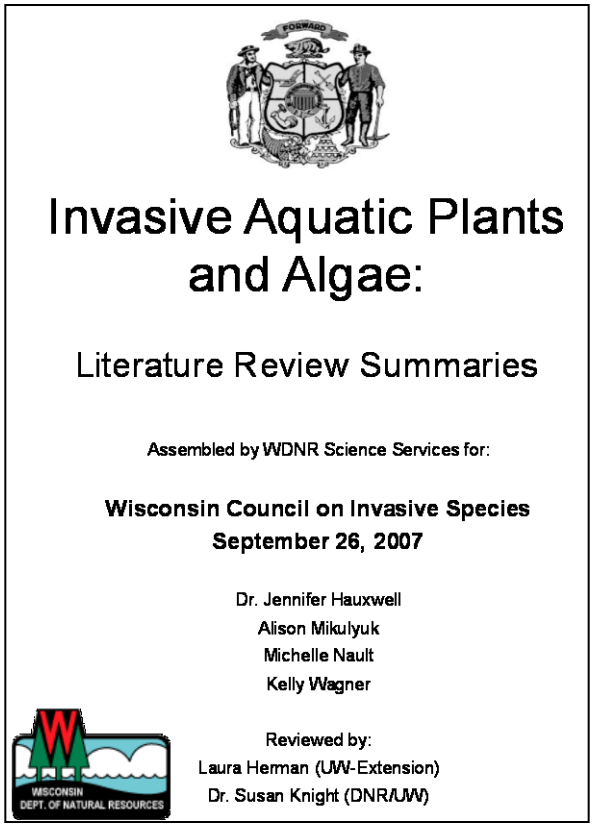
Process and next steps

- WI Council on Invasive Species (WCIS) created by Legislature – advisory to DNR
- Developed process, criteria, categories, draft regulations
- Created species lists, conducted literature reviews
- Species Assessment Group evaluations
- Draft rule
- Informal Public Listening Sessions
- DNR responds to comments – revises rule
- Proposed rule to Natural Resources Board
- Formal public hearings around state
- DNR revises rule based on public comments
- Proposed rule to NRB for adoption
- Legislative review and possible hearings
- Publication—rule takes effect (Sept 2009)
- **Revision as new information becomes available**

“Stop Aquatic Hitchhikers”

Conclusions for NR 40

- Science plays a critical role in making good regulations



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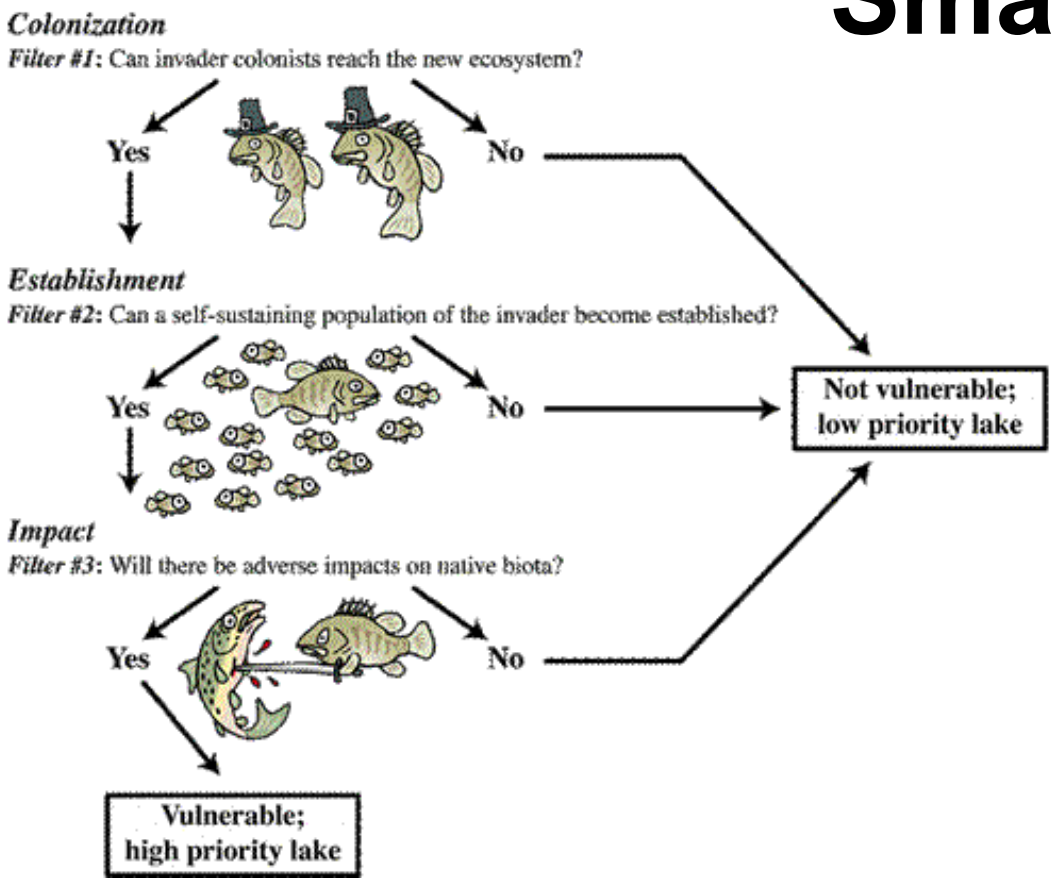
- So do stakeholders…

Thanks to many of you!

Lake residents,
Lake organizations,
Industry reps,
Educators,
Local and county reps
SAG members

Understanding the ecology of invasions as a framework for:

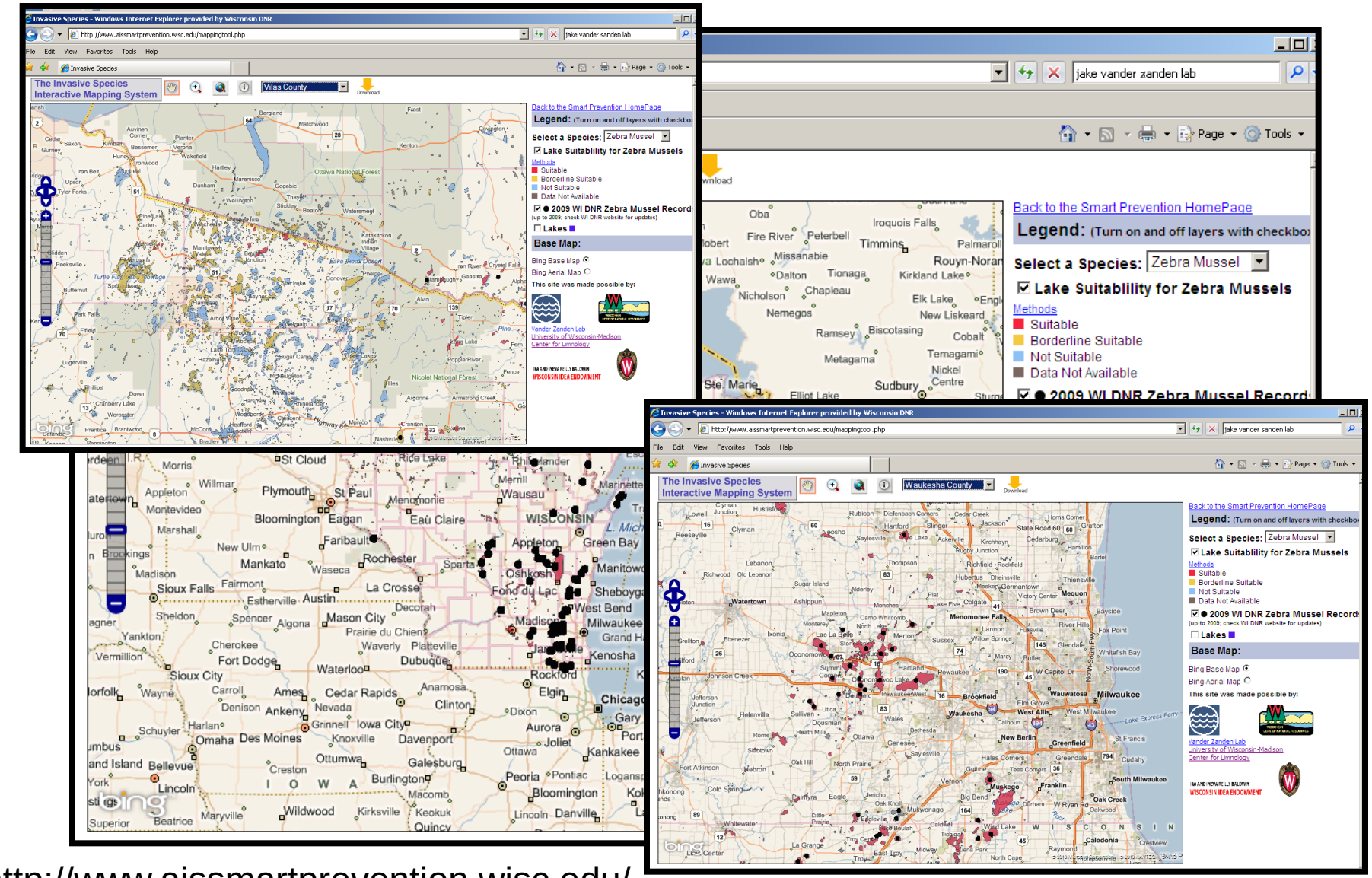
“Smart Prevention”



From Jake Vander Zanden
UW Center for Limnology

Online mapping tool for lake suitability

aka “who can survive where?”



http://www.aissmartprevention.wisc.edu/

Smart prevention maps

Available:

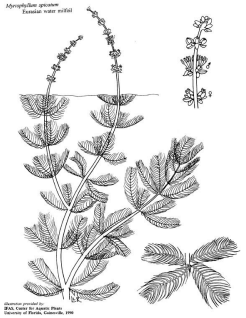
- Zebra mussels
- Rainbow smelt

In progress

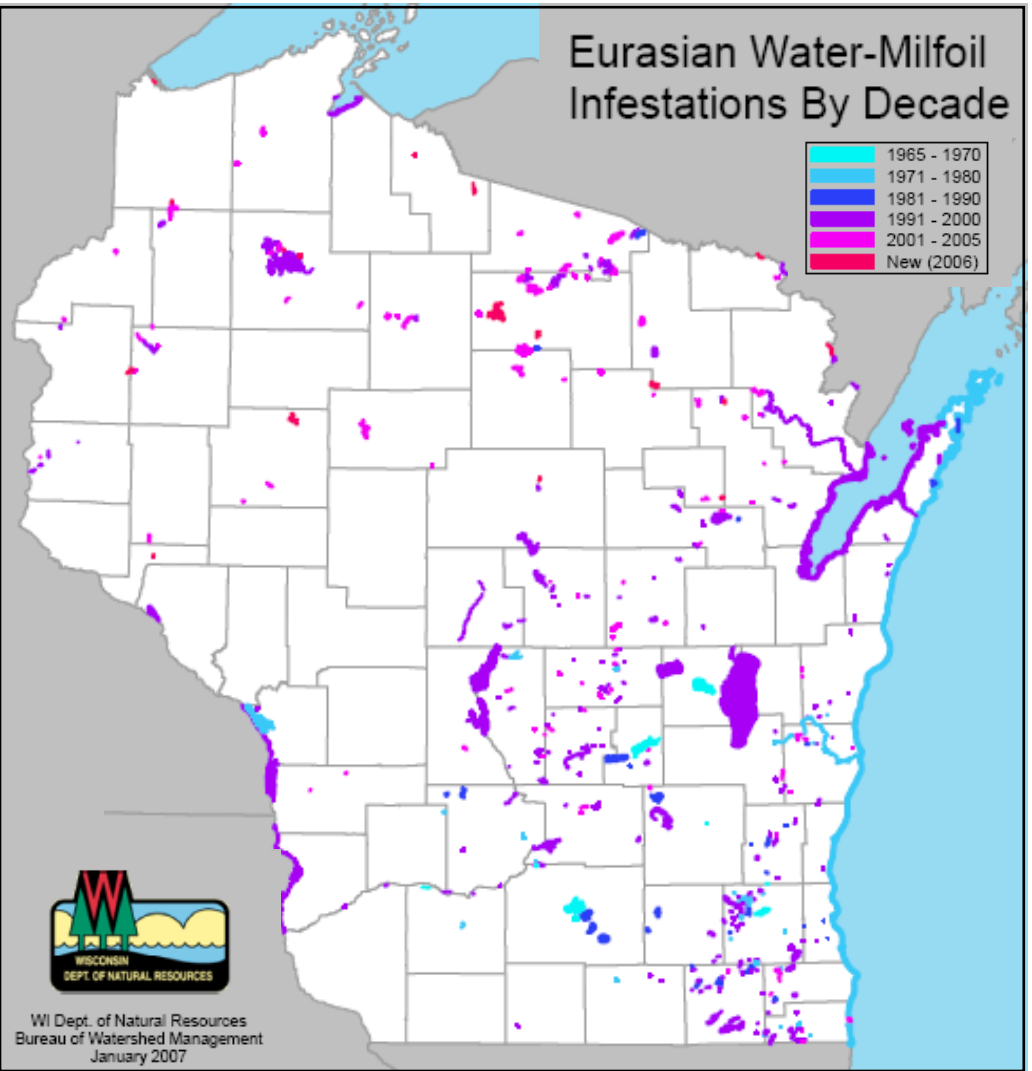
- Spiny water flea
- Rusty crayfish
- Chinese mystery snail
- Round goby
- Eurasian watermilfoil

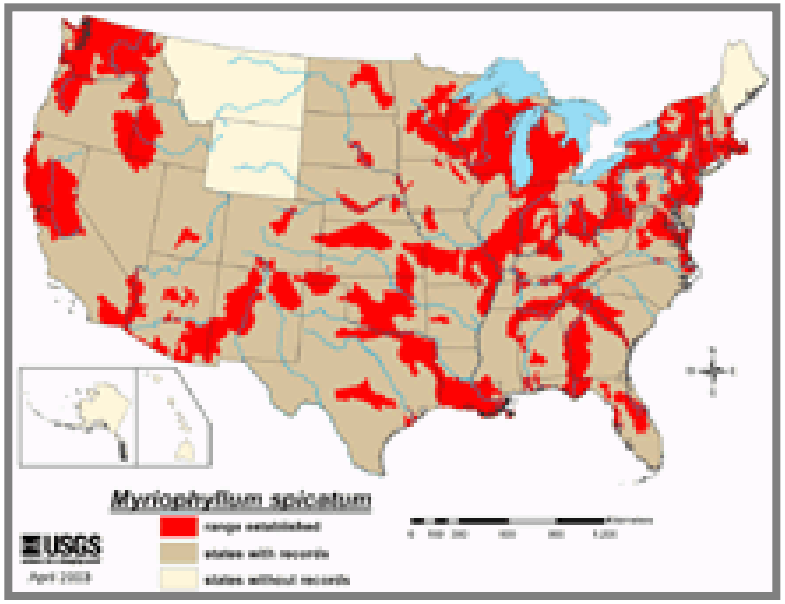
The Milfoil story in Wisconsin

- Once, there was snow and ice covering most of the state (c.a. 10,000 – 110,000 BP)
- Then, there were many lakes
- Then, over time, those lakes were colonized by 7 “native” milfoils and many other species
- Then, along came a milfoil species from another continent and it got loose in the Chesapeake (1940s)
- Then, it showed up in the Madison lakes (1960s)
- 50 years later, it’s made it to northern Wisconsin
  - Human-mediated succession
  - What do we do about this?
  - First, get our facts straight.



We know in general:

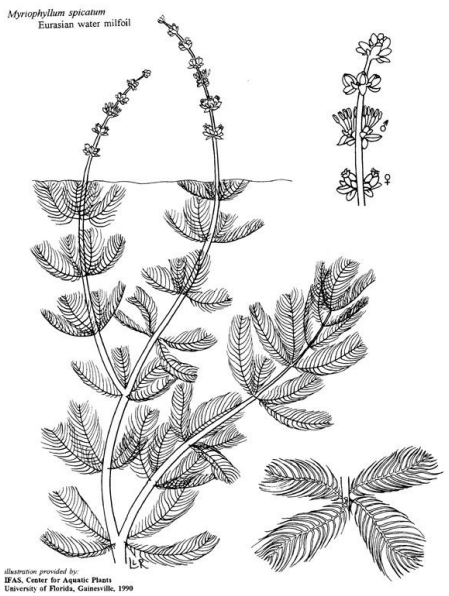




Eurasian watermilfoil (EWM)

Recorded in:

- 46 states
- 539 lakes in WI



Despite good tracking of EWM populations in WI (✓yes if present):

- How much? Where in the lake? What will the lake look like in the future?

-different lake types, different outcome?
-different location, different outcome?
-different management, different outcome?

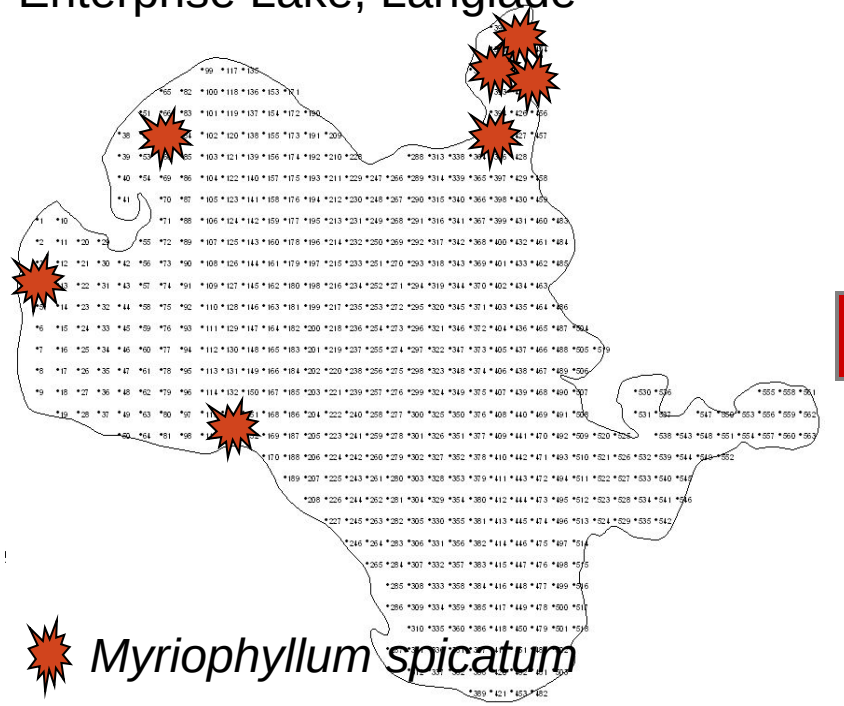
If we knew more, we could manage better.

1) Develop observation system (2004-2005)

- assess how aquatic plant communities vary in lakes across the state and over time

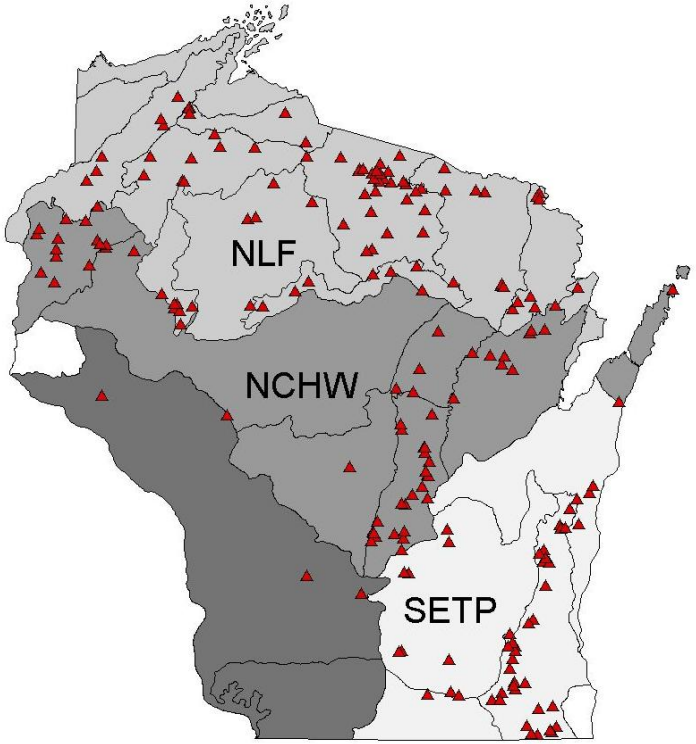
N = 1

Enterprise Lake, Langlade



Myriophyllum spicatum

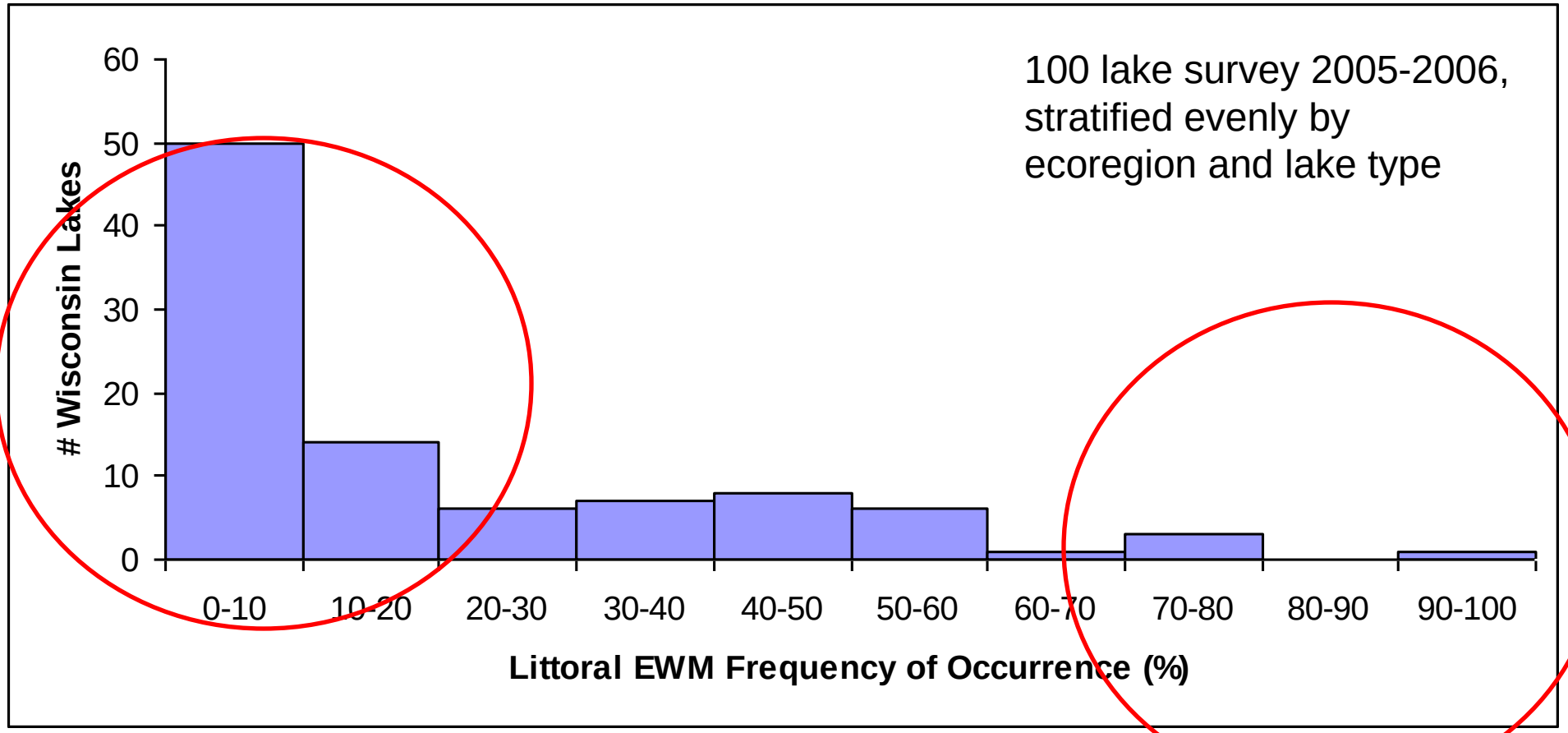
N = 266



Making the best management decisions for WI lakes using data (What species? Where? How much? Response to management?)

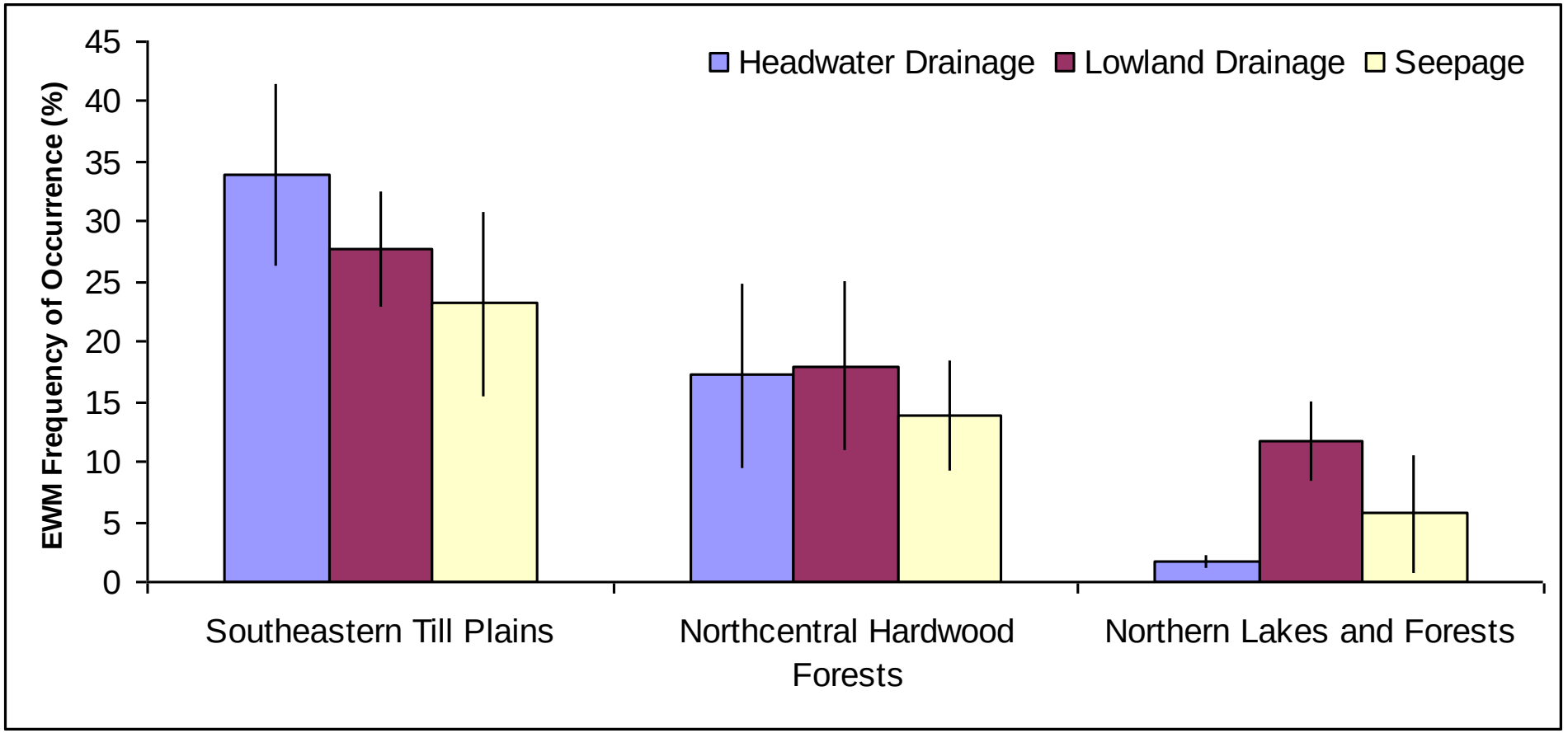
2) Ask the questions…

-How much Eurasian watermilfoil is in our milfoil lakes?



-Most EWM littoral frequencies are <10%

-What is a snapshot of abundance and distribution of Eurasian watermilfoil around the state?



EWM frequency varies by ecoregion (*P<0.001*)

Lake type/overall no significant difference

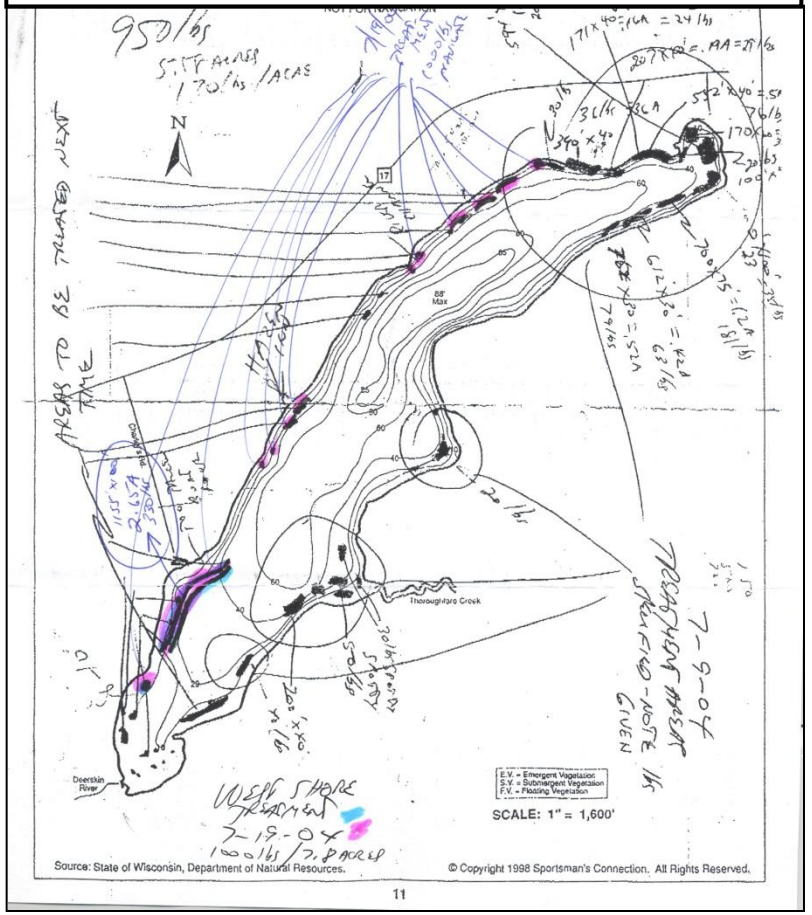
-How does abundance and distribution of Eurasian watermilfoil relate to how long it's been in the lake or past management?

Ideally, we'd know:

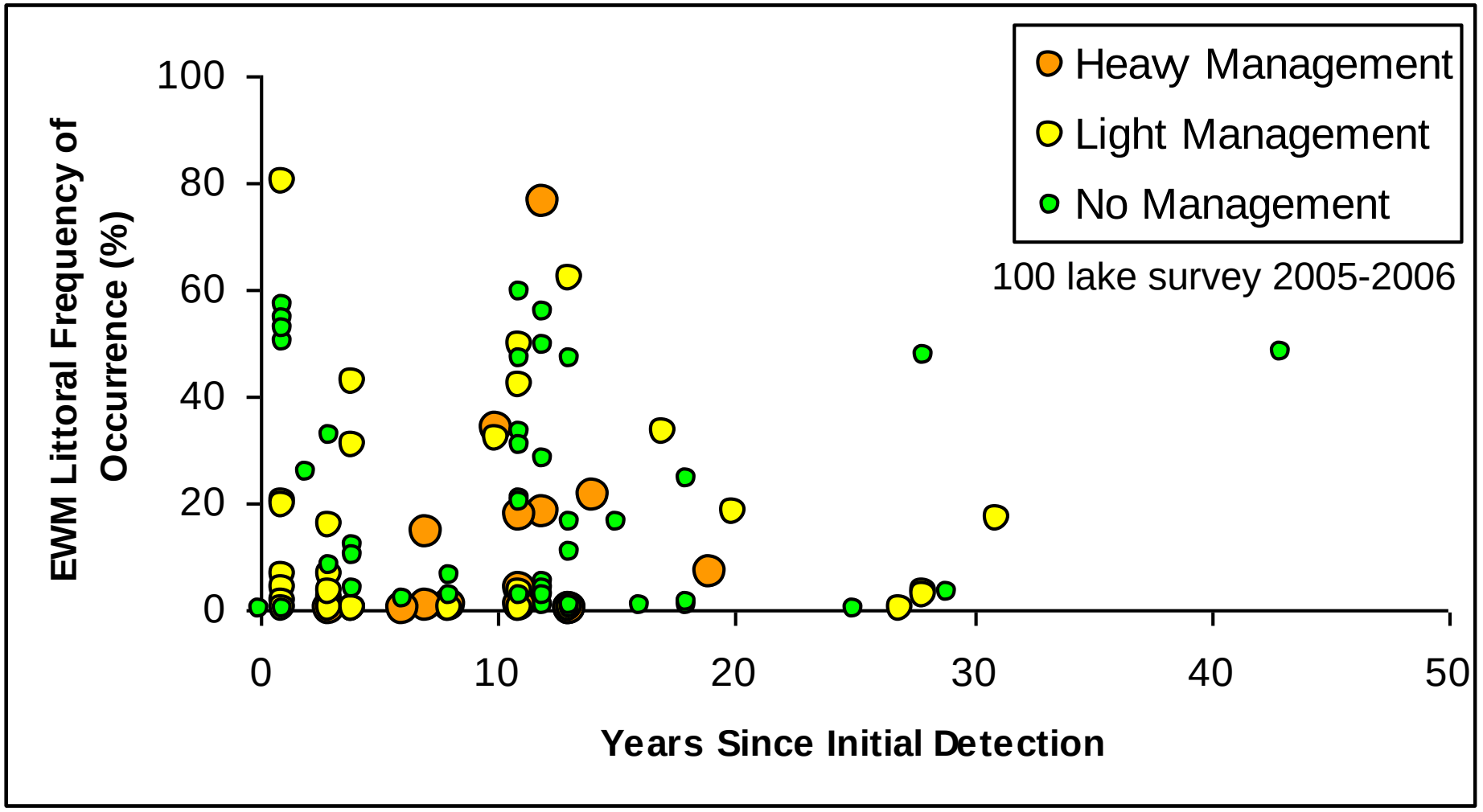
- Date of introduction
- Acreage of EWM
- Acreage of EWM treated
- Chemical used
- Amount used
- When
- Where

vs

- Date first detected,
- and ???



-How does past management relate to today's population levels?



As we have managed in the past, any management approach can result in wide variation in current EWM = short term "nuisance" control

Smart management and investment

- An ounce of prevention…
- Strategic vs non-strategic control?

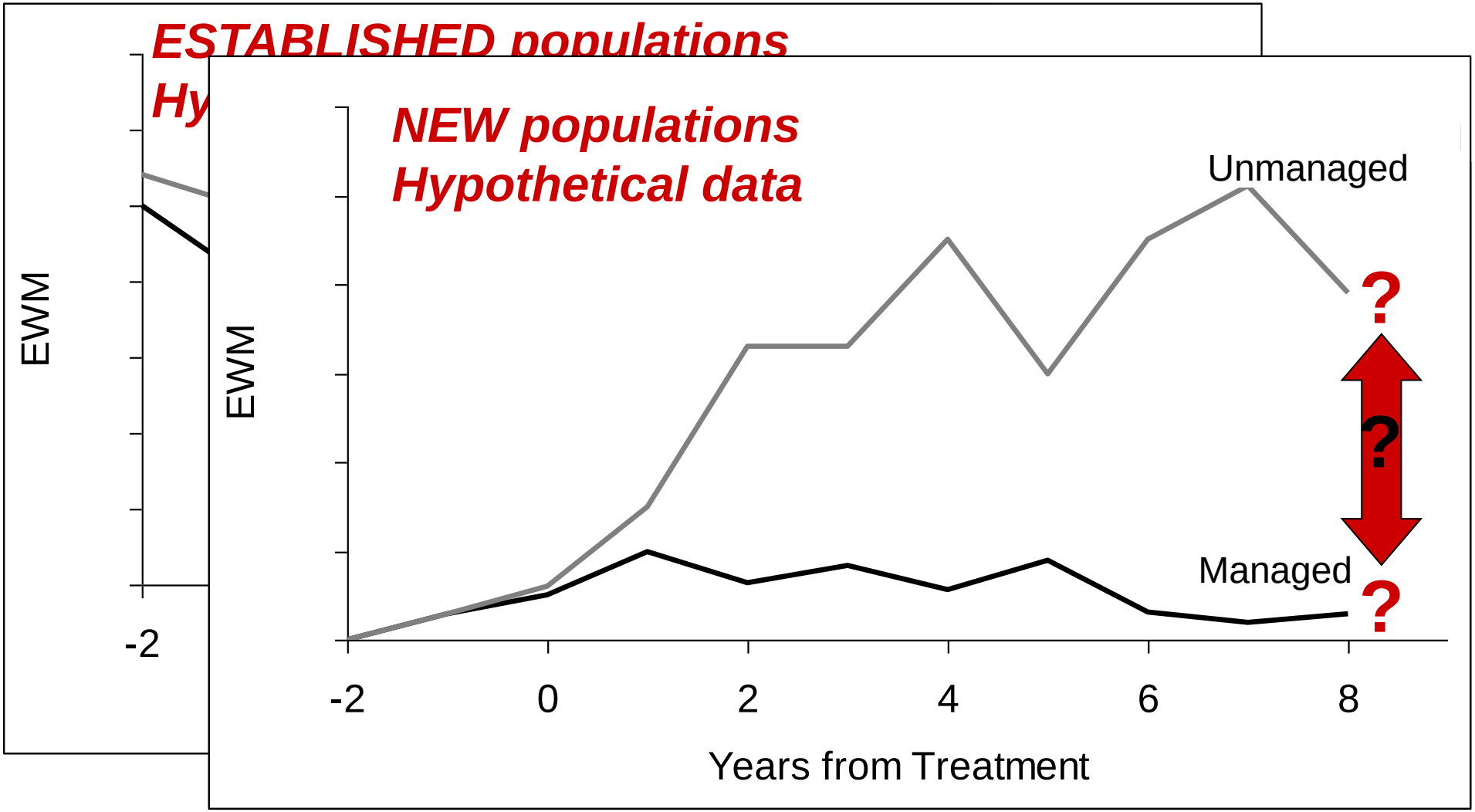
Past management (non strategic) outcomes =
short term nuisance relief

Future management (strategic) outcomes =
long-term restoration?

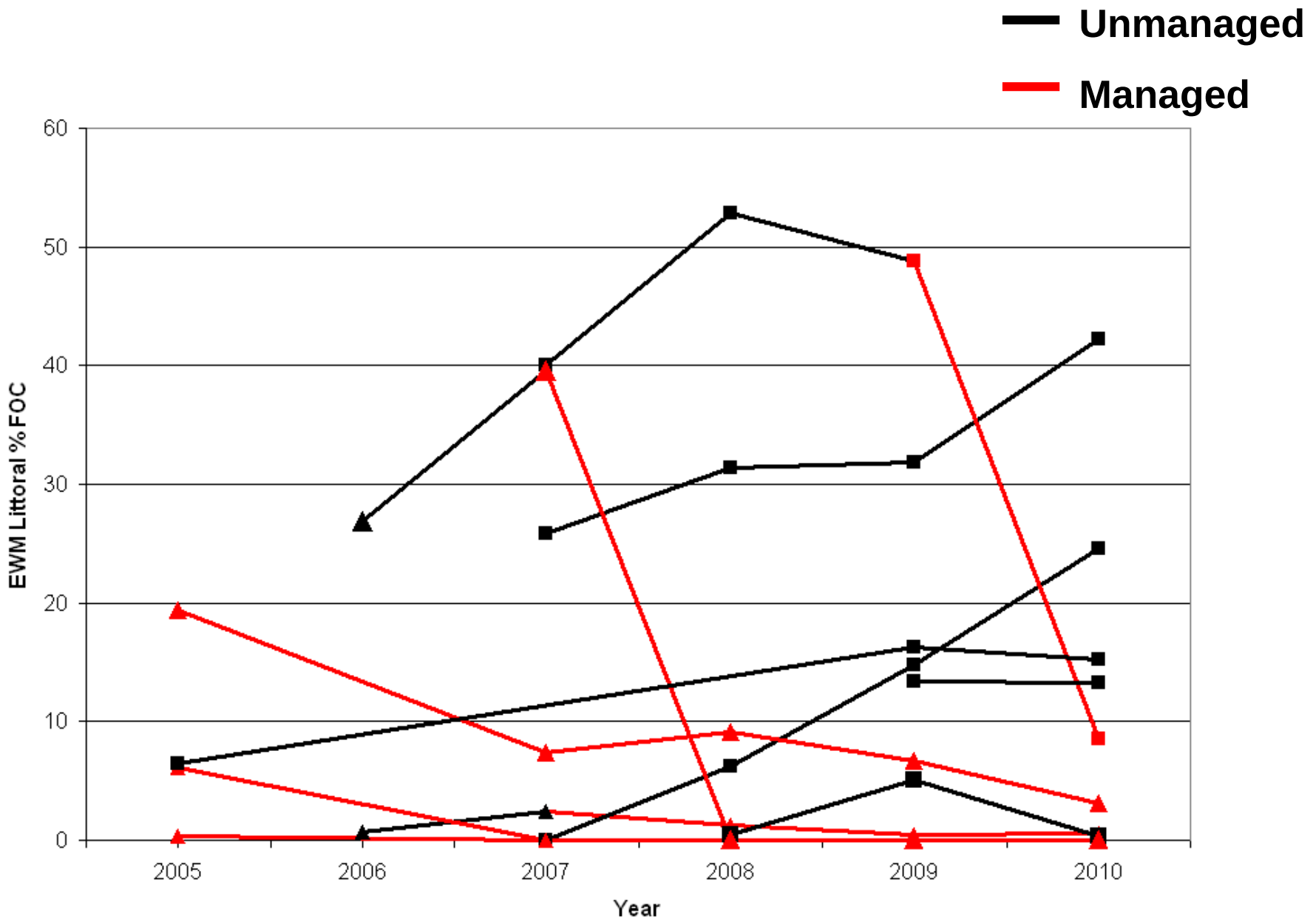
- Established EWM - Early season herbicide approach
  - Maximize control of milfoil, minimize effects on natives?
  - Targeted treatment areas based on monitoring data
- New EWM - Rapid response
  - Hand-pulling, targeted herbicides
- Adaptive management based on good monitoring

-How does *strategic* management affect long-term EWM population levels?

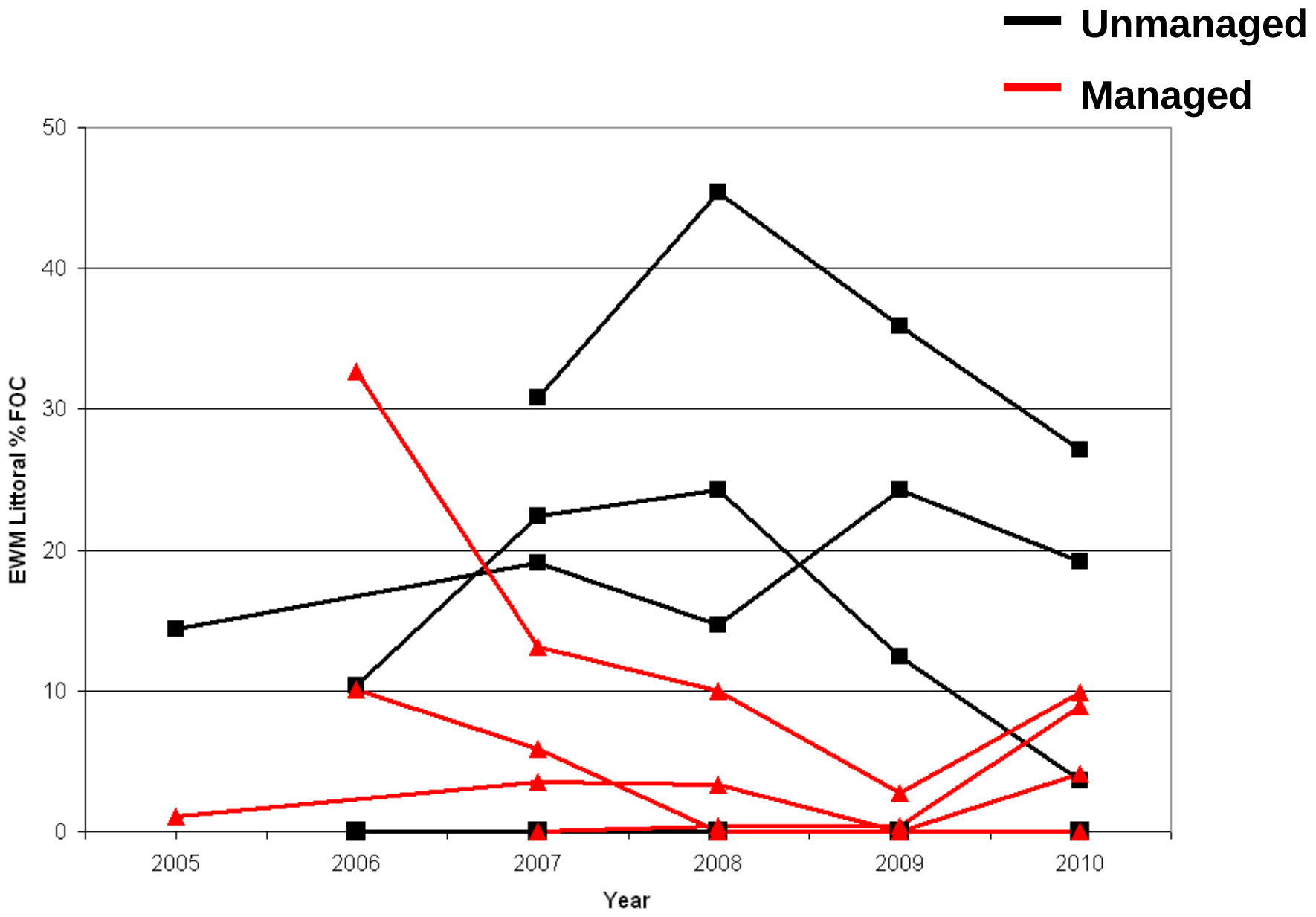
Tracking 24 lakes over time, 2007 – ongoing
3 regions, established and new, managed and unmanaged
Strategic management supported by monitoring



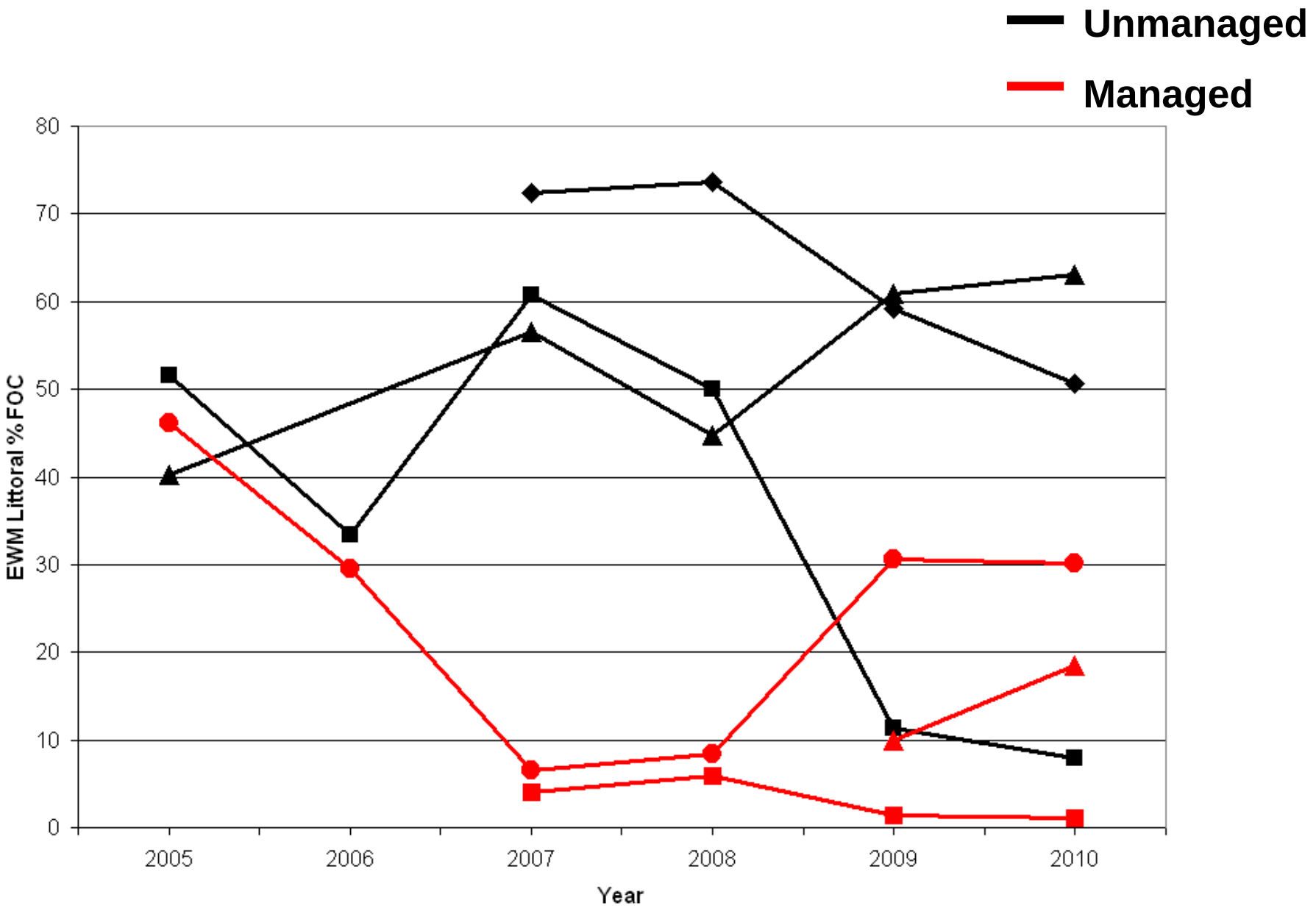
Northern Lakes & Forests



North Central Hardwood Forests



Southeastern Till Plains



Short-term Results for EWM ☑

Long-term Results for EWM?

Short- and Long-term for Natives?

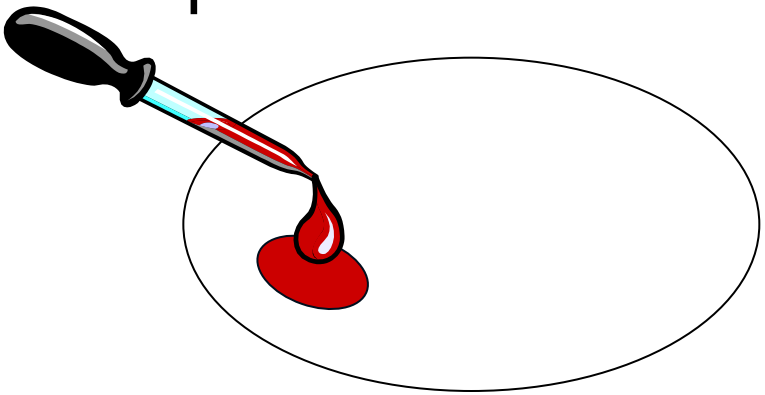
Short- and Long-term Economic Costs?

-How are aquatic plant communities affected by new management tools?

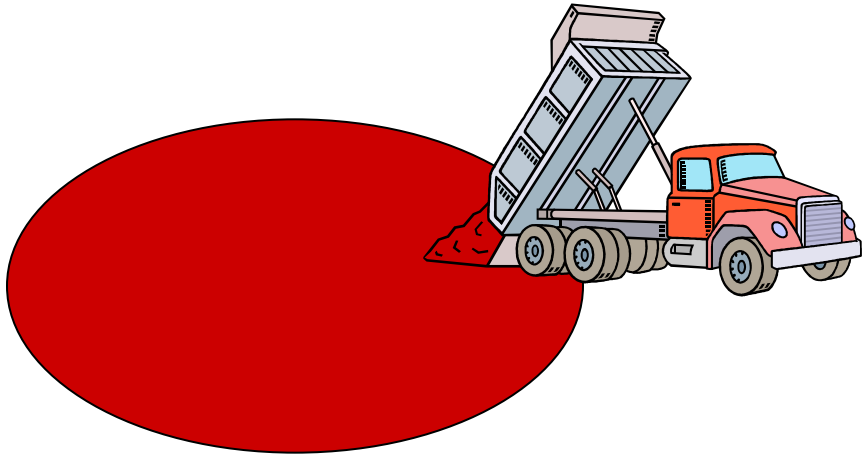
Whole-lake herbicide treatments for Eurasian watermilfoil – established populations

Q: So what's the big deal with whole-lake treatments?

A: Spatial scale!



vs



Whole lake treatment = Whole ecosystem manipulation

Specific Questions for Whole Lake Treatments

1) What are the primary and secondary ecological effects (both intended and unintended)?

-Vegetation (exotic and native)

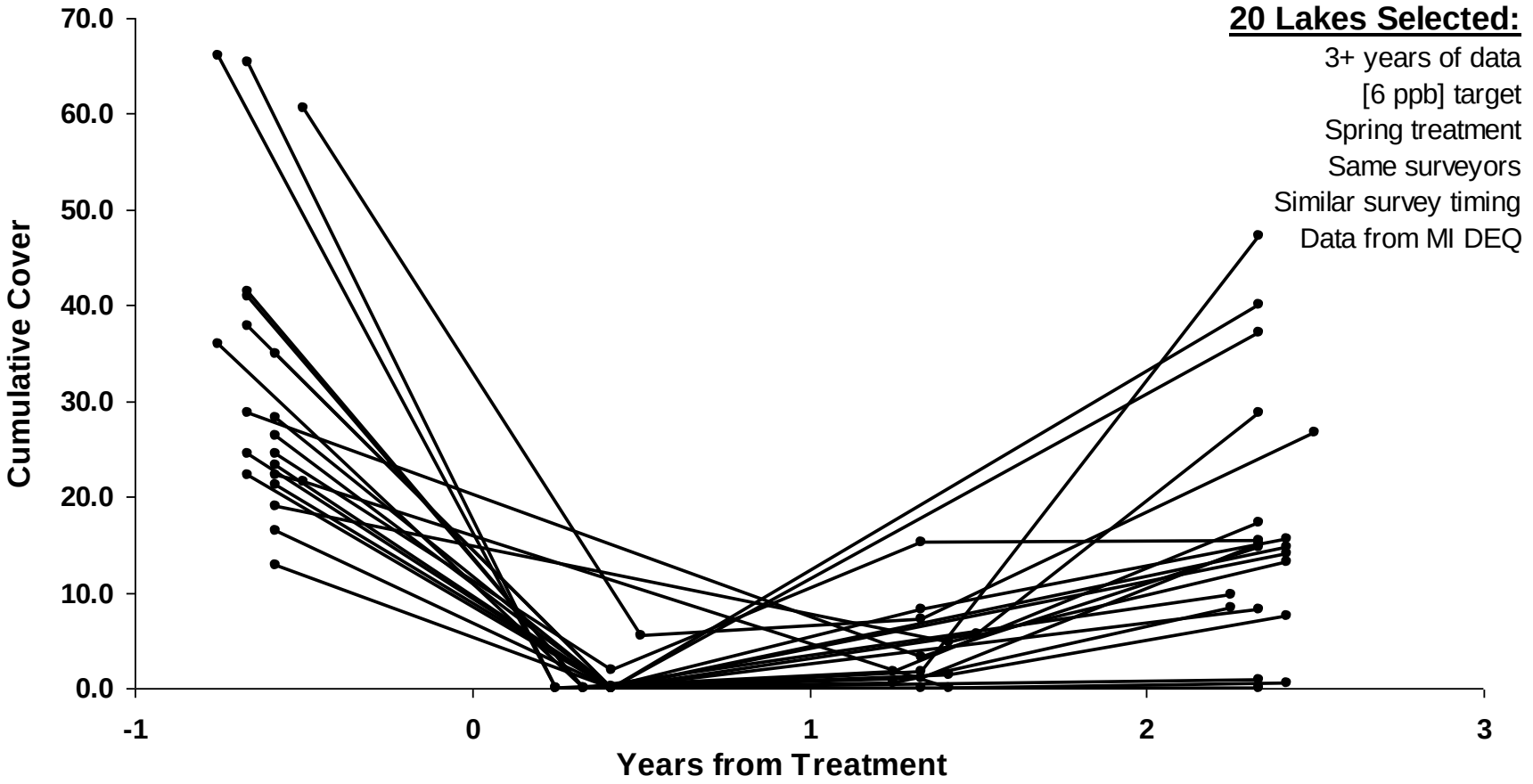
-Water quality (algae)

-Fisheries

2) What has been done already to address those questions?

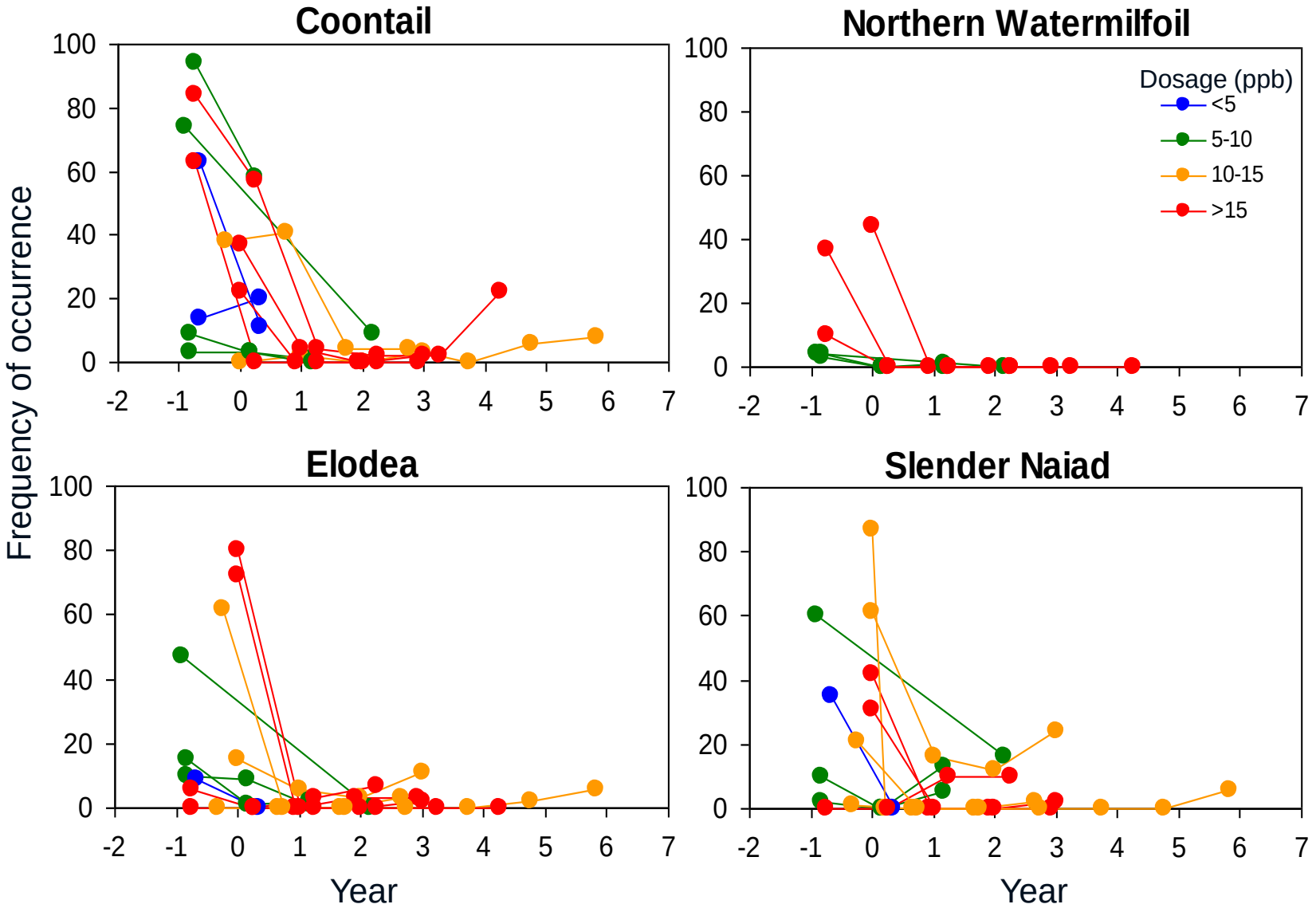
Technical review of DATA
Generalize effects

Long-term effects on EWM (3+ year data sets):



*Cumulative cover – indicates coverage and density of plants in lake

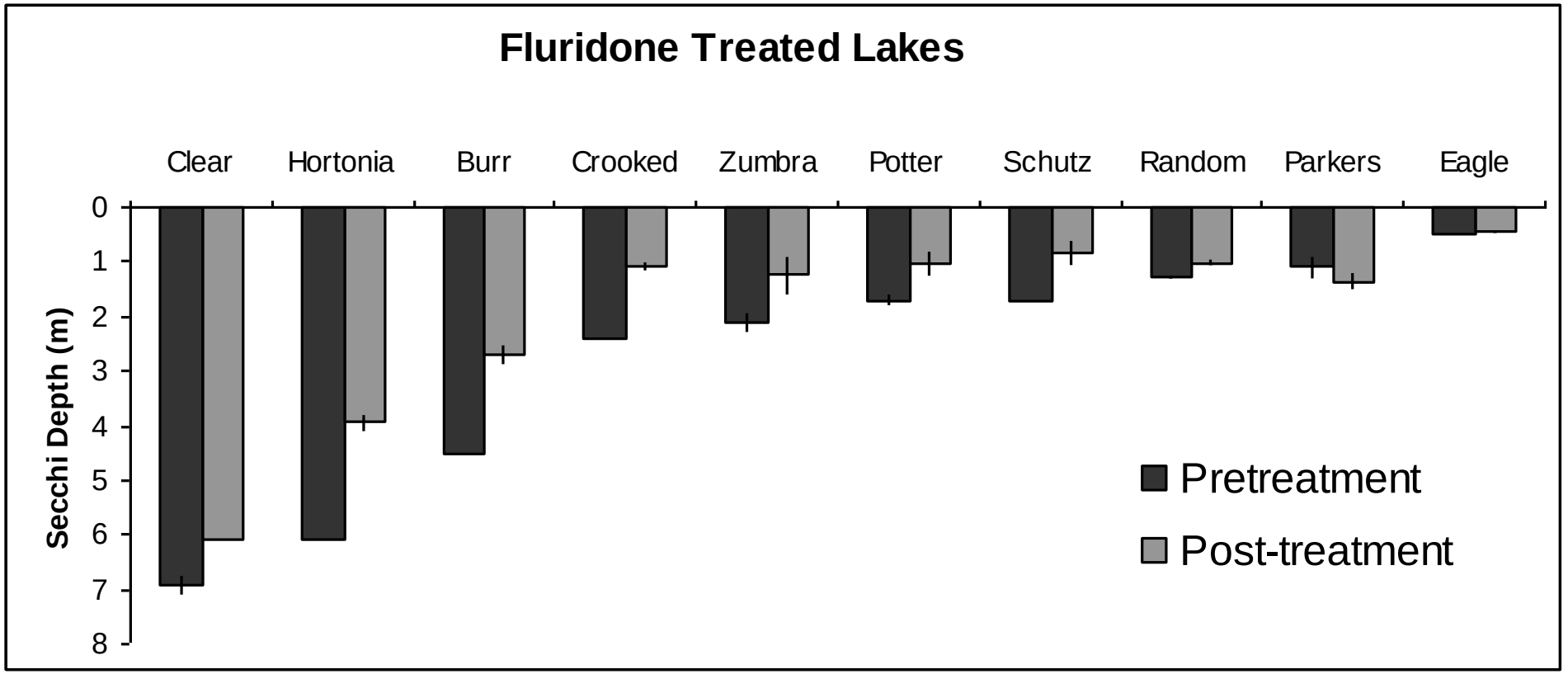
Long-term effects on susceptible native plants:



-Potential large decreases, regardless of dosage

Effects on algae / water clarity

-Since they compete for nutrients, trade-off between plants and algae
-Plant decay also provides nutrients for algal growth



Statistically significant reductions in secchi depth in 80% of treated lakes

Potter Lake 9/30/05

Weighing the costs and benefits:

Depends on the lake:

- Amount of susceptible vegetation
- Amount of phosphorus
- Shape and depth of lake (% of lake area that is vegetated)

Shallow, eutrophic lake with high biomass of EWM, coontail, and elodea throughout

vs

Deep, oligotrophic lake with some EWM, and high biomass of tolerant natives

Deciding on the best management approach:

1) Quantify the perceived problem! Data, data, data…

-Established vs new populations, locations in lake

2) Set reasonable expectations (ecological and economical)

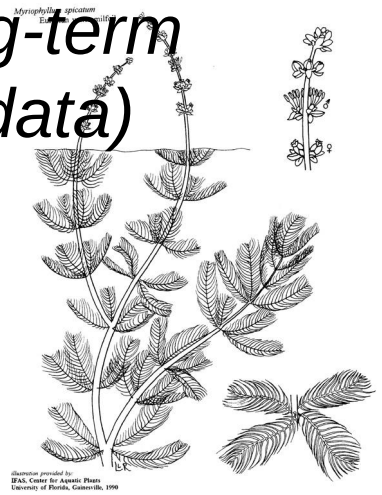
-Eradication(?) vs long-term management

-Can incur unintended ecological effects – need to evaluate data **lake by lake** (physical features, plants, algae/water clarity, fisheries)

3) Weigh the benefits with the risks

4) Recognize that managing invasives is a long-term commitment with any tool (action based on data)

5) Don't forget about the watershed



-How does watershed and lakeshore development affect lakes?

(DNR staff? UW Extension staff? Lake Leaders? Universities?)

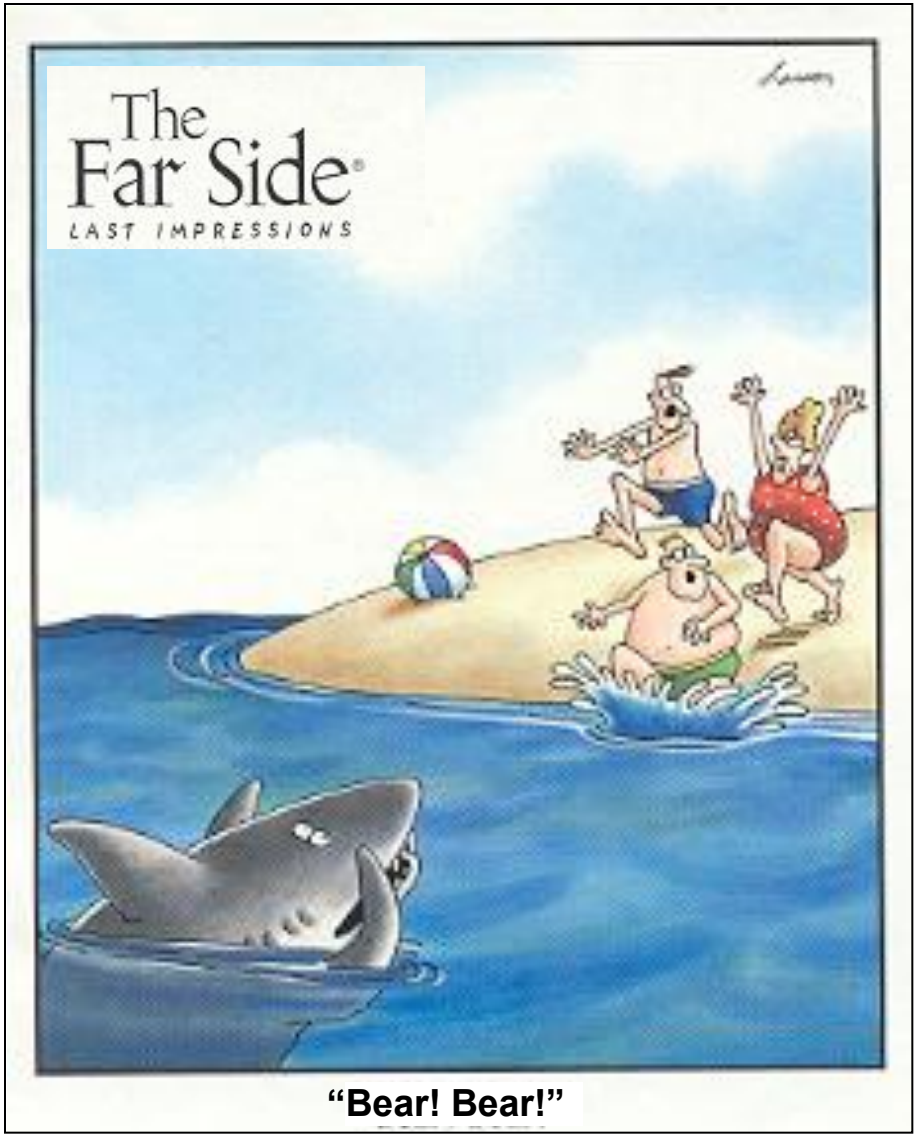
Water clarity?

Plants?

Fish?

Invasives?

Always look both ways…



“Bear! Bear!”

- “AIS! AIS!”
- Great energy and resources invested in our lakes surrounding our AIS challenges
- Don’t forget to look back to the land

Moving Forward

- Prevent spread of invasives through careless action (moving boats, equipment, sale of exotics for aquarium or water garden)
- Responsible control of existing invasives (use best available science)
- Reduce nutrient inputs to lakes – critical
- Steps toward understanding effects of climate change
- Foster partnerships

In conclusion, the importance of this partnership…

A Collaborative Partnership for Michigan's Lakes –

McNALMS sponsored two luncheon conferences to…

initiate discussion on the possibility of developing a collaborative partnership in Michigan to promote protection and management of the State's lakes, similar to the Wisconsin Lakes Partnership.

Given Michigan's abundant water resources, it is unrealistic to expect any one agency or single entity to strategically manage the thousands of lakes in the State. The most realistic solution to this "commons dilemma" is the development of collaborative management relationships. McNALMS is now working with the DNR, DEQ, MSUE and other NGOs to define how the partnership should work.