Eurasian watermilfoil research and management options

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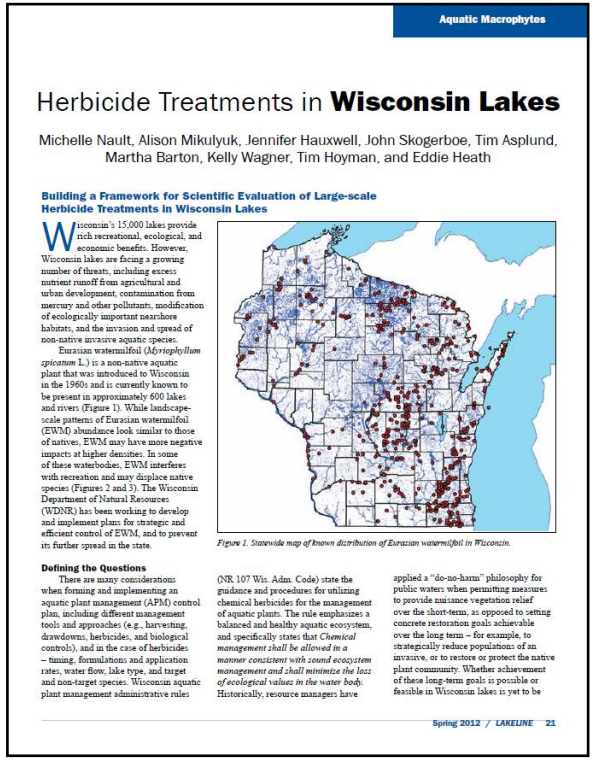
APM Research & Evaluation

- What is the statewide distribution, abundance, and genetics of non-native watermilfoil?
  - What are the long-term trends in unmanaged milfoil populations?
- What is the efficacy and selectivity of control under different management techniques?



Aquatic Macrophytes

Herbicide Treatments in **Wisconsin Lakes**

Michelle Nault, Alison Mikulyuk, Jennifer Hauxwell, John Skogerboe, Tim Asplund, Martha Barton, Kelly Wagner, Tim Hoyman, and Eddie Heath

Building a Framework for Scientific Evaluation of Large-scale Herbicide Treatments in Wisconsin Lakes

Wisconsin's 15,000 lakes provide rich recreational, ecological, and economic benefits. However, Wisconsin lakes are facing a growing number of threats, including excess nutrient runoff from agricultural and urban development, contamination from mercury and other pollutants, modification of ecologically important nearshore habitats, and the invasion and spread of non-native invasive aquatic species.

Eurasian watermilfoil (*Myriophyllum spicatum* L.) is a non-native aquatic plant that was introduced to Wisconsin in the 1960s and is currently known to be present in approximately 600 lakes and rivers (Figure 1). While landscape-scale patterns of Eurasian watermilfoil (EWM) abundance look similar to those of natives, EWM may have more negative impacts at higher densities. In some of these waterbodies, EWM interferes with recreation and may displace native species (Figures 2 and 3). The Wisconsin Department of Natural Resources (WDNR) has been working to develop and implement plans for strategic and efficient control of EWM, and to prevent its further spread in the state.

Figure 1. Statewide map of known distribution of Eurasian watermilfoil in Wisconsin.

Defining the Questions

There are many considerations when forming and implementing an aquatic plant management (APM) control plan, including different management tools and approaches (e.g., harvesting, drawdowns, herbicides, and biological controls), and in the case of herbicides – timing, formulations and application rates, water flow, lake type, and target and non-target species. Wisconsin aquatic plant management administrative rules (NR 107 Wis. Adm. Code) state the guidance and procedures for utilizing chemical herbicides for the management of aquatic plants. The rule emphasizes a balanced and healthy aquatic ecosystem, and specifically states that *Chemical management shall be allowed in a manner consistent with sound ecosystem management and shall minimize the loss of ecological values in the water body.* Historically, resource managers have applied a "do-no-harm" philosophy for public waters when permitting measures to provide nuisance vegetation relief over the short-term, as opposed to setting concrete restoration goals achievable over the long term – for example, to strategically reduce populations of an invasive, or to restore or protect the native plant community. Whether achievement of these long-term goals is possible or feasible in Wisconsin lakes is yet to be

Spring 2012 / LAKELINE 21

A bed of Eurasian watermilfoil found in Jeanis Lake.

The science behind the "so-called"

super weed

EWM found in Porters Lake.

RECENT STUDIES HELP TO UNDERSTAND THE EFFECTS OF EURASIAN WATERMILFOIL ON WISCONSIN LAKES.

Michelle Nault

In the early 1990s, Eurasian watermilfoil (EWM) was described in a report to the legislature: "A super weed capable of stopping a speeding boat [which] has a chokehold on Wisconsin lakes." In order to better understand the impacts of EWM in Wisconsin, DNR staff compiled a decade's worth of data collected on hundreds of waterbodies across the state. The results may surprise you, and challenge some commonly held beliefs about this invasive aquatic plant species.

Eurasian watermilfoil is still absent from many Wisconsin waterbodies

Eurasian watermilfoil is a submerged aquatic plant native to Europe, Asia and northern Africa. It was first reported in the United States in the 1940s and in Wisconsin in the 1960s. Like many other invasive species, the natural factors that keep EWM populations in balance in its native range are missing in Wisconsin. This means that EWM has the potential to cause changes to our native aquatic ecosystems, as well as cause navigational, recreational and aesthetic issues when occurring at high population densities.

Since its initial introduction, EWM has spread throughout the state primarily as an unintentional aquatic hitchhiker on recreational boats and trailers. It is now documented in approximately 650 Wisconsin inland lakes and flowages. Although this number of waterbodies with EWM may seem high, less than 5 percent of the nearly 15,000 lakes within the state have EWM. The majority of lakes with public access do not have EWM, especially in the northern portion of the state. From the perspective of how many lakes could be affected, versus how many currently have EWM, resource managers are optimistic that the low percentage of Wisconsin lakes with EWM speaks to the success of our aquatic invasive species prevention and control programs.

Preliminary results from a multi-year statewide study looking at the rate of spread of aquatic invasive species indicate that the number of newly discovered EWM populations has stabilized, further suggesting that prevention programs are successfully minimizing the spread of EWM into new lakes.

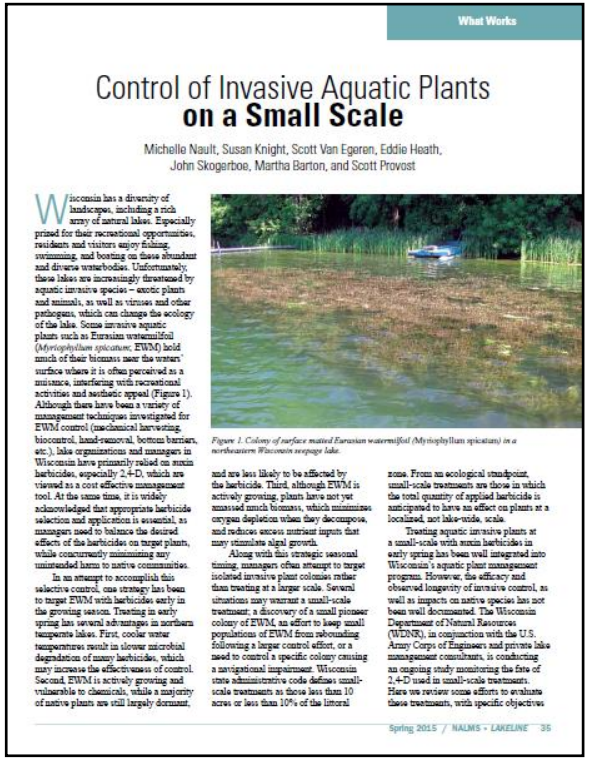
Genetics makes a difference

Eurasian watermilfoil in one lake can be quite genetically different than that found in another lake, challenging any notion of a simplified management strategy.

Eurasian watermilfoil is distinguished from other aquatic plants in having whorls of four, feather-like leaves along the stem, with each individual leaf having 12 or more pairs of hair-like leaflets. Native watermilfoil species usually have similar whorls of feather-like leaves, but have fewer than 12 pairs of leaflets on each leaf.

Several genetic DNA studies have recently been done on watermilfoil populations across the United States and within Wisconsin. Researchers have

10 Wisconsin Natural Resources



What Works

Control of Invasive Aquatic Plants **on a Small Scale**

Michelle Nault, Susan Knight, Scott Van Egeren, Eddie Heath, John Skogerboe, Martha Barton, and Scott Provost

Wisconsin has a diversity of landscapes, including a rich array of natural lakes. Especially prized for their recreational opportunities, residents and visitors enjoy fishing, swimming, and boating on these abundant and diverse waterbodies. Unfortunately, these lakes are increasingly threatened by aquatic invasive species – exotic plants and animals, as well as viruses and other pathogens, which can change the ecology of the lake. Some invasive aquatic plants such as Eurasian watermilfoil (*Myriophyllum spicatum*; EWM) hold much of their biomass near the waters' surface where it is often perceived as a nuisance, interfering with recreational activities and aesthetic appeal (Figure 1). Although there have been a variety of management techniques investigated for EWM control (mechanical harvesting, biocontrol, hand-removal, bottom barriers, etc.), lake organizations and managers in Wisconsin have primarily relied on auxin herbicides, especially 2,4-D, which are viewed as a cost effective management tool. At the same time, it is widely acknowledged that appropriate herbicide selection and application is essential, as managers need to balance the desired effects of the herbicides on target plants, while concurrently minimizing any unintended harm to native communities.

In an attempt to accomplish this selective control, one strategy has been to target EWM with herbicides early in the growing season. Treating in early spring has several advantages in northern temperate lakes. First, cooler water temperatures result in slower microbial degradation of many herbicides, which may increase the effectiveness of control. Second, EWM is actively growing and vulnerable to chemicals, while a majority of native plants are still largely dormant, and are less likely to be affected by the herbicide. Third, although EWM is actively growing, plants have not yet amassed much biomass, which minimizes oxygen depletion when they decompose, and reduces excess nutrient inputs that may stimulate algal growth.

Along with this strategic seasonal timing, managers often attempt to target isolated invasive plant colonies rather than treating at a larger scale. Several situations may warrant a small-scale treatment: a discovery of a small pioneer colony of EWM, an effort to keep small populations of EWM from rebounding following a larger control effort, or a need to control a specific colony causing a navigational impairment. Wisconsin state administrative code defines small-scale treatments as those less than 10 acres or less than 10% of the littoral zone. From an ecological standpoint, small-scale treatments are those in which the total quantity of applied herbicide is anticipated to have an effect on plants at a localized, not lake-wide, scale.

Treating aquatic invasive plants at a small-scale with auxin herbicides in early spring has been well integrated into Wisconsin's aquatic plant management program. However, the efficacy and observed longevity of invasive control, as well as impacts on native species has not been well documented. The Wisconsin Department of Natural Resources (WDNR), in conjunction with the U.S. Army Corps of Engineers and private lake management consultants, is conducting an ongoing study monitoring the fate of 2,4-D used in small-scale treatments. Here we review some efforts to evaluate these treatments, with specific objectives

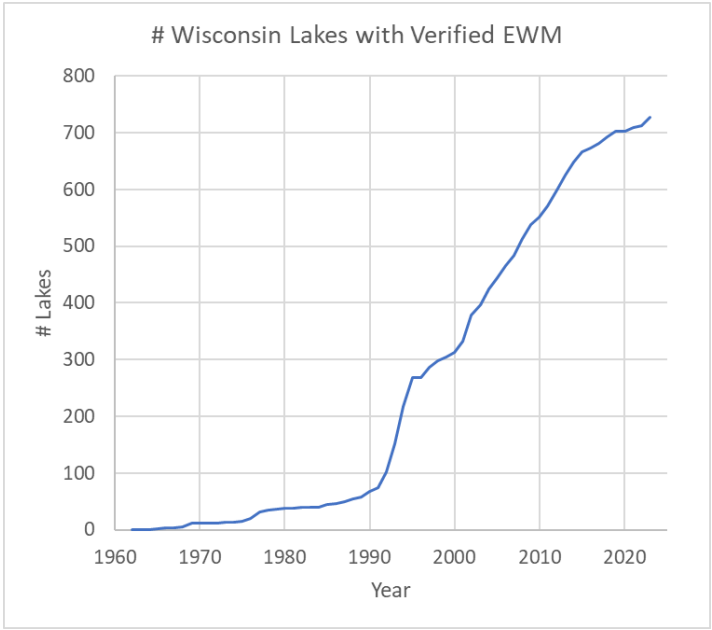
Figure 1. Colony of surface matted Eurasian watermilfoil (Myriophyllum spicatum) in a northeastern Wisconsin seepage lake.

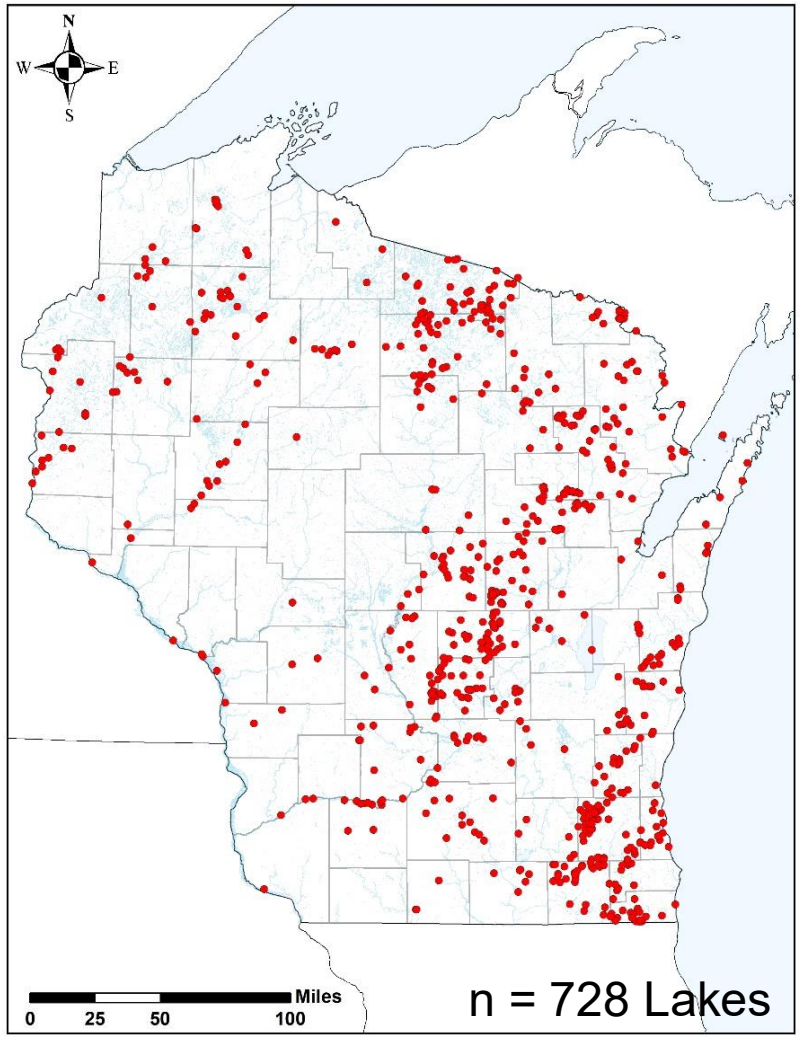
Spring 2015 / NALMS - LAKELINE 35

https://dnr.wi.gov/lakes/plants/research/

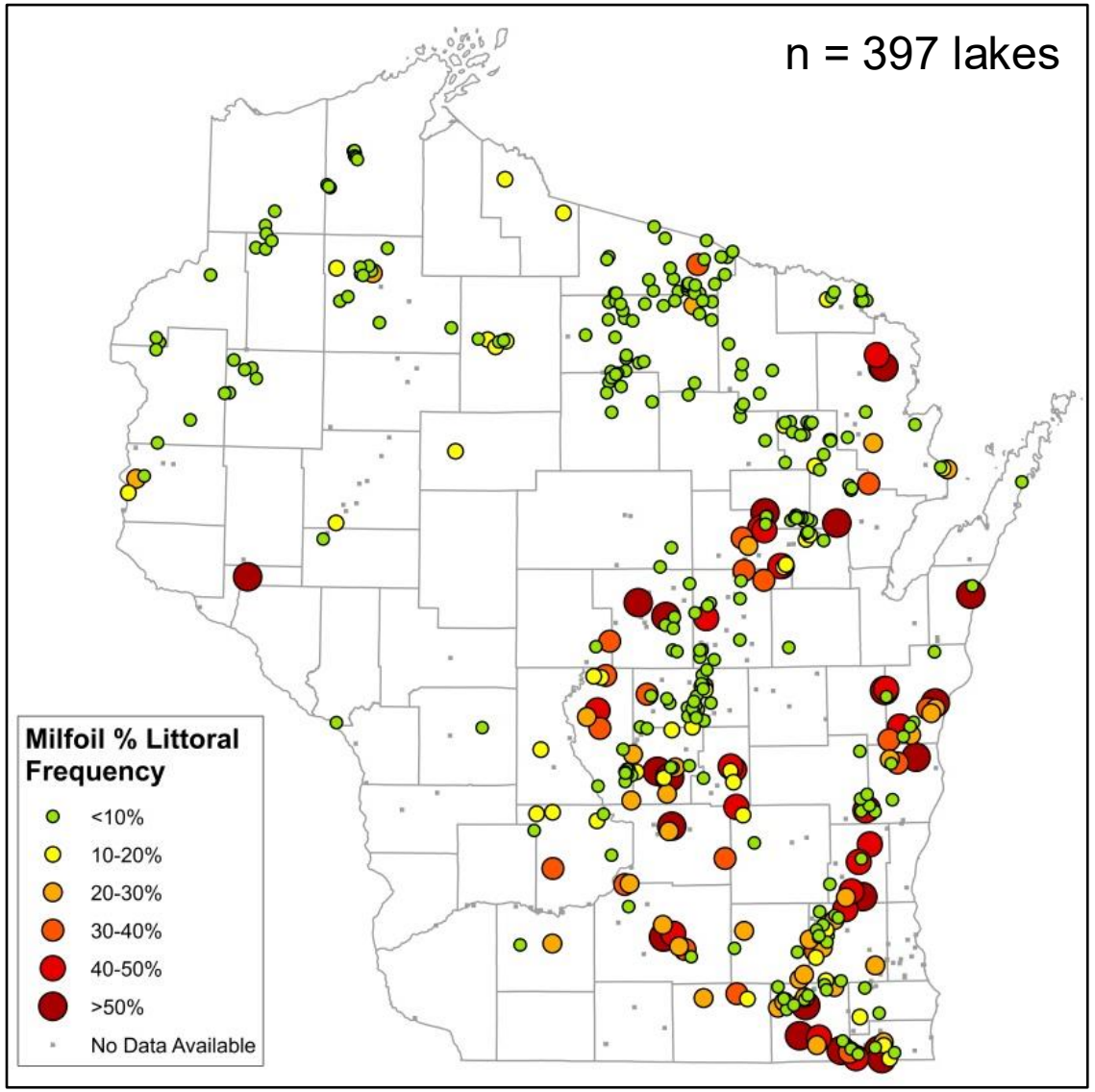
Eurasian Watermilfoil

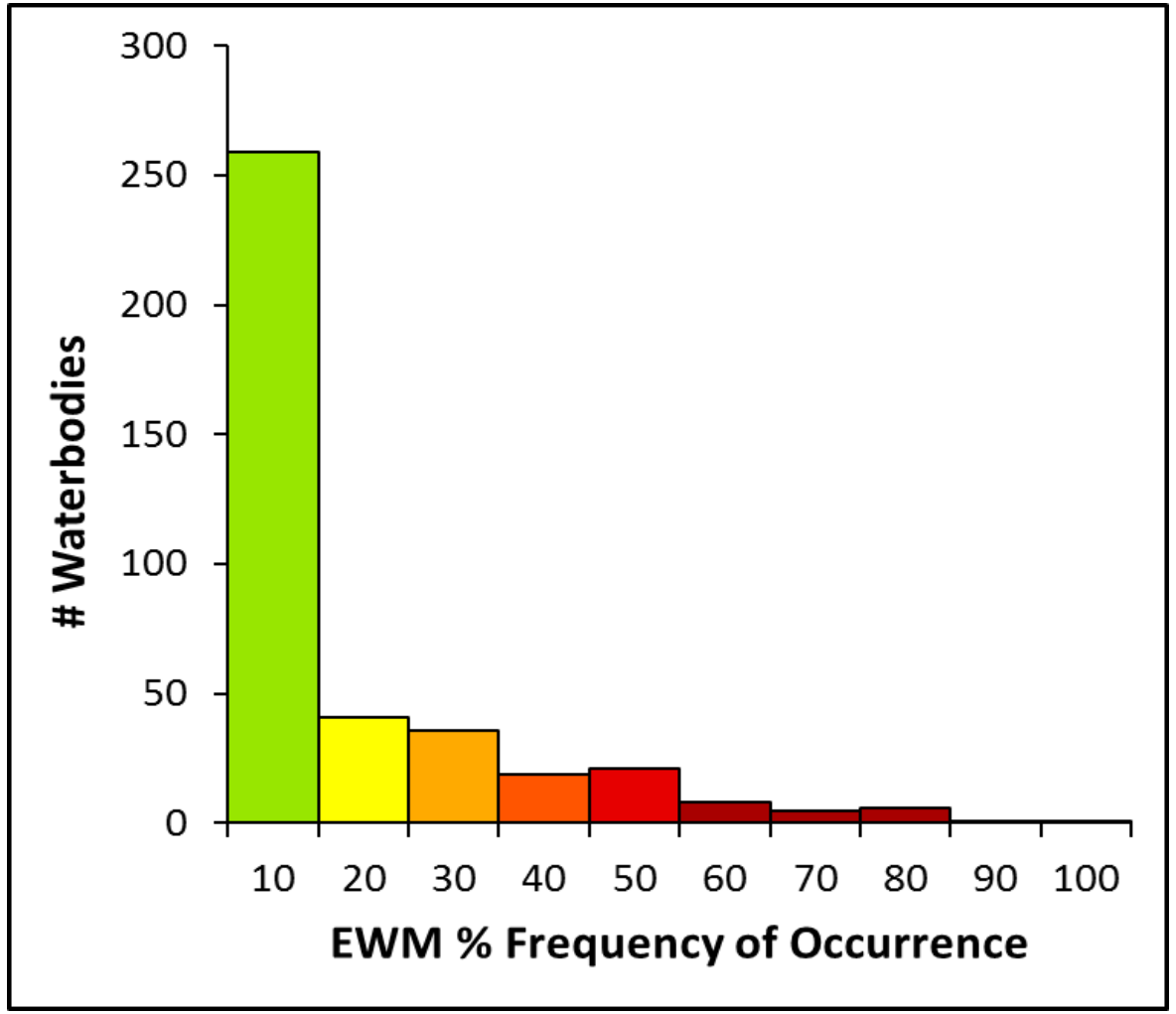
- Non-native submersed aquatic plant with feather-like leaves.
- First reported in U.S. in 1900s; Wisconsin in 1960s.
- Currently verified in ~700 inland lakes and flowages in Wisconsin.



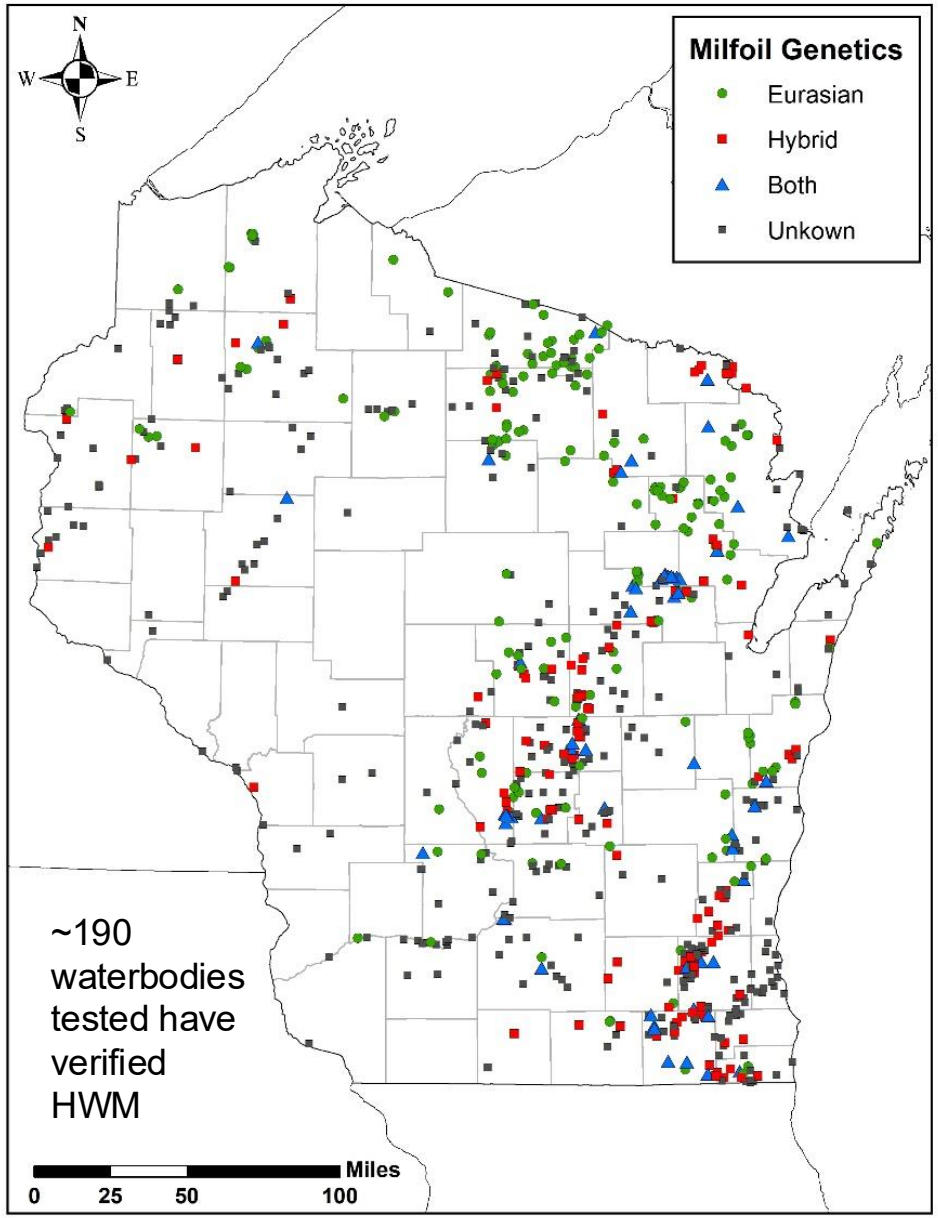


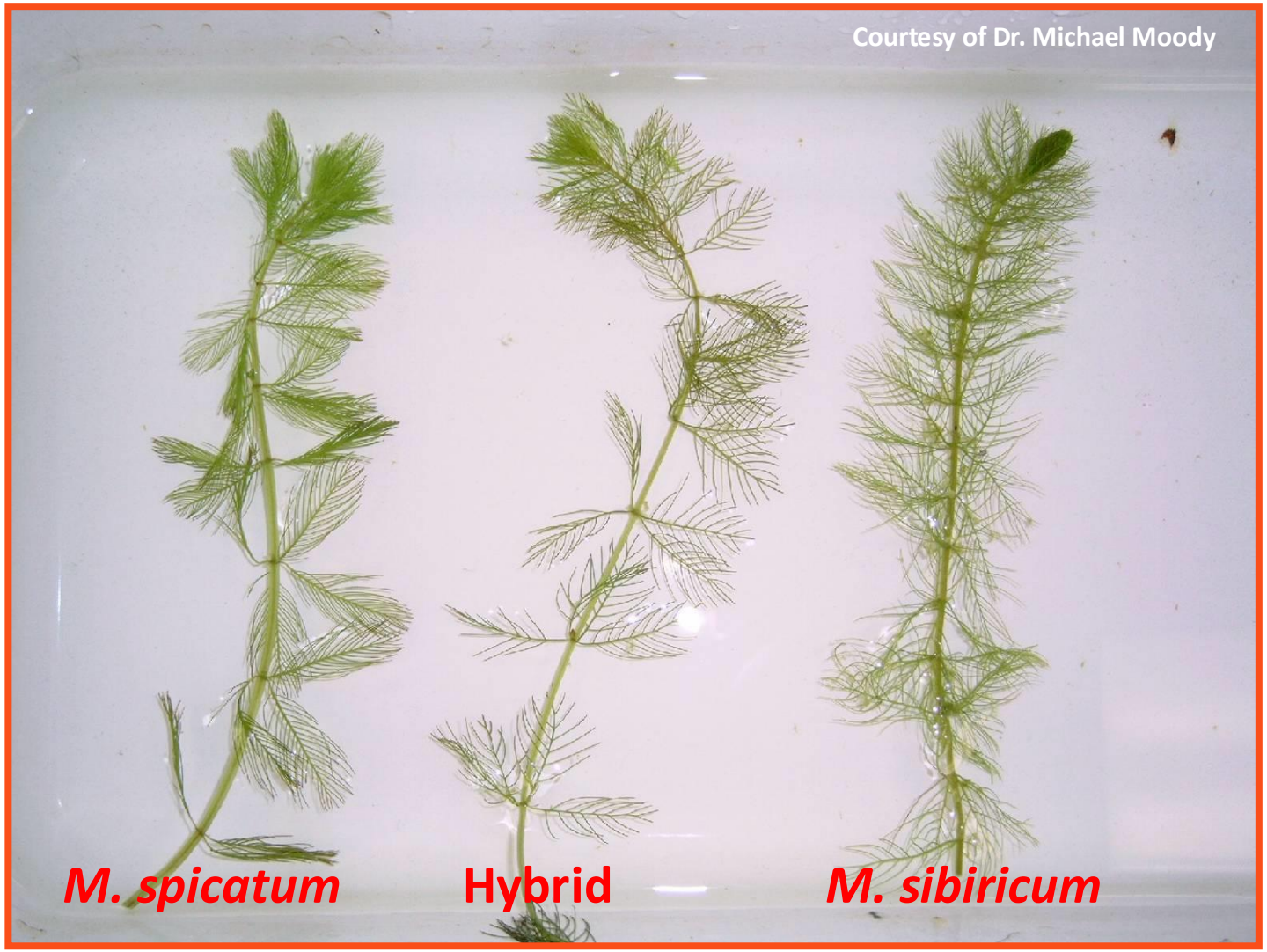
Statewide Watermilfoil Study



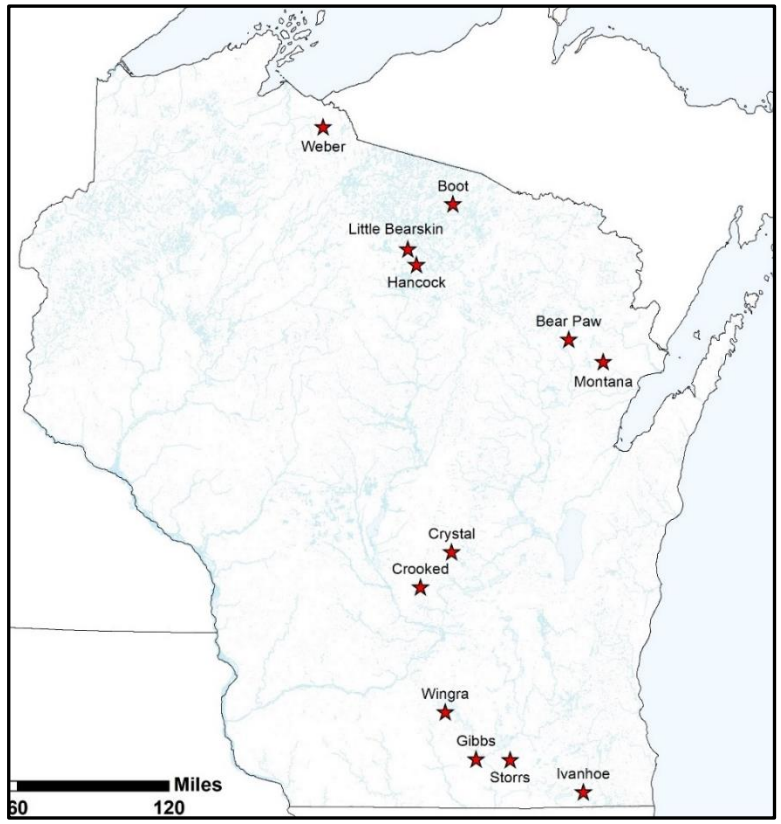


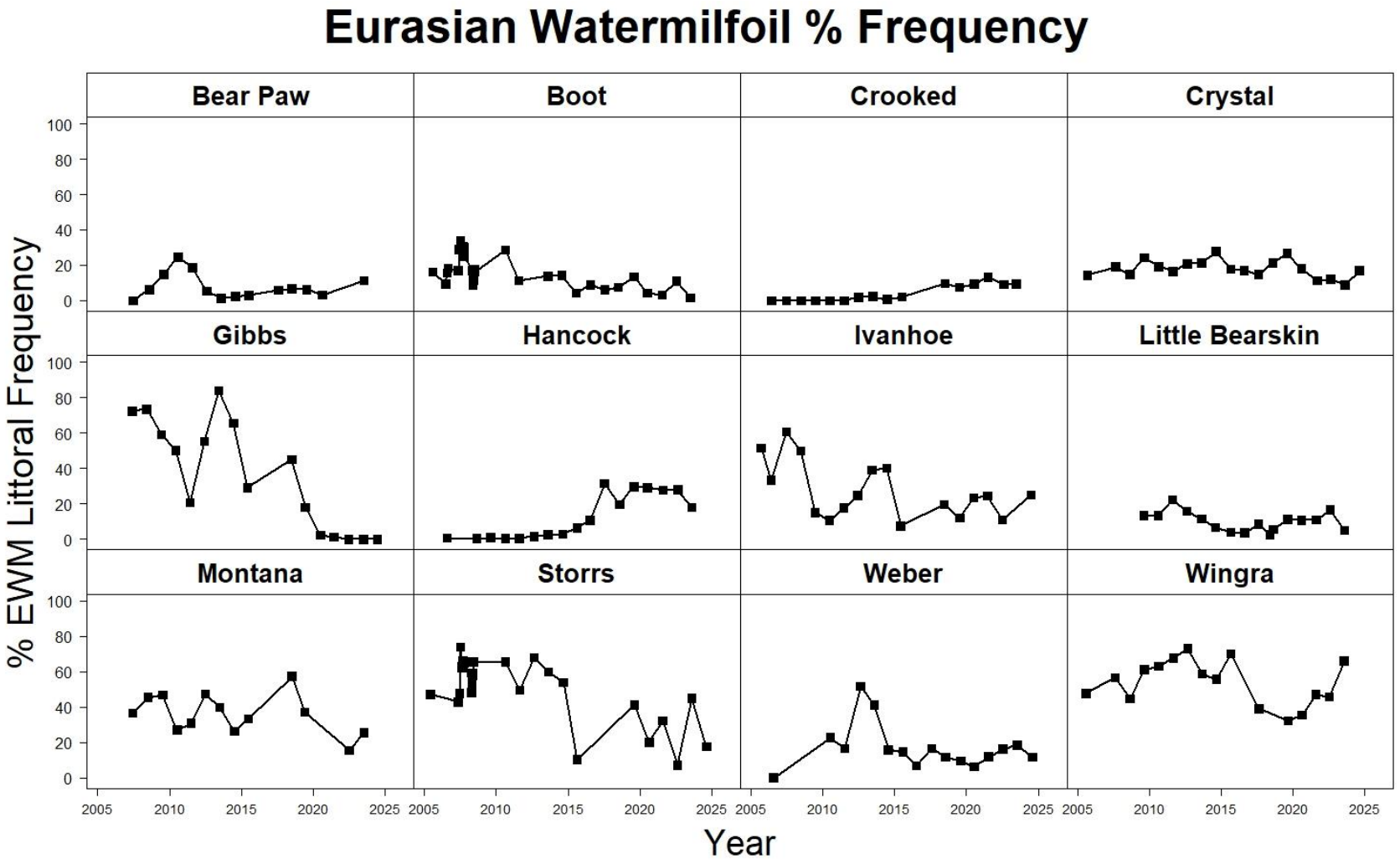
Statewide Watermilfoil Study



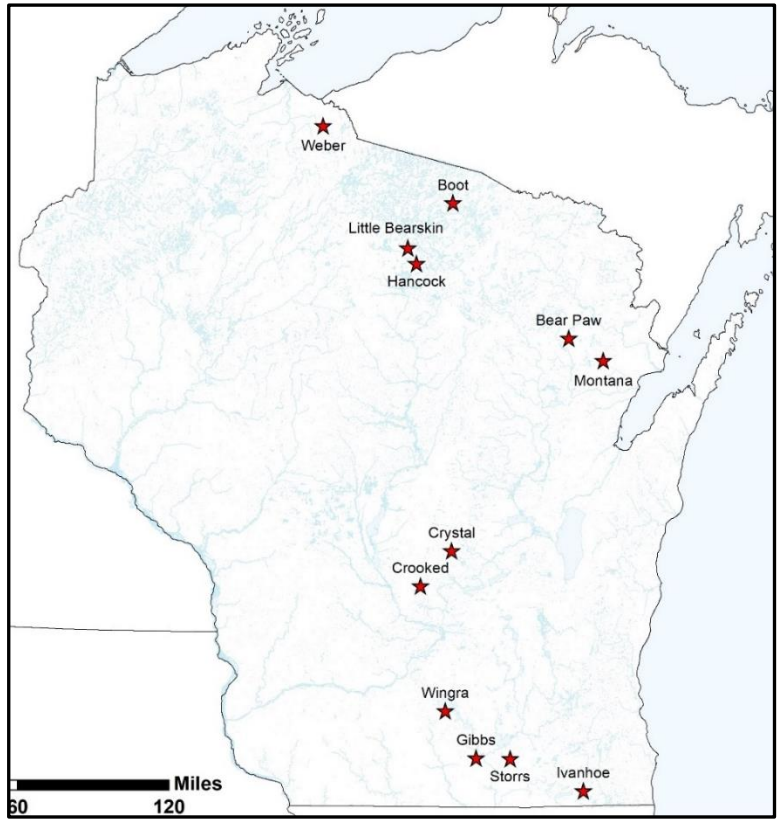


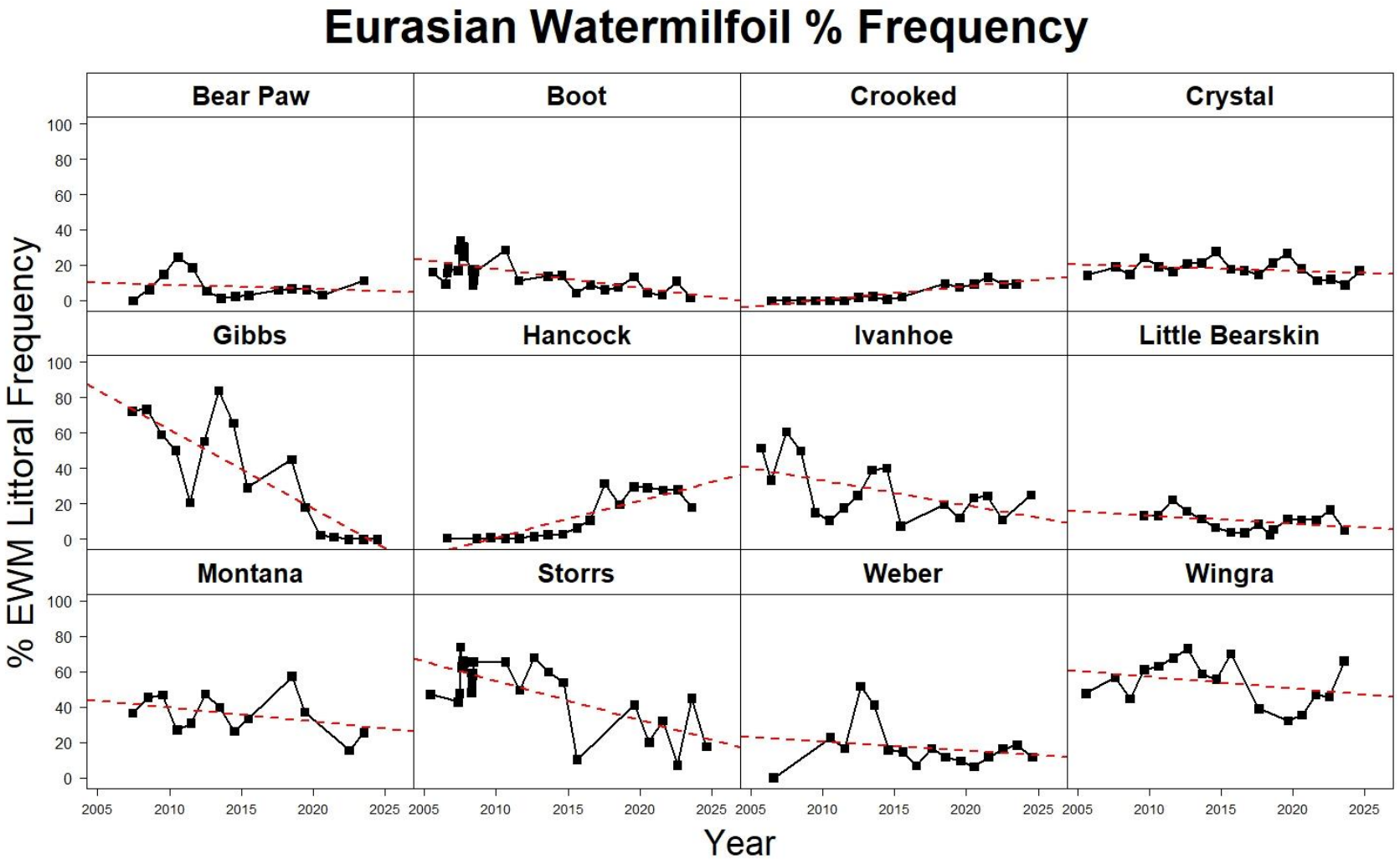
Long-Term Watermilfoil Study





Long-Term Watermilfoil Study





Aquatic Plant Management

- Manual
- Mechanical harvesting
- Diver assisted suction harvesting (DASH)
- Physical
- Biocontrol
- Chemical

Manual Removal

Manual Removal Around a Dock - A Permit May Not Be Needed If:

Manual Removal of Plants Around Your Dock

Less is More

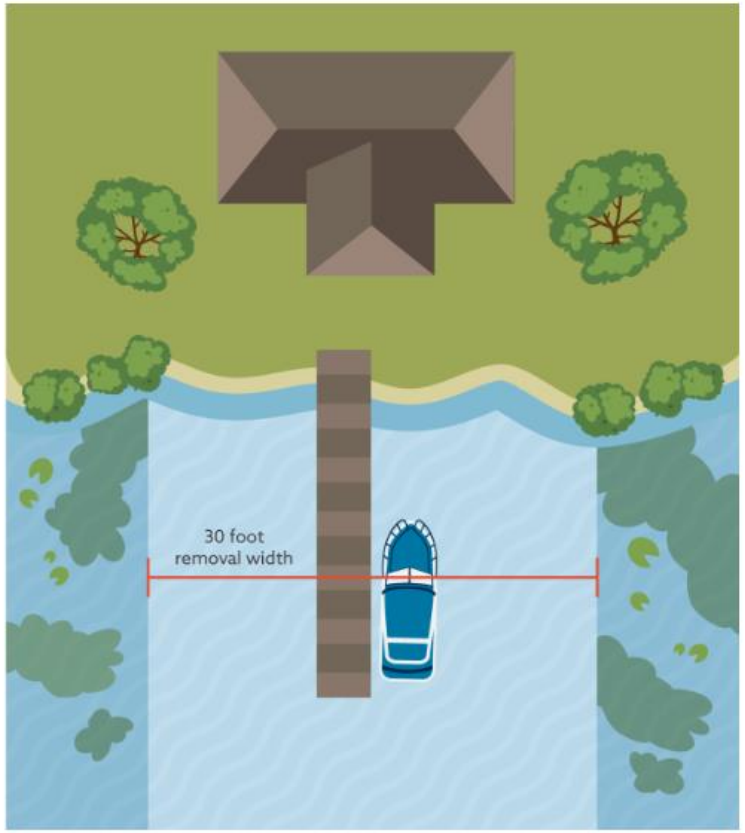
Aquatic plants provide significant benefit to our shorelines. Only remove plants to get your boat to open water and recreate.

This homeowner manually removed one 30-foot swath of aquatic plants around their pier for their boat and swimming. No permit was needed. There was no wild rice in the area.

It's up to all of us to protect the nearshore from erosion, water quality impacts and habitat destruction.

Discover More:
Wisconsin's Healthy Lakes Program - Best Practices

dnr.wi.gov/tiny/3446

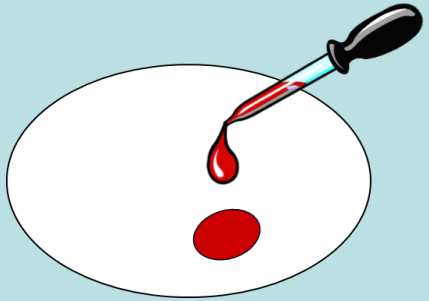


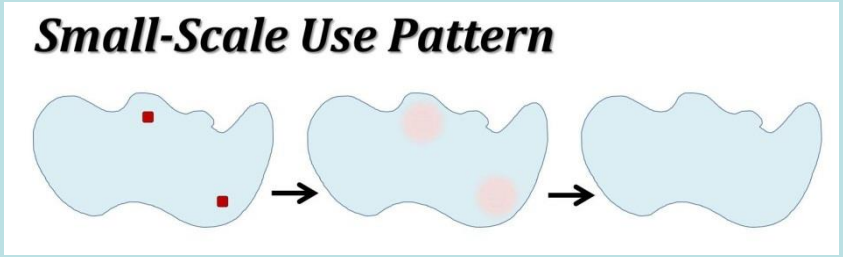
Riparian Owners Exemption: No Permit Needed [PDF]

Scale of Management

Small

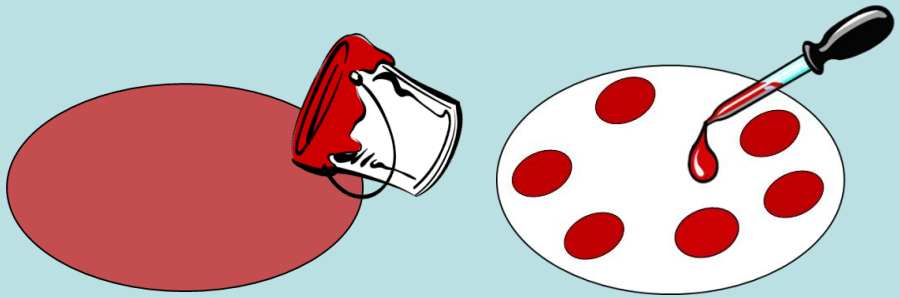
- Herbicide will be applied at a scale where dissipation will not result in significant lakewide concentrations and effects are anticipated on a localized scale

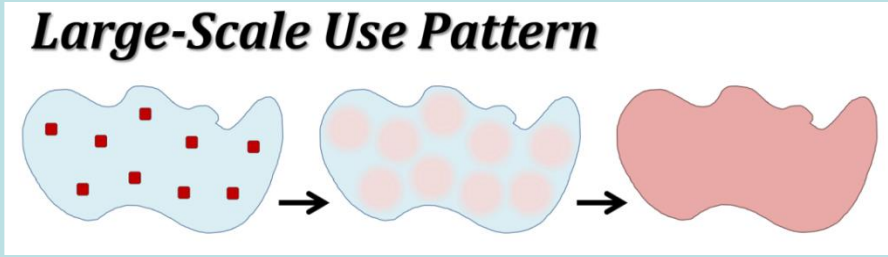




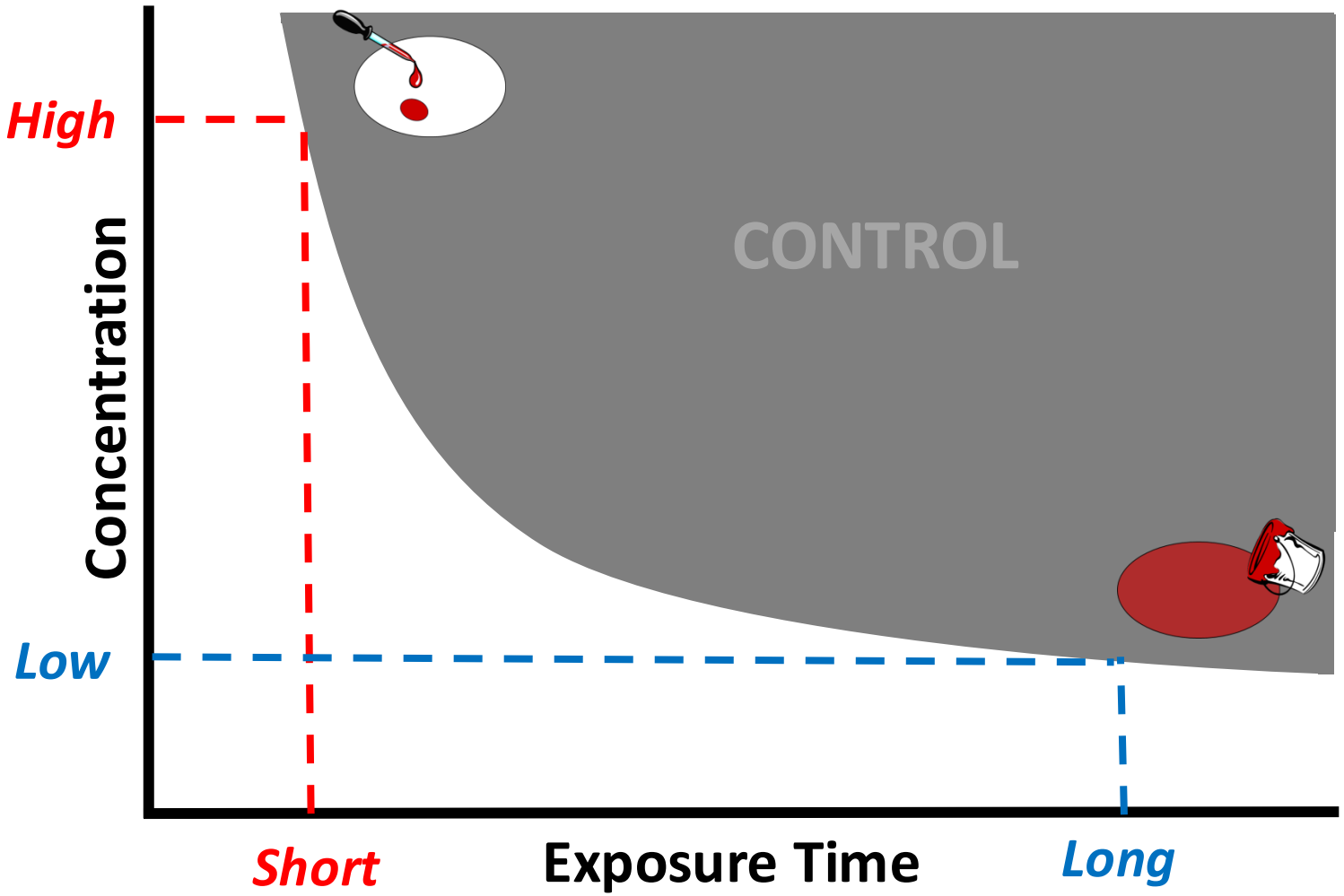
Large

- Herbicide will be applied at a scale where dissipation will result in significant lakewide concentrations and effects are anticipated on a lakewide scale





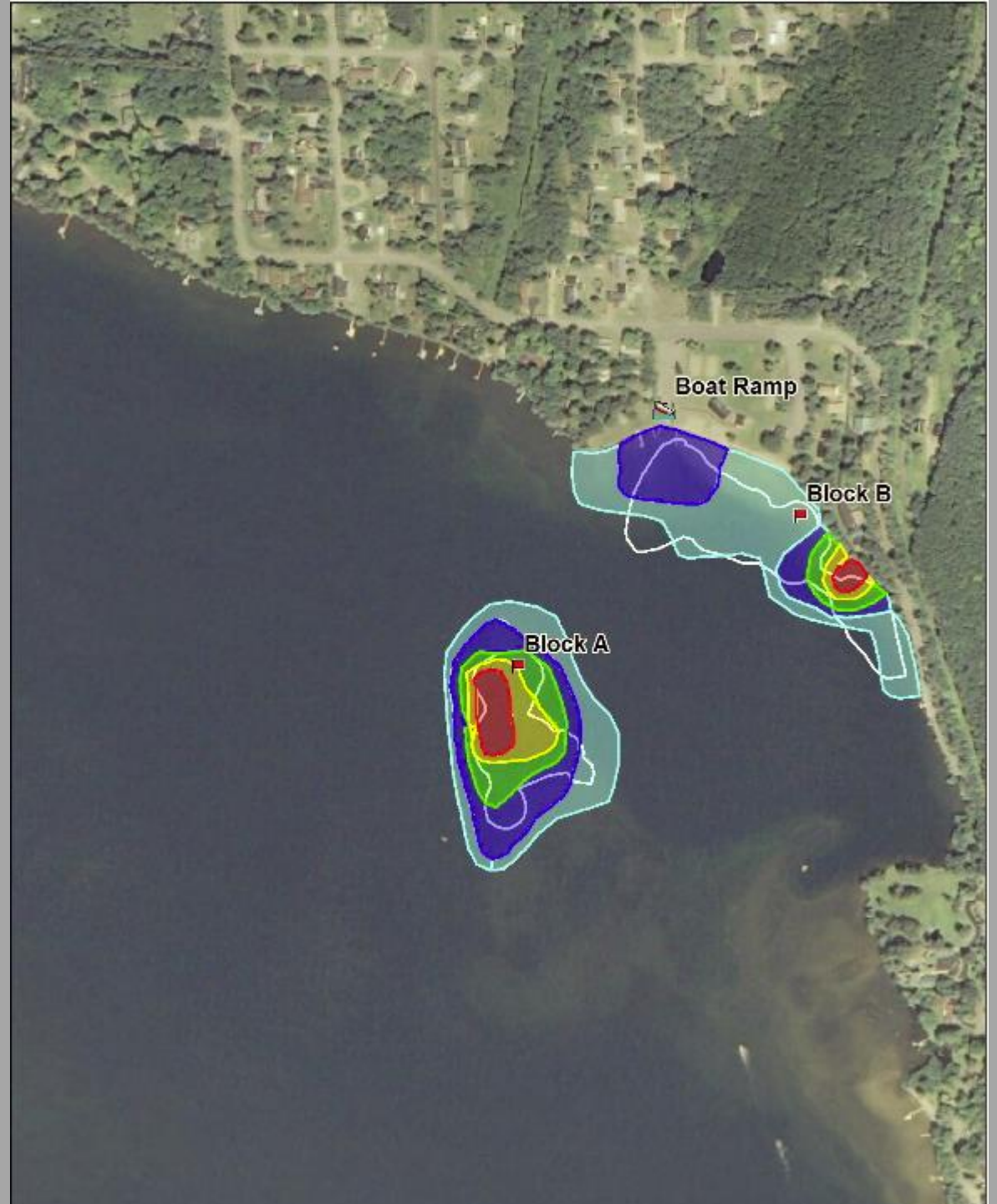
Concentration Exposure Time



Small-Scale

1 HAT

75-100%
50-75%
25-50%
10-25%
5-10%



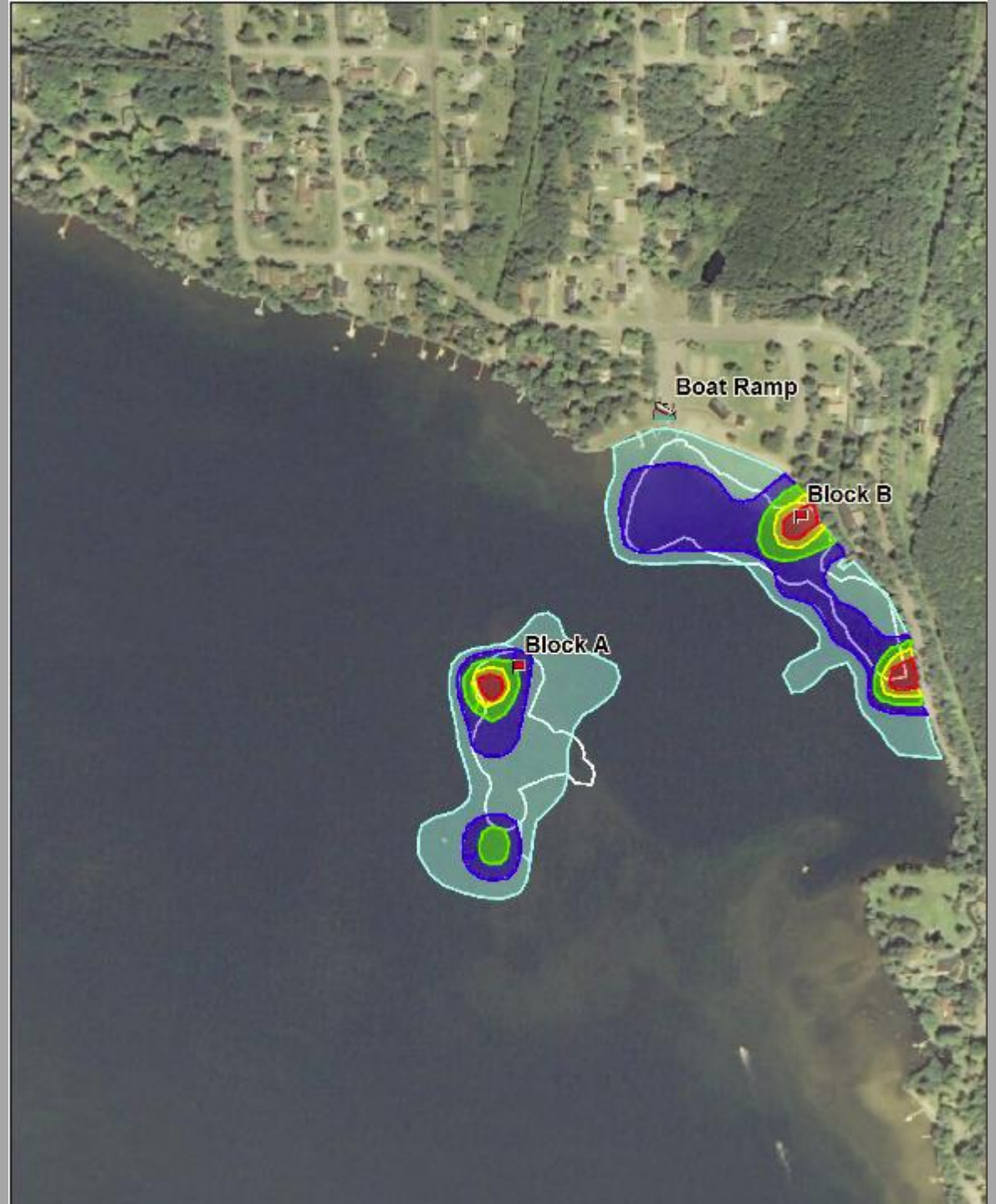
Lake Metonga, Forest Co.

Site A: 2.8 acres
Site B: 4.2 acres

Small-Scale

2 HAT

75-100%
50-75%
25-50%
10-25%
5-10%



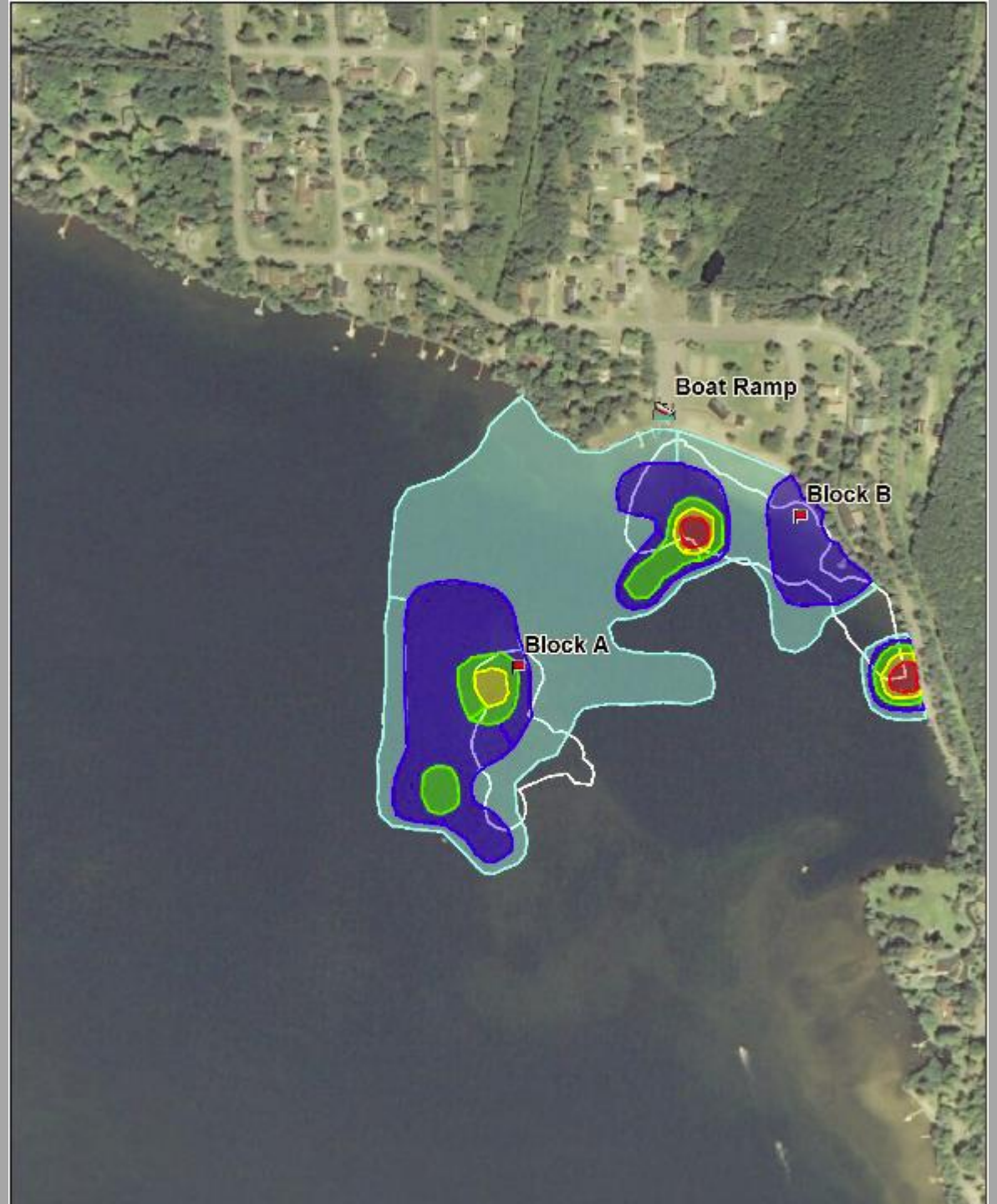
Lake Metonga, Forest Co.

Site A: 2.8 acres
Site B: 4.2 acres

Small-Scale

3 HAT

75-100%
50-75%
25-50%
10-25%
5-10%



Lake Metonga, Forest Co.

Site A: 2.8 acres
Site B: 4.2 acres

Small-Scale

5 HAT

75-100%
50-75%
25-50%
10-25%
5-10%

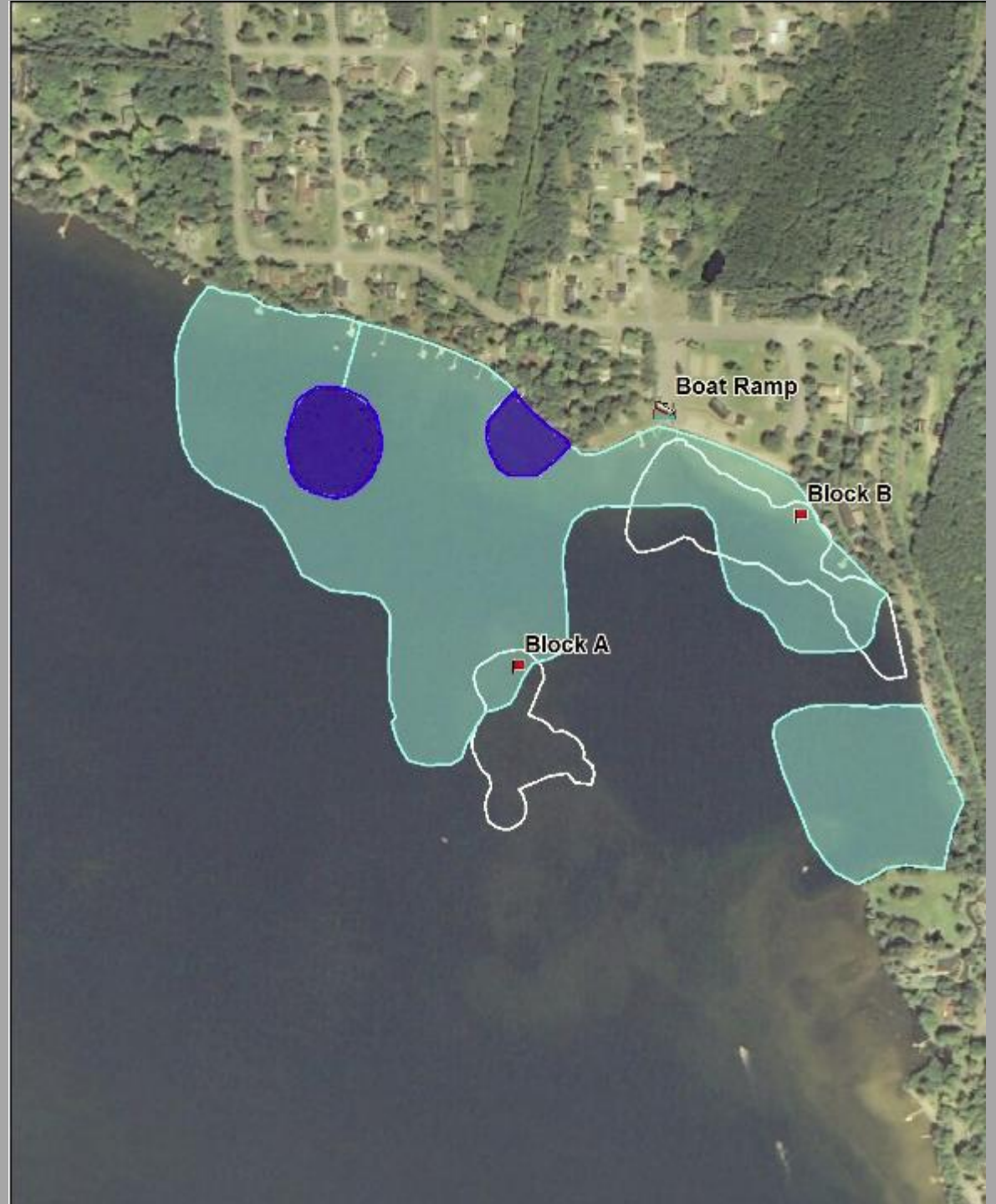
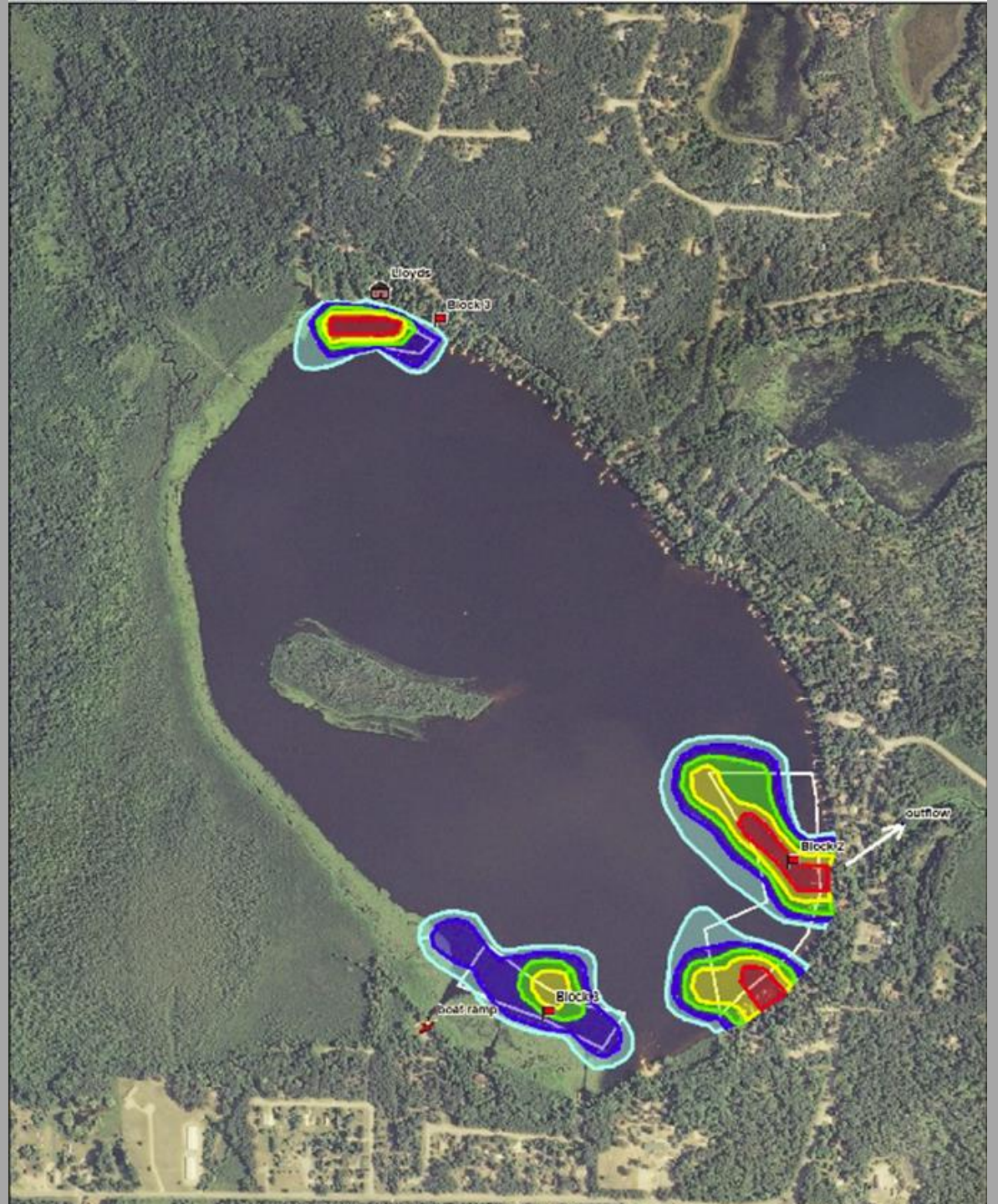


Table 3. Estimated Dye Exposure Times	
Application Block	Exposure Time (HAT)
A	1 TO 2
B	<1 TO 2

Large-Scale

1 HAT

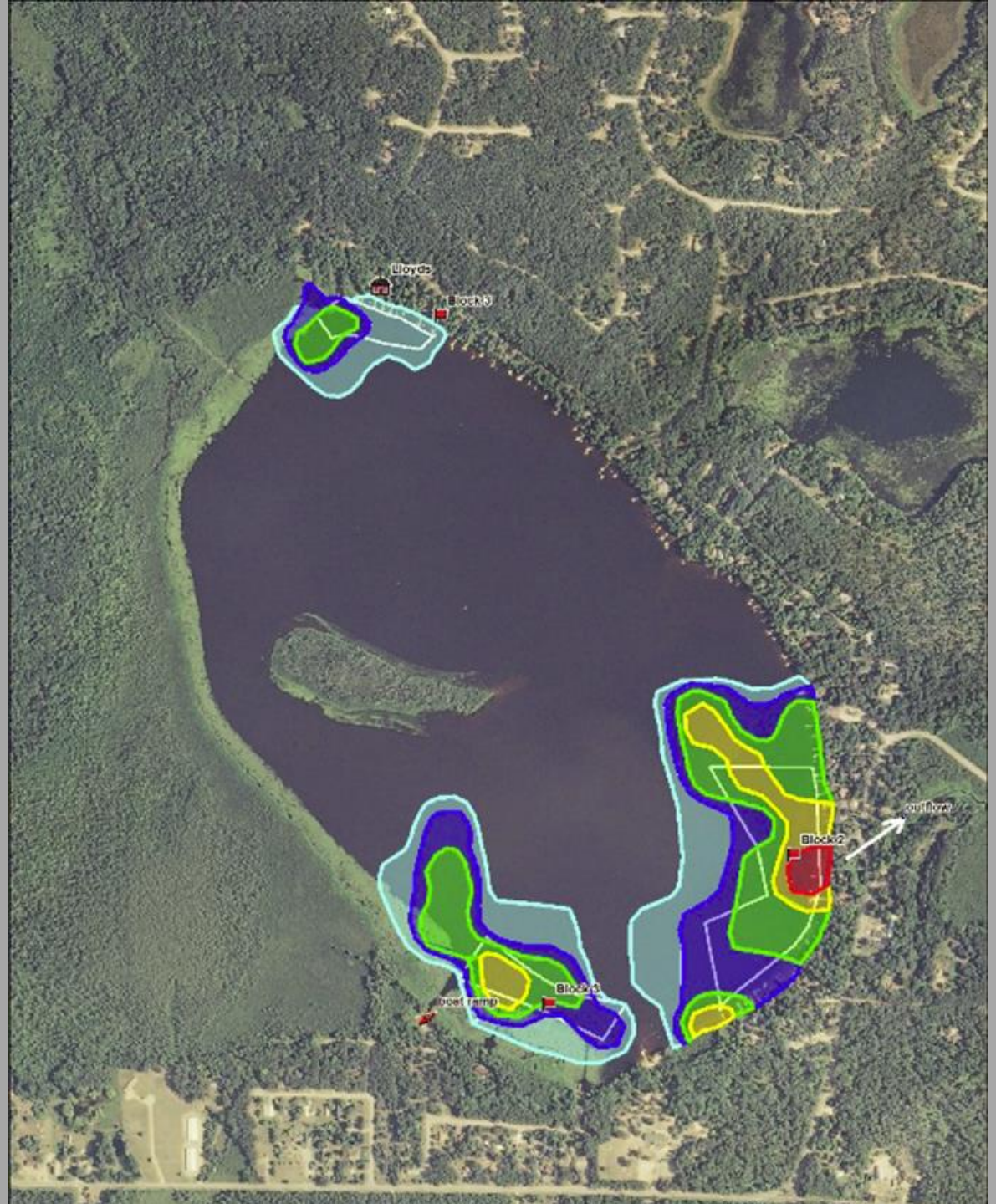
75-100%
50-75%
25-50%
10-25%
5-10%



Large-Scale

2.5 HAT

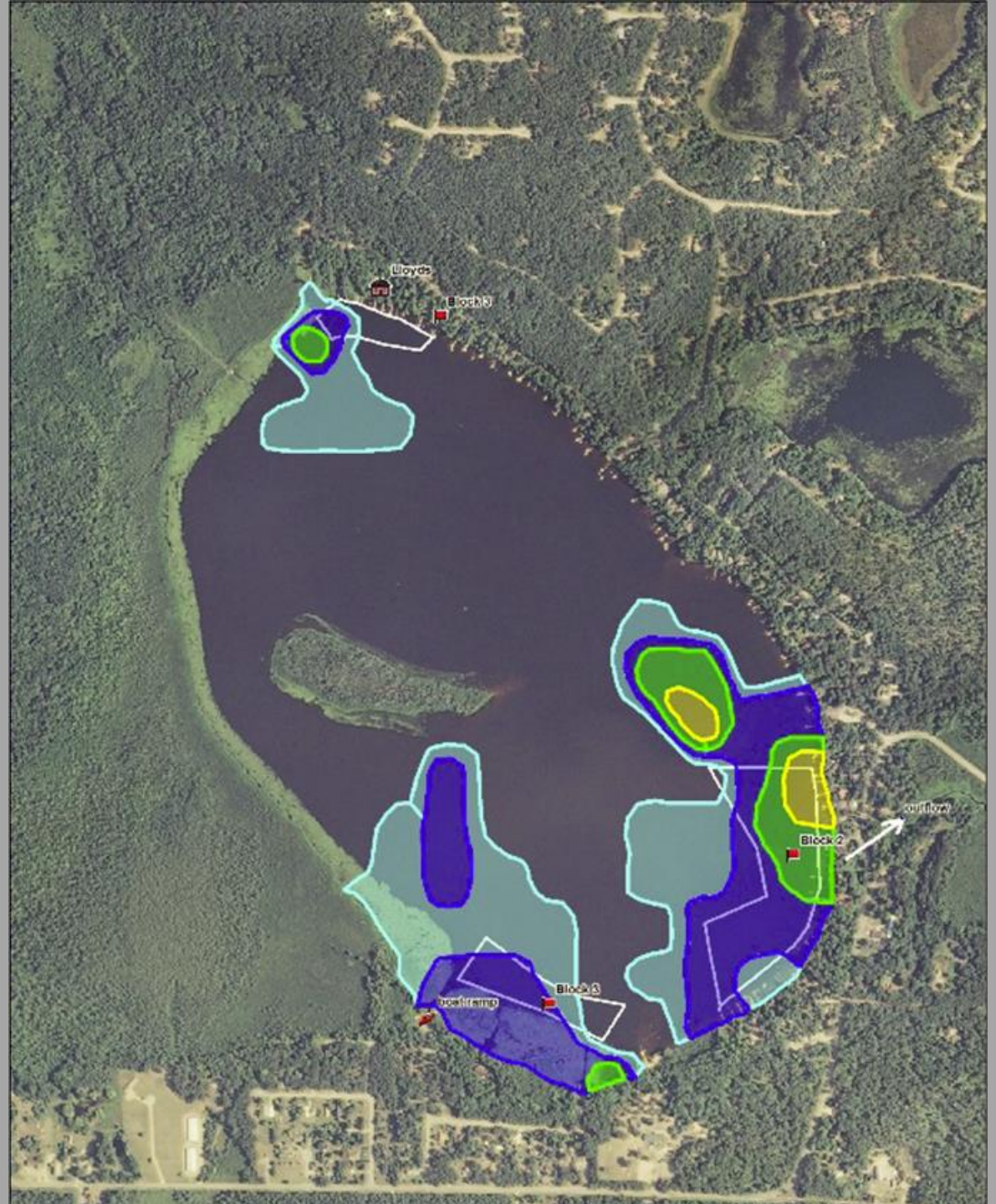
75-100%
50-75%
25-50%
10-25%
5-10%



Large-Scale

4 HAT

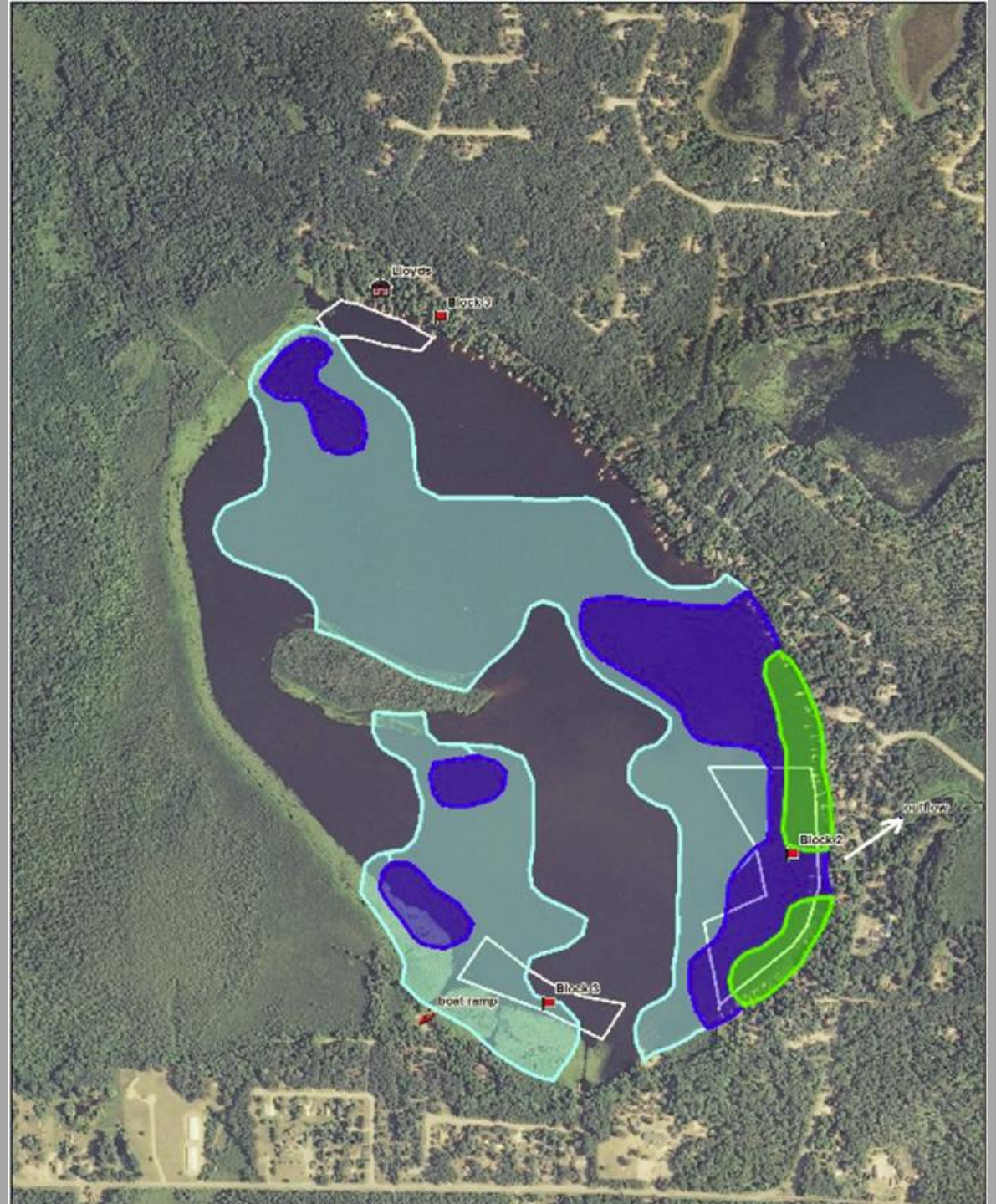
75-100%
50-75%
25-50%
10-25%
5-10%



Large-Scale

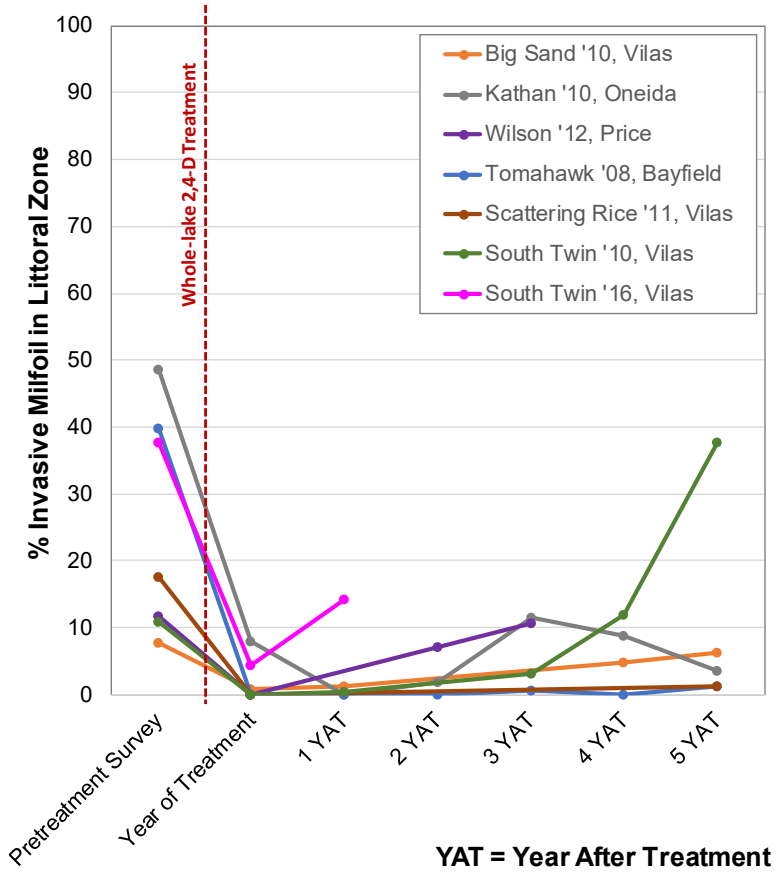
6 HAT

75-100%
50-75%
25-50%
10-25%
5-10%

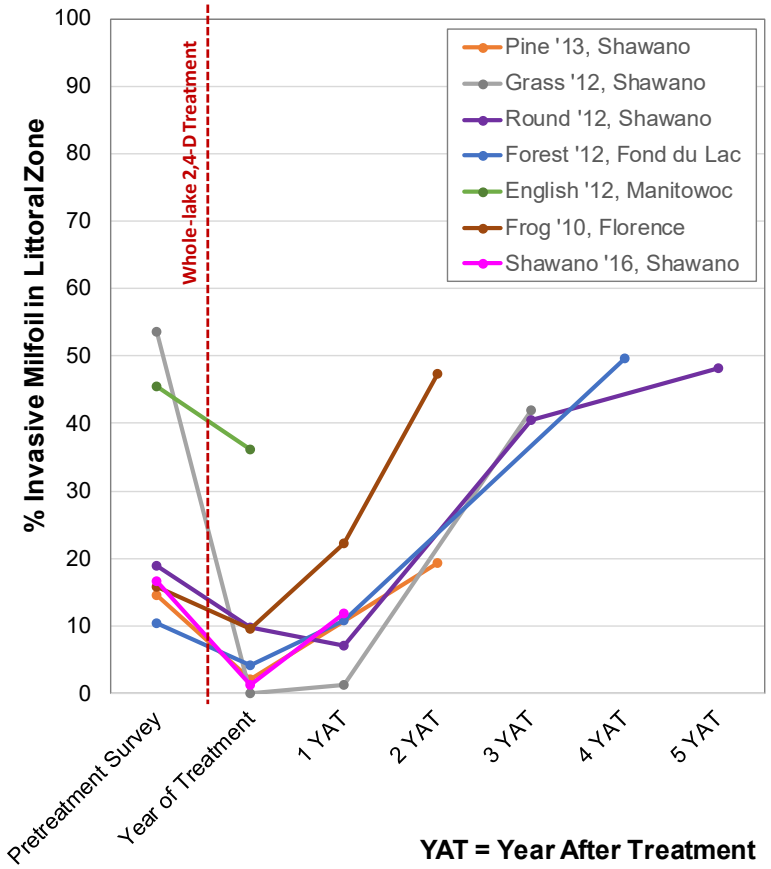


Large-Scale Treatments

EWM



HWM



Large-Scale Treatments

	Tomahawk	Sandbar '11	South Twin '09	Kathan	Wilson	Frog	Silver	Deep	Marion	Wolf	Helen	Emily	Parker	Lundgren
B. beckii	-	-	↓↓↓	-	-	-	-	-	-	-	-	-	-	↓↓
B. schreberi	-	-	-	n.s.	-	-	-	-	-	-	-	-	-	↓↓
C. demersum	-	-	n.s.	n.s.	↓↓↓	-	n.s.	-	n.s.	n.s.	-	-	-	-
Chara spp.	n.s.	n.s.	↓↓↓	n.s.	-	n.s.	n.s.	n.s.	-	↓	↑	↑	n.s.	↑
E. acicularis	-	n.s.	-	-	-	-	-	-	-	-	-	-	-	-
E. canadensis	↓↓↓	n.s.	n.s.	n.s.	-	-	-	-	↓↓↓	-	-	-	-	-
H. dubia	-	-	↓↓↓	-	-	-	-	-	-	-	-	-	-	-
M. sibiricum	-	-	↓↓↓	-	-	-	-	↓↓	-	-	↓↓↓	-	-	-
N. flexilis	↓↓↓	↓↓	n.s.	↓↓↓	-	↓↓↓	n.s.	-	↓↓↓	-	↓↓↓	↓↓↓	↓↓↓	↓↓
N. guadalupensis	-	-	-	-	-	-	↑↑↑	-	-	-	↓↓↓	-	↑↑↑	-
*N. marina**	-	-	-	-	-	-	↑↑↑	-	-	-	-	-	-	
Nitella spp.	-	-	-	↓↓↓	-	-	-	n.s.	↓↓↓	-	-	↑	-	-
N. odorata	-	-	-	-	-	-	-	-	-	-	-	n.s.	-	-
P. amplifolius	↓↓↓	-	-	-	-	n.s.	-	n.s.	-	-	-	-	-	n.s.
P. epihydrus	-	-	-	↓↓↓	-	-	-	-	-	-	-	-	-	-
P. foliosus	-	-	-	-	-	-	-	-	-	-	-	-	-	↓↓↓
P. friesii	-	-	-	-	-	-	-	-	↓↓↓	-	-	↓↓↓	-	-
*P. gramineus/P. illinoensis***	↓	↓	n.s.	-	-	-	n.s.	-	-	-	↓↓↓	n.s.	↓↓↓	n.s.
P. praelongus	-	-	n.s.	-	-	-	-	-	↑	-	-	-	-	n.s.
P. pusillus	↓↓↓	↓↓↓	↓	↓↓↓	-	n.s.	-	-	-	-	-	-	-	-
P. richardsonii	-	-	n.s.	-	-	-	-	-	-	-	-	-	-	-
P. robbinsii	↓	-	n.s.	-	↓↓↓	-	-	-	-	-	-	-	-	-
P. strictifolius	-	-	-	↓↓↓	-	↓↓↓	-	-	-	-	-	-	-	-
P. zosteriformis	-	-	n.s.	↑	↓↓↓	-	-	↓↓↓	-	-	-	↓↓↓	-	-
S. pectinata	-	-	-	-	-	-	n.s.	-	↓↓↓	↓	↓↓↓	-	↓↓↓	-
U. vulgaris	-	-	-	n.s.	-	-	-	-	-	-	-	-	-	-
V. americana	↓↓↓	↓↓↓	↓↓↓	↑	-	-	↑	-	-	n.s.	-	n.s.	n.s.	-

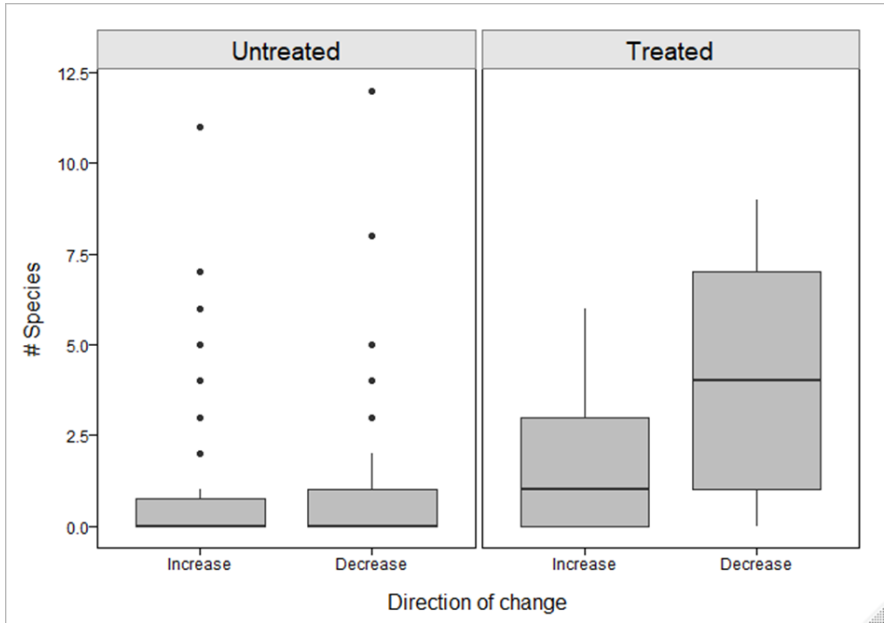
# native spp sig increase	0	0	0	2	0	0	2	0	1	0	1	2	1	1
# native spp sig decrease	7	4	6	5	3	2	0	2	5	2	5	3	3	4
net increase/decrease	-7	-4	-6	-3	-3	-2	+2	-2	-4	-2	-4	-1	-2	-3

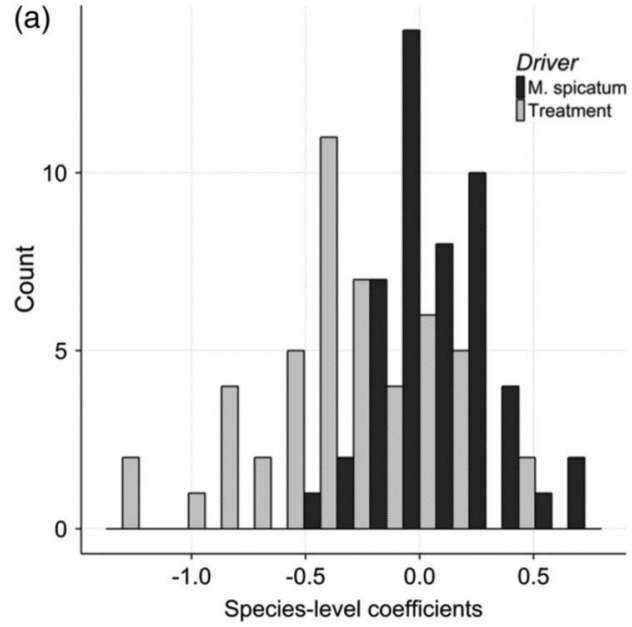
*considered non-native in Wisconsin

***P. gramineus* and *P. illinoensis* (& hybrids) combined for analysis

Large-Scale Treatments

- Compared the ecological effects of EWM on native plant communities with the effects of lake-wide herbicide treatments.
- Lake-wide herbicide treatments aimed at controlling EWM had larger effects on native aquatic plants than unmanaged EWM had on the plant community.



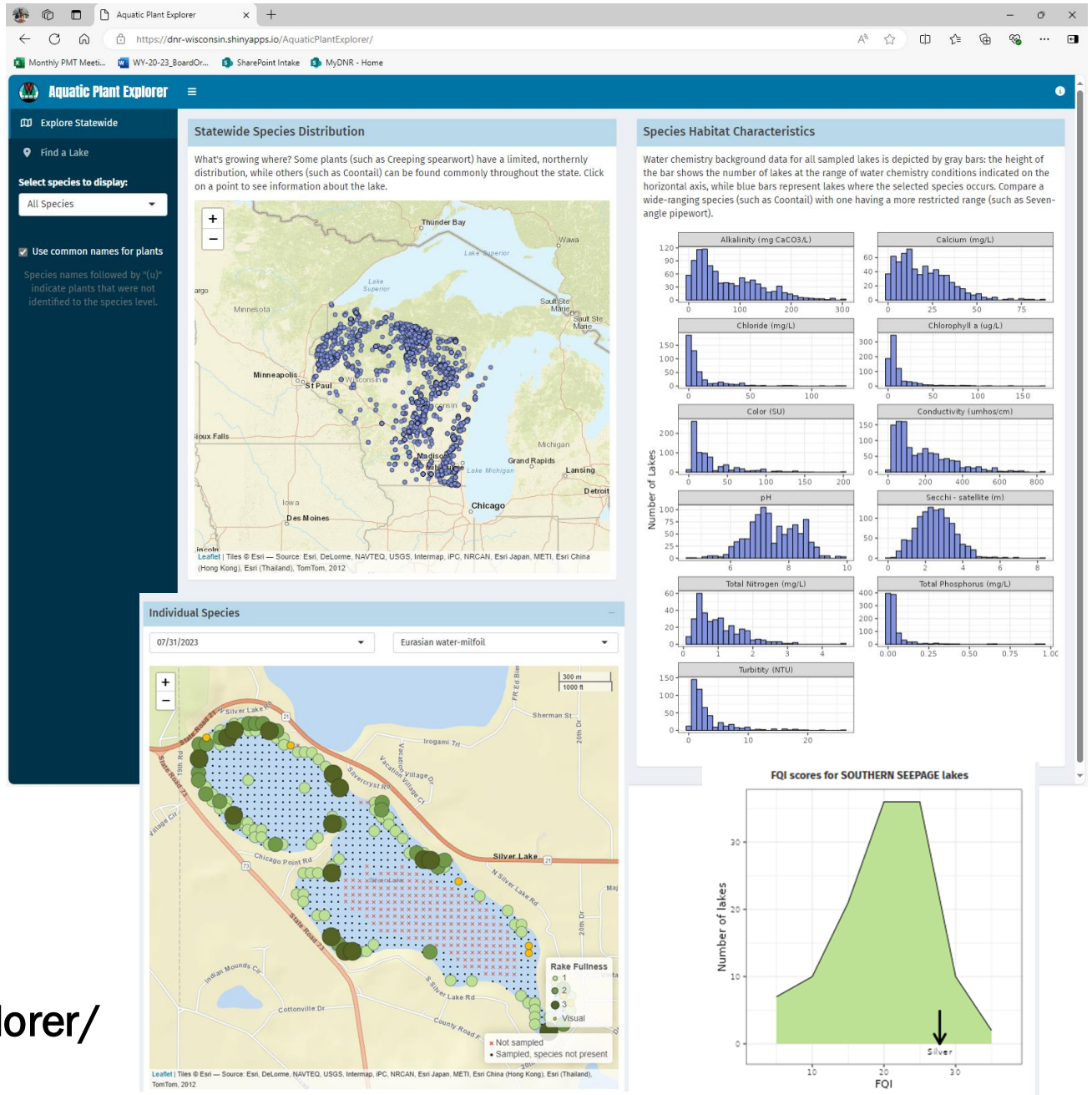


Mikulyuk et al. 2020. FACETS 5:353-366.

Aquatic Plant Data Explorer (APEx)

- Contains 2,994 unique plant surveys across 1,161 different waterbodies in Wisconsin.
- Ability to explore statewide data by individual species to understand statewide distribution and habitat characteristics.
- Ability to explore long-term plant community data on an individual waterbody over time.
- Provides statewide and regional context for interpreting aquatic plant data on a lake scale.

https://dnr-wisconsin.shinyapps.io/AquaticPlantExplorer/



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OFF THE RECORD"