

# Emerging Issues for Permitting the Chemical Treatment of Invasive Aquatic Plant Species in Michigan

Taking Charge: Aquatic Invasive Species

and Other Current Lake Research

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Lisa E. Huberty, PhD

Michigan Department of Environmental Quality

Water Resources Division

Aquatic Nuisance Control Program

# Overview

- Challenges of the expansion of starry stonewort
  - identification and statewide distribution
  - surveying and monitoring
  - permitting and treatment
- New approaches to management and permitting treatment of non-native watermilfoil

Planning, management, and permitting:

Taking charge in the face of uncertainty

# Starry stonewort can be a problem in Michigan

- Can reach monoculture, nuisance level
- Can impede recreation
- May have significant ecological impacts
- Permitting treatment and managing the species in a vacuum of information about the ecology and impact of the species

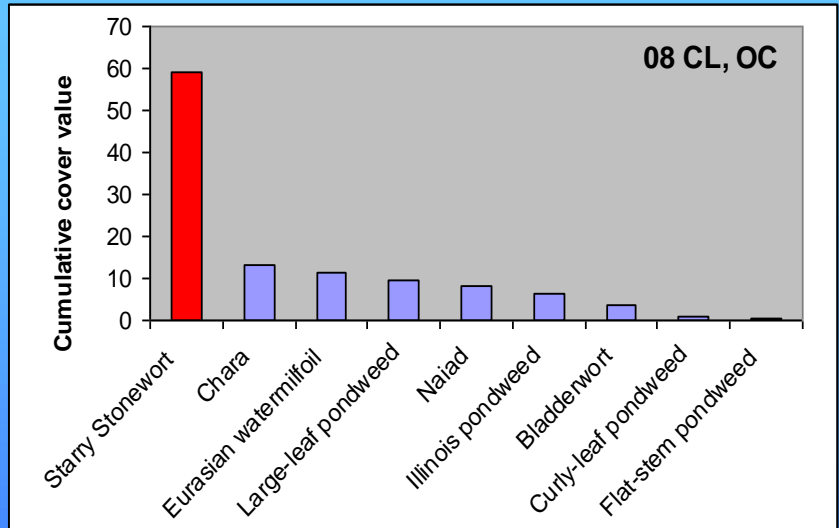


Photo by Doug Pullman

Chara

Starry stonewort



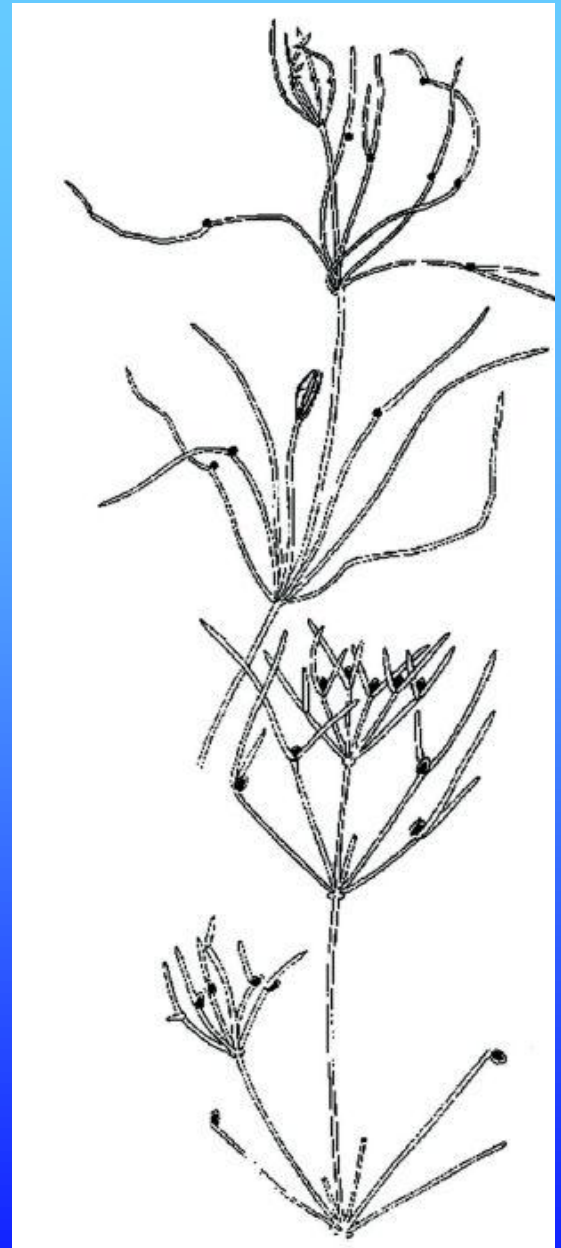
Photo by Progressive AE

- Eurasian green charoid macroalgae
- Appears lighter, brighter green than Chara
- Irregular branching pattern makes it look disheveled

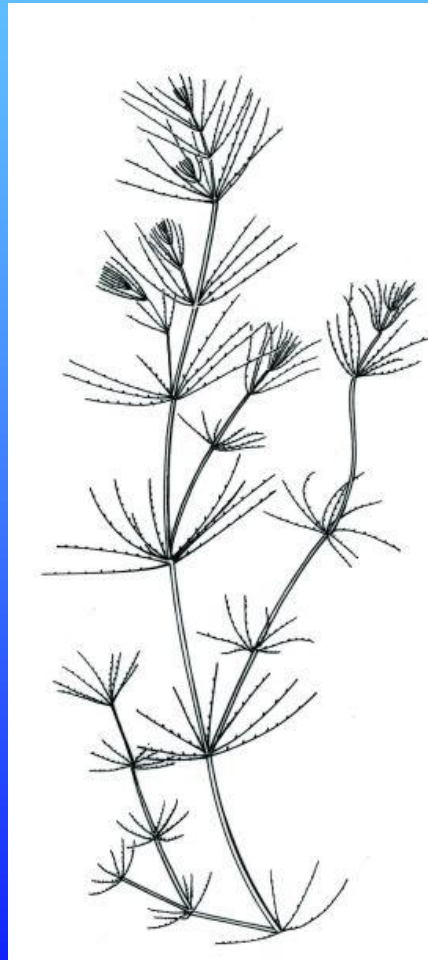


- Longer internodal cells than Chara
- Main stem to 80 cm (or more)

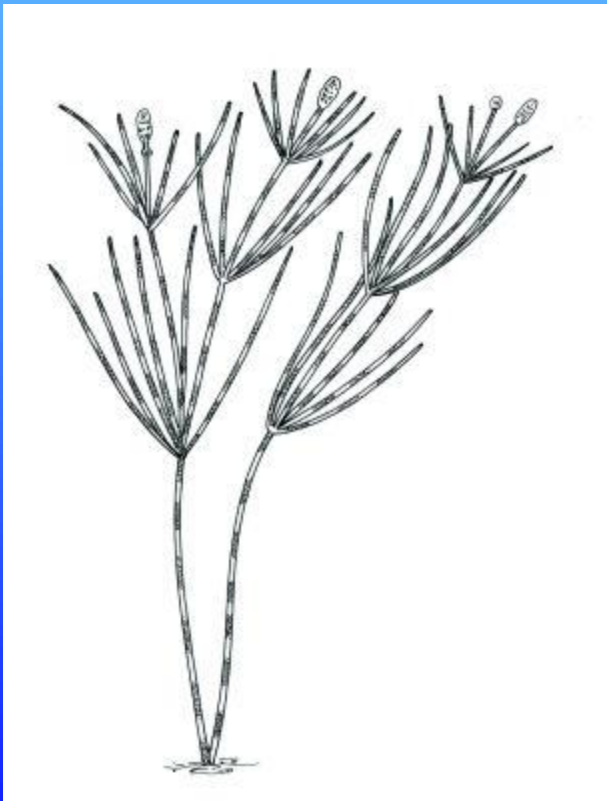
*Nitellopsis obtusa*



*Chara* spp.



*Nitella* spp.





Photos by Doug Pullman



- Grows at greater depth and to greater height than Chara
- Can form dense mats that completely cover lake bottom – a benthic barrier

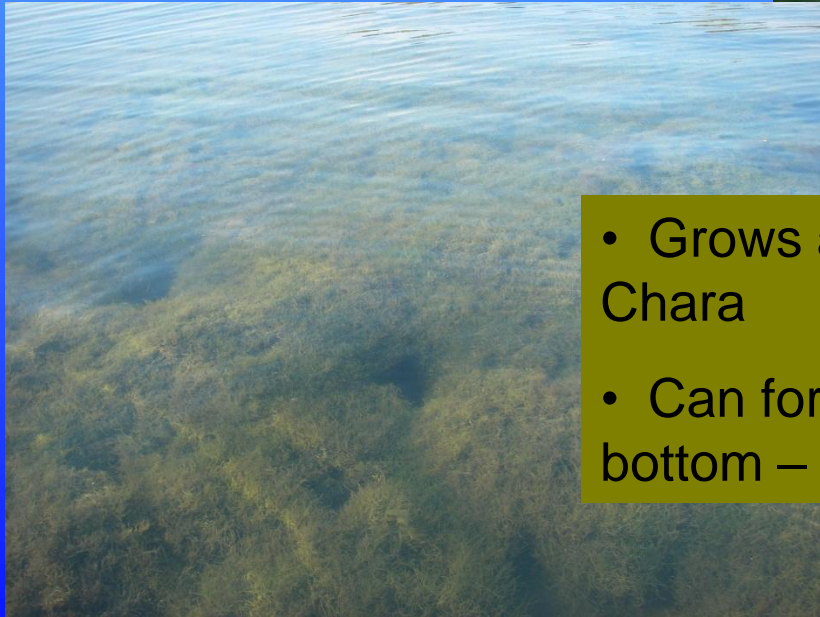
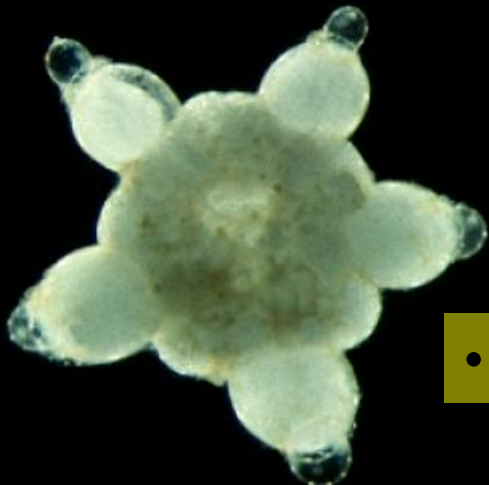






Photo by Doug Pullman



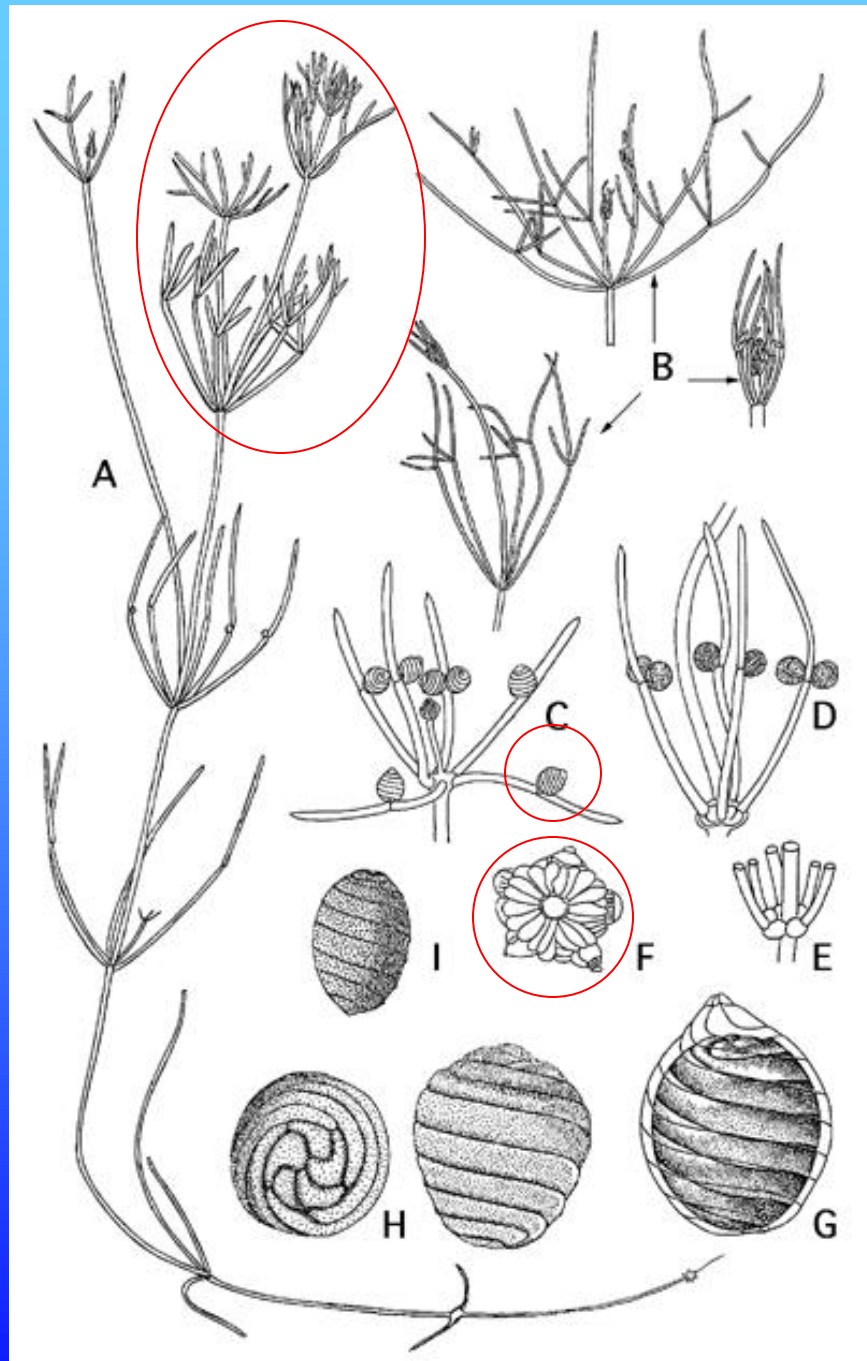
- Creamy white bulbils at base of main axis

- Dioecious
- Dark red gametangia on branches at nodes



Photo by Doug Pullman





We don't know how starry stonewort is spread within and between inland lakes.

Reproduction and candidates for dispersal

- Oospores
- Starry bulbils
- Fragments

# Status in native range: not a nuisance

- Thought to be extirpated but rediscovered in Germany and Japan
- Rare in Bremen, Germany
- Vulnerable in Sweden



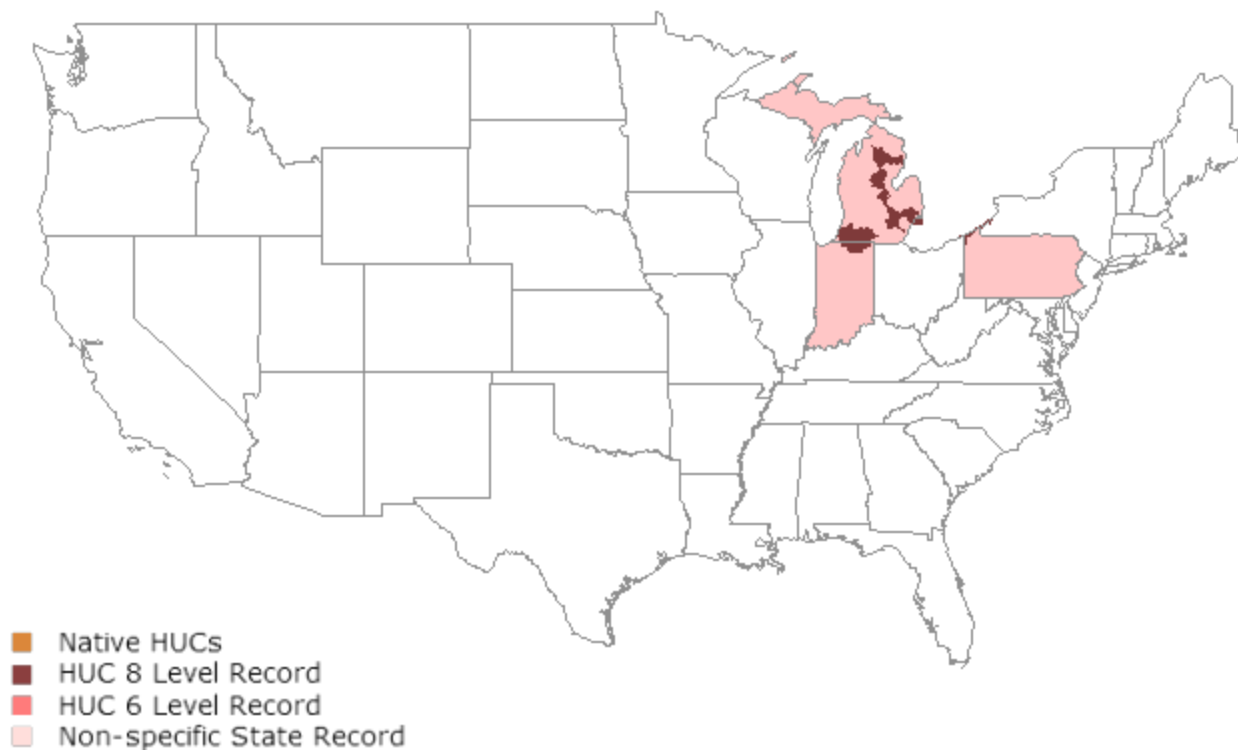
# Introduction history

- Native to Eurasia from west coast of Europe to Japan
- Ballast water introduction
- Found in the St. Lawrence River in 1978
- St. Clair – Detroit River system in 1983
  - 9<sup>th</sup> most common plant at the time
- Lake Ontario embayments and Oneida Lake
- Inland lakes in Michigan confirmed by Dr. Doug Pullman of Aquest in 2006



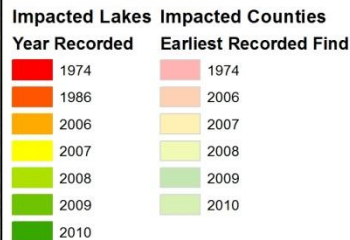


*Nitellopsis obtusa*



Map created on 6/10/2011. United States Geological Survey

# Starry Stonewort Finds in Michigan Lakes 1974 - 2010



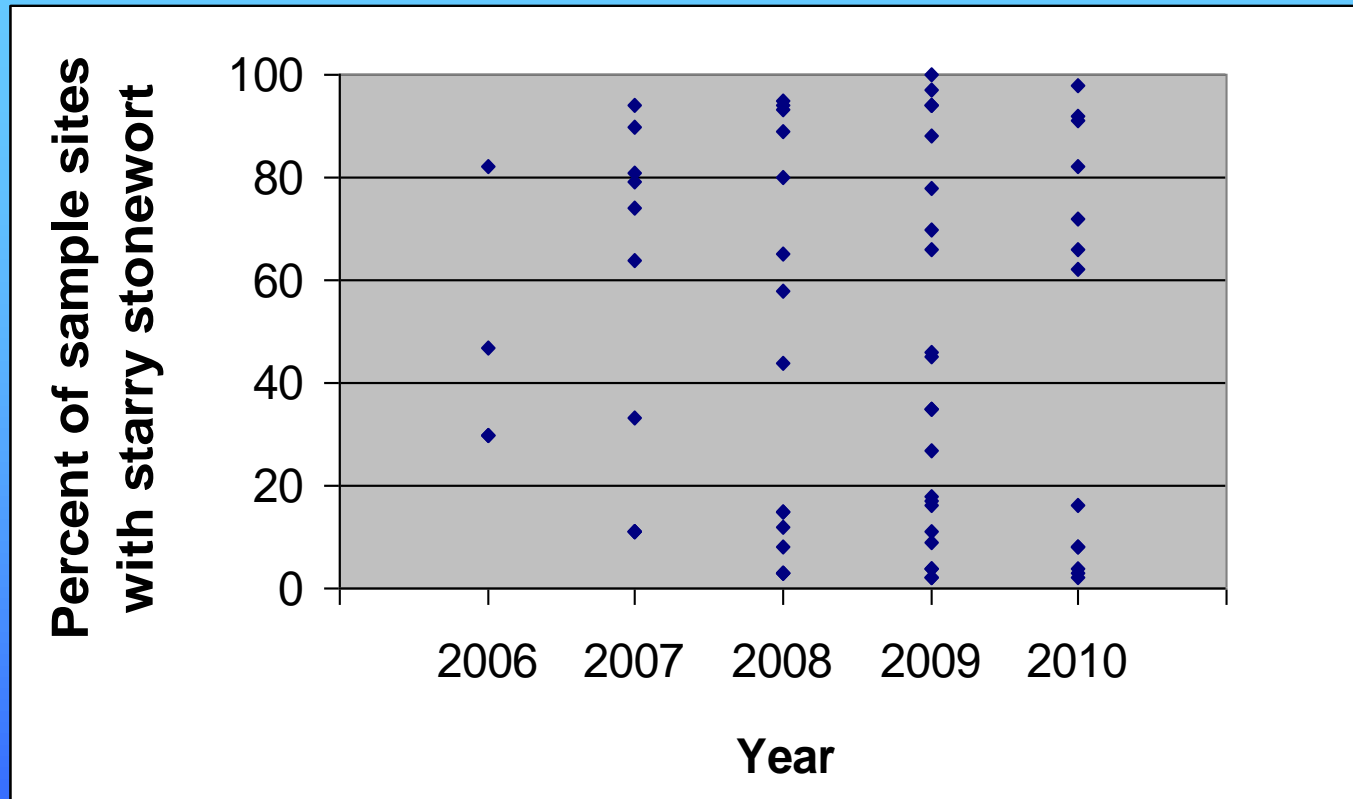
County Name	Impacted Lakes in County	Earliest Recorded Find
Oakland	43	2006
Livingston	15	2006
Branch	8	2006
Jackson	8	2007
Washtenaw	6	2007
Barry	5	2008
Genesee	4	2006
Cass	3	2008
Kent	3	2008
Lenawee	3	2007
Montcalm	3	2006
Allegan	2	2008
Hillsdale	2	2007
Macomb	2	1974
Mason	2	2006
Wayne	2	1974
Alcona	1	2007
Calhoun	1	2008
Clinton	1	2010
Gladwin	1	2008
Ingham	1	2010
Ionia	1	2010
Kalamazoo	1	2010
Lapeer	1	2009
Mackinac	1	2007
Midland	1	2007
Ogemaw	1	2007
Iosco	1	2007
Roscommon	1	2008
St. Clair	1	1974
St. Joseph	1	2009

Aquatic Nuisance Control database:

- 119 waterbodies
- 31 counties



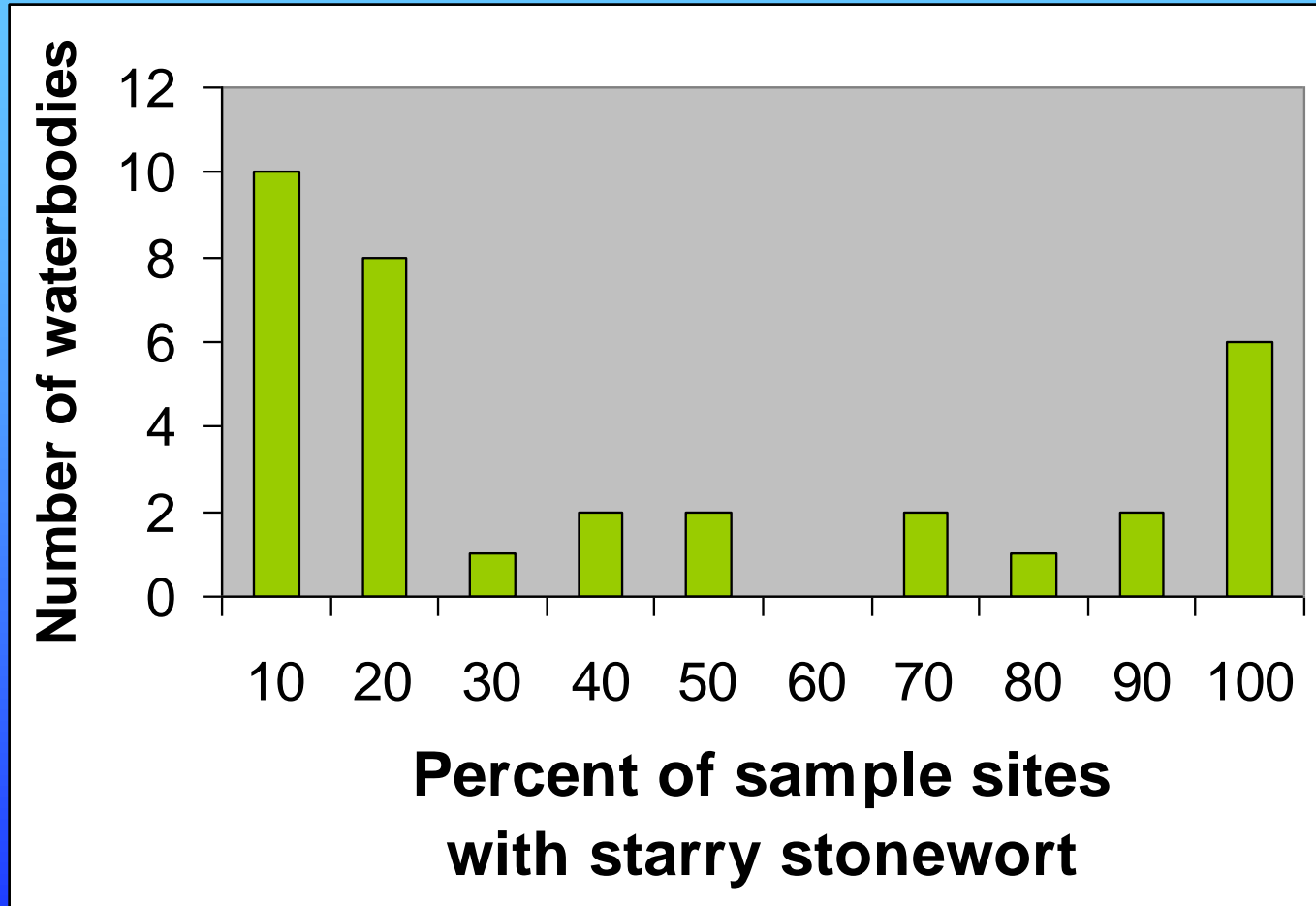
# Improving detection of starry stonewort



- Increasing detection at low distribution
- Age of infestation is usually unknown
- Can not be certain whether we are detecting spread or just detecting presence



# What is the frequency of different levels of infestation?

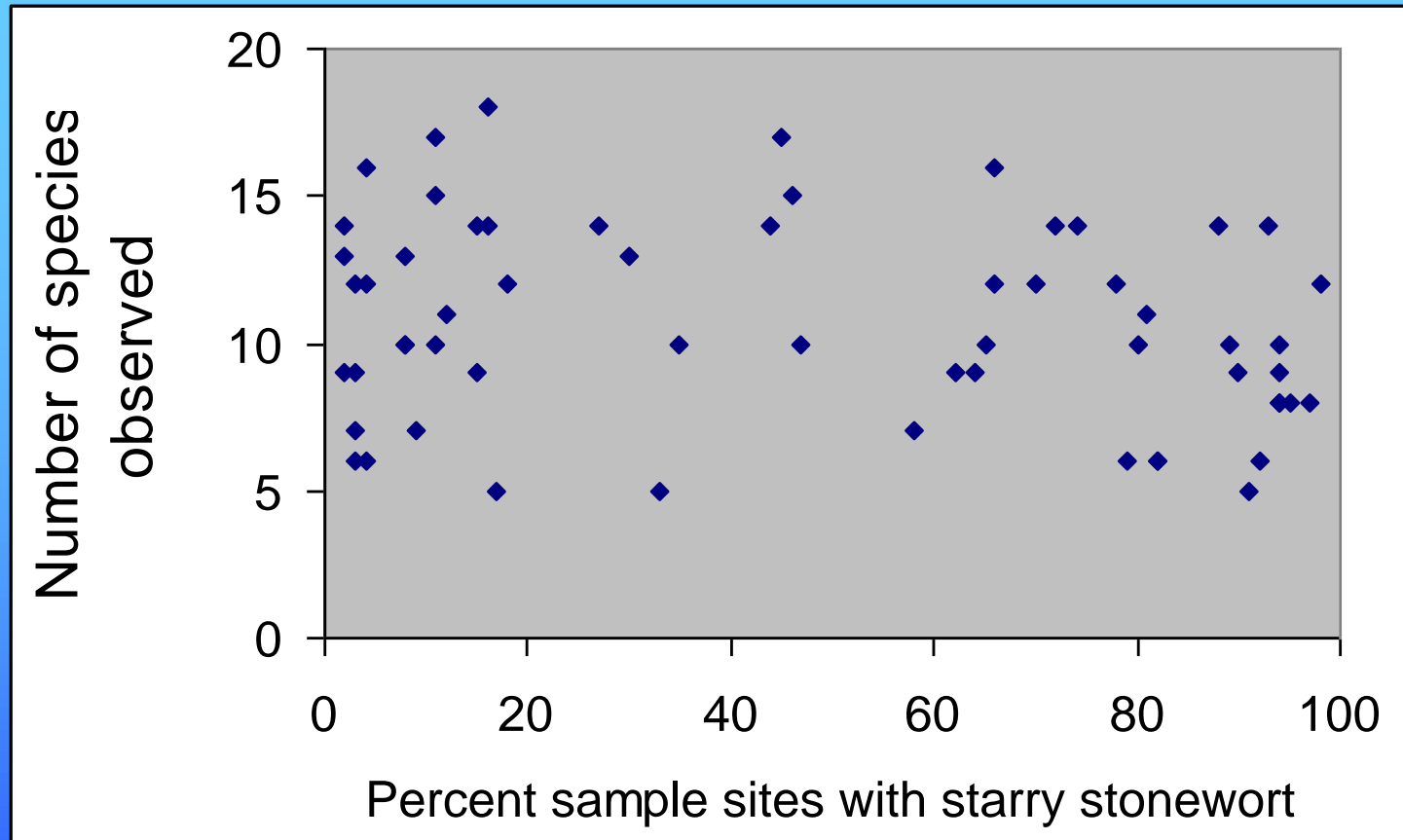


We don't know if this distribution of levels of infestation extends to the larger inventory of waterbodies with starry stonewort.

# Ecology and impacts of starry stonewort are unknown for inland lakes in North America

- Basic ecology
  - Temperature, light, nutrient, substrate requirements
  - Phenology and annual variation
  - Spread within and between lakes
  - Association with zebra mussels
  - Allelopathic effects
- Ecological impacts
  - Native plant community
  - Sediment water interface
  - Water quality
  - Primary production and algal community
  - Secondary production and zooplankton community
  - Fish and other aquatic organisms

Across waterbodies, does starry stonewort reduce species richness?



- Species richness varies widely at a given level of starry stonewort distribution
- Creates a band not a line
- Response to detect: trend of the band



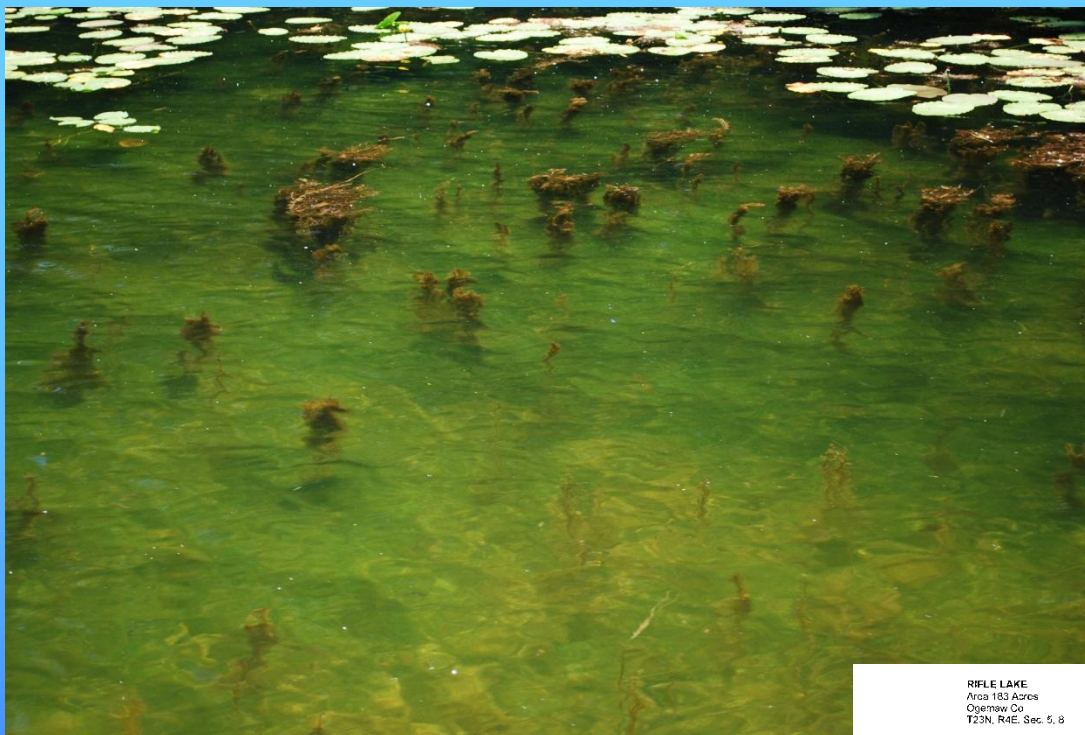


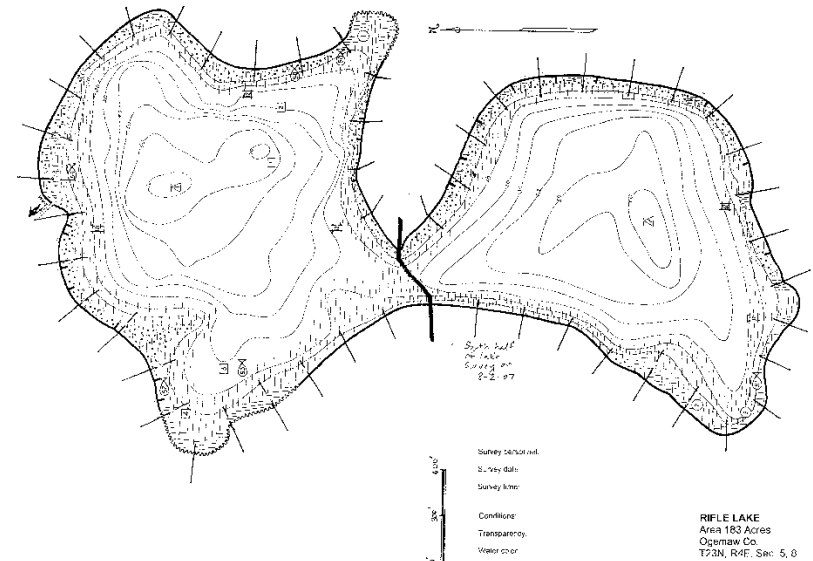
Photo by Doug Pullman

# Native species abundance response

A = Found < 2 % coverage per sample site  
 B = Sparse 2-20 % coverage per sample site  
 C = Moderate 21-60 % coverage per sample site  
 D = Dense 61-100% coverage per sample site

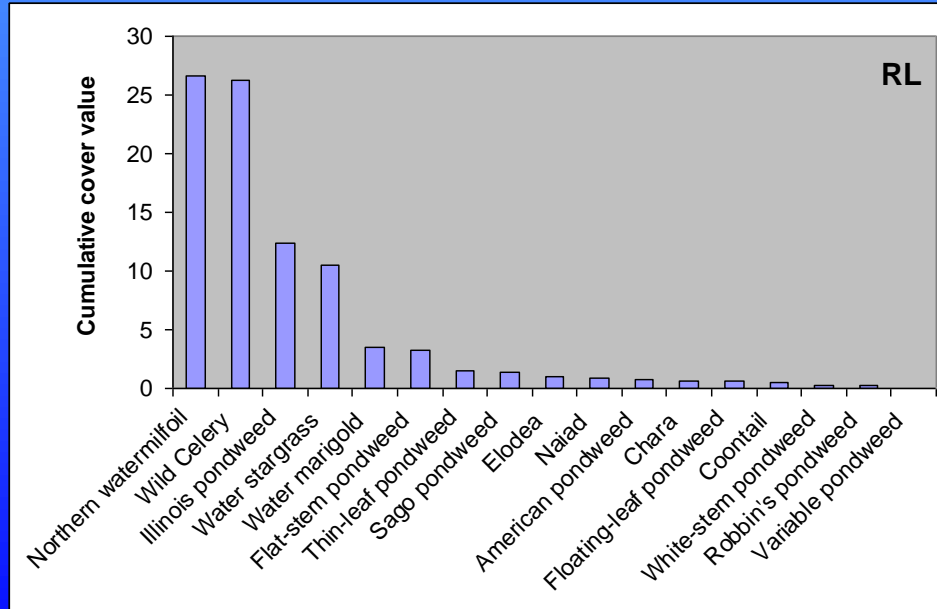
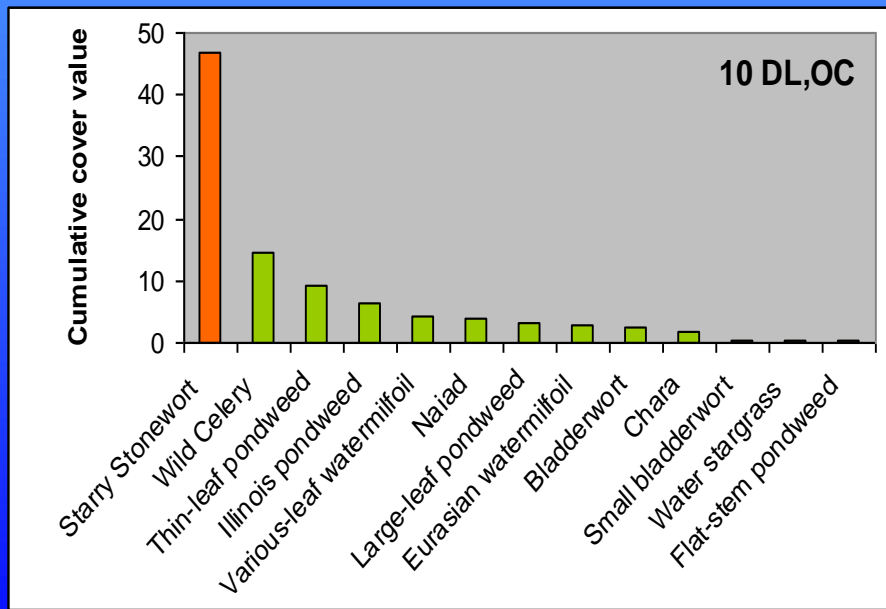
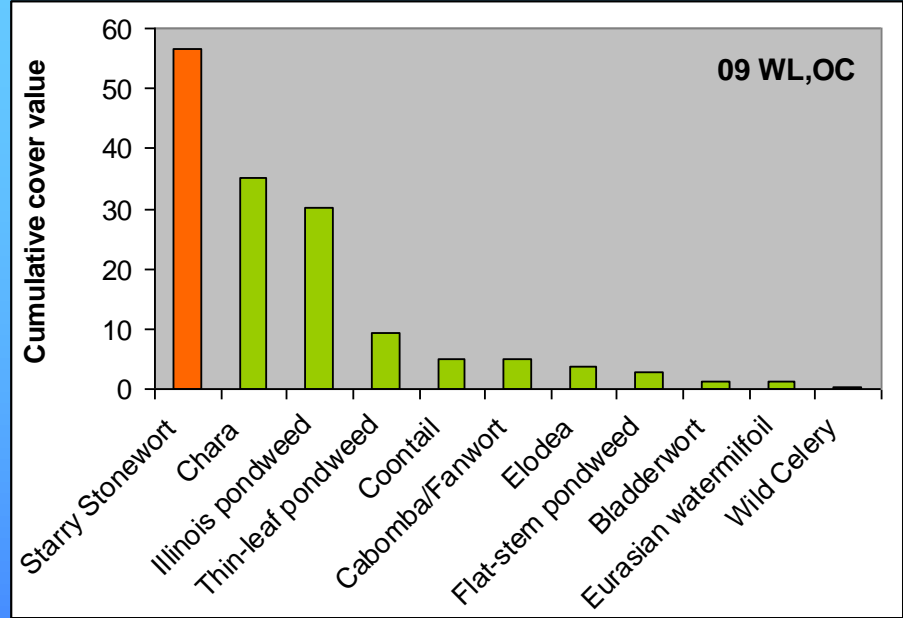
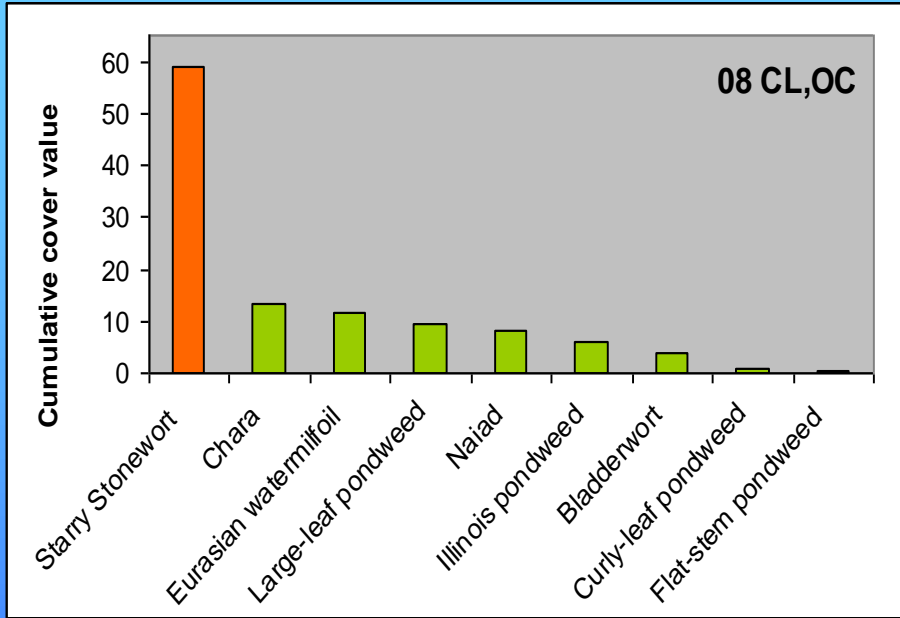
RIFLE LAKE  
 Area 183 Acres  
 Ogemaw Co  
 T23N, R4E, Sec. 5, 8

A = Found - < 2% coverage per AUVS  
 B = Sparse - 2-20% coverage per AUVS  
 C = Moderate - 21-60% coverage per AUVS  
 D = Dense - 61-100% coverage per AUVS  
 AUVS = Aquatic Vegetation Survey



# Starry stonewort can dominate the plant community

in terms of distribution and abundance.





Photos by Doug Pullman

In the absence of scientific information, managers are relying on anecdotal or local observations of impacts to fisheries and recreation and making a decision about treatment.





# Heavy management without information about the basic ecology and ecological impact of starry stonewort



## Mechanical harvesting

- Efficacious?
- Significant physical disturbance
- Non-selective removal
- Impacts to aquatic organisms



Photo by Progressive AE  
BMP?

## Chemical treatment

- Efficacy ?
- High rates of copper
- Additional Hydrothol
- Treatment beyond standard permitted areas
- Expense

# Taking charge in the face of uncertainty

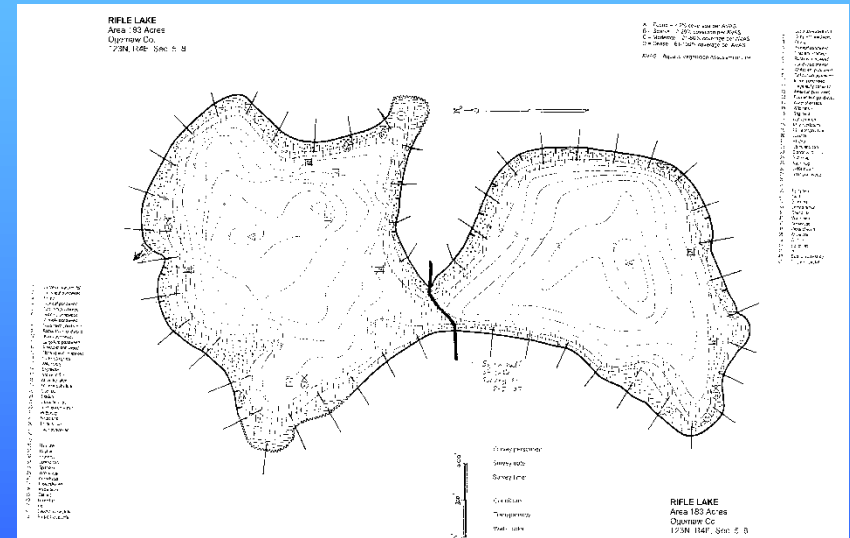
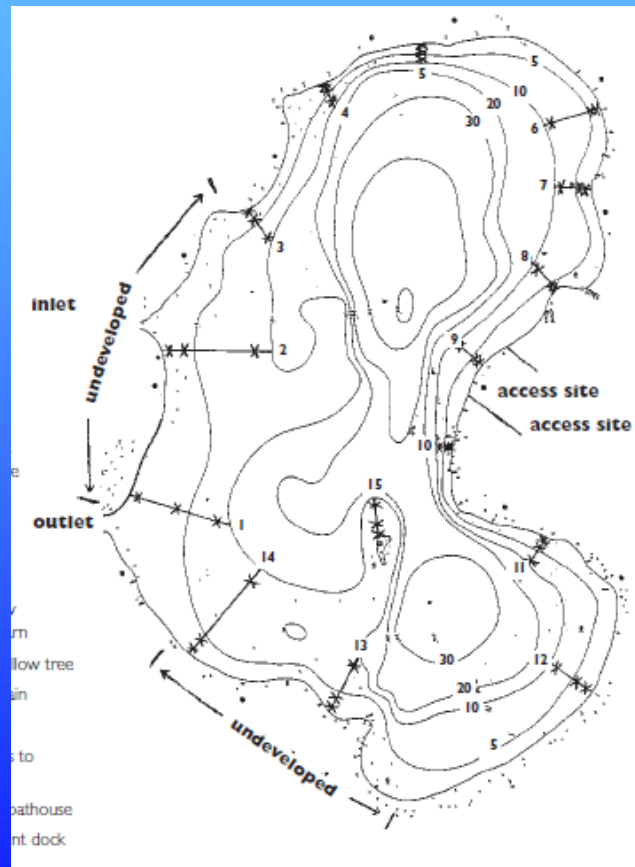
Aquatic plant survey for distribution,  
abundance and mapping

- DEQ – ANC: methodology
- MiCorps: Michigan Clean Water Corps
- Aquest: LakeScan

# MiCorps

[www.micorps.net/CLMPdocuments.html](http://www.micorps.net/CLMPdocuments.html)

Sample at 1, 4, 8 feet depth at multiple transects

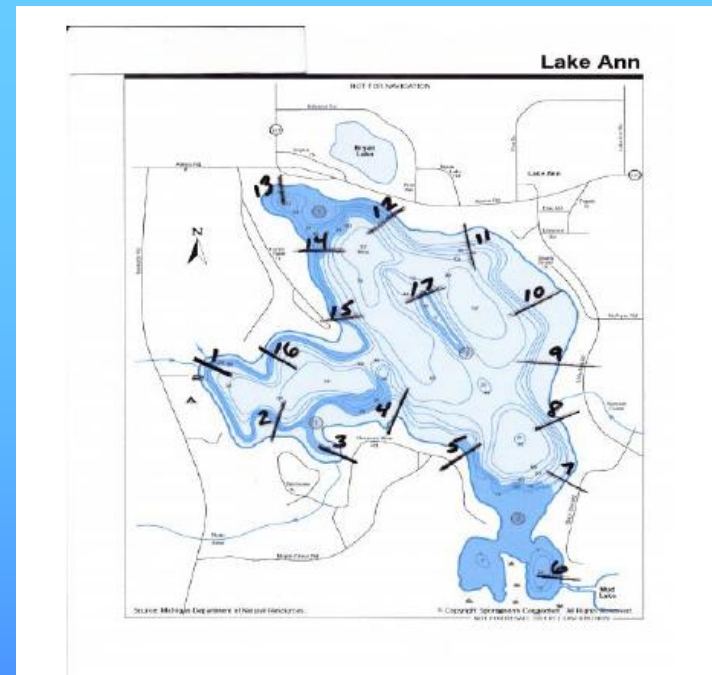


DEQ – ANC Program

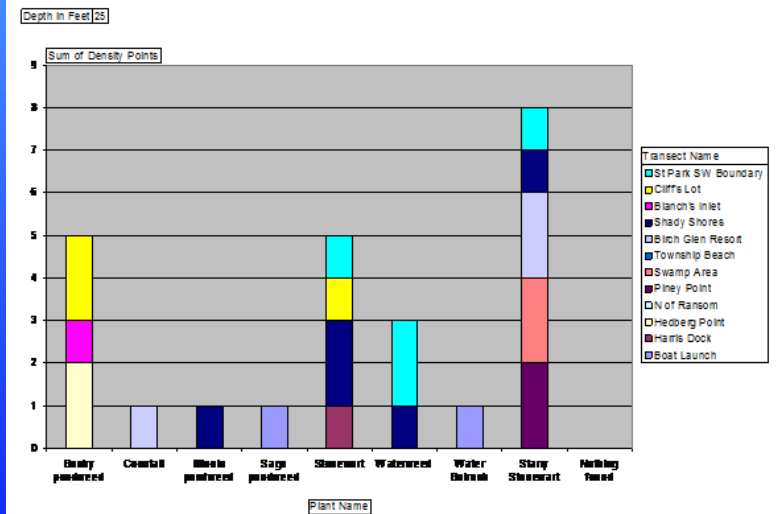
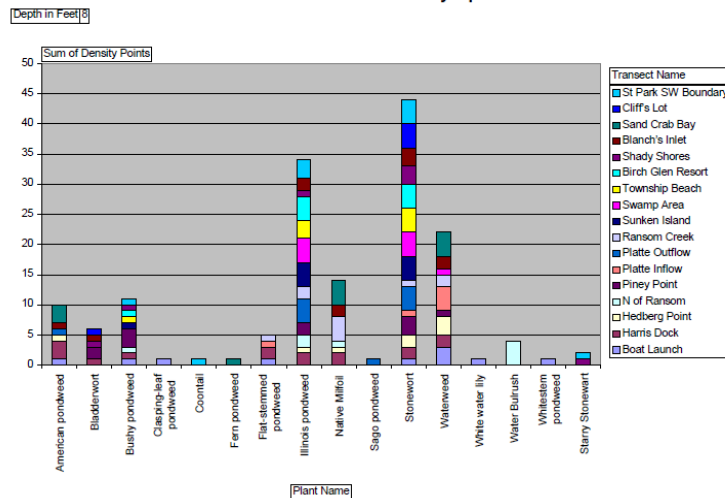
[www.michigan.gov/deqinlandlakes](http://www.michigan.gov/deqinlandlakes)

AVAS survey procedure





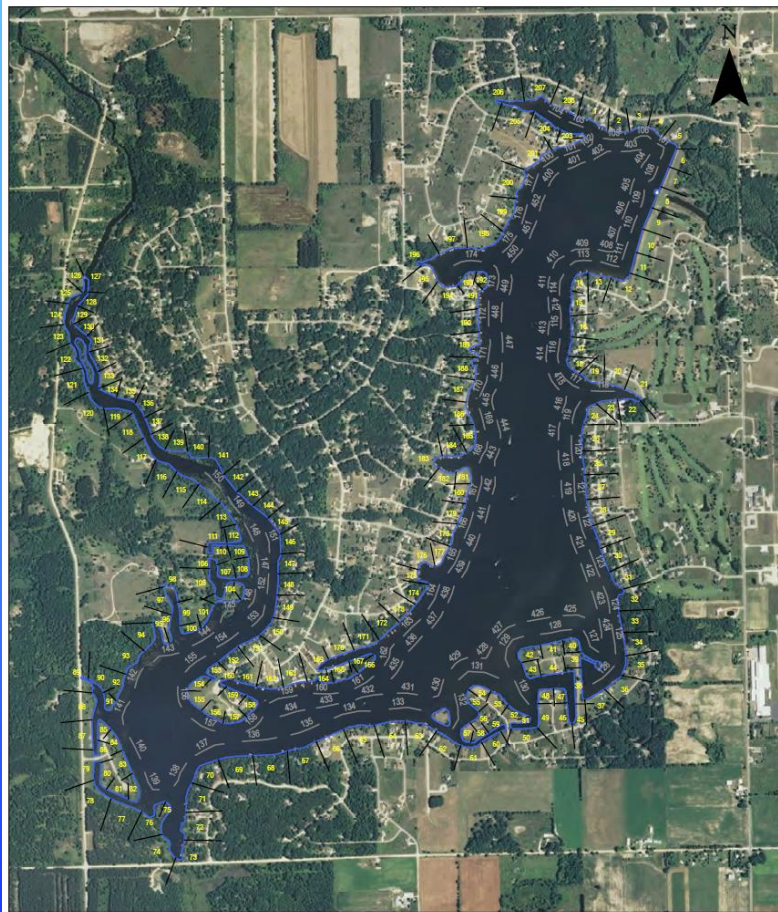
Plants Found at 8 feet Sorted by Species



Thank you to Kent Taylor for permission to share Ann Lake vegetation survey results

# LakeScan

## Aquatic Resource Observation Sites



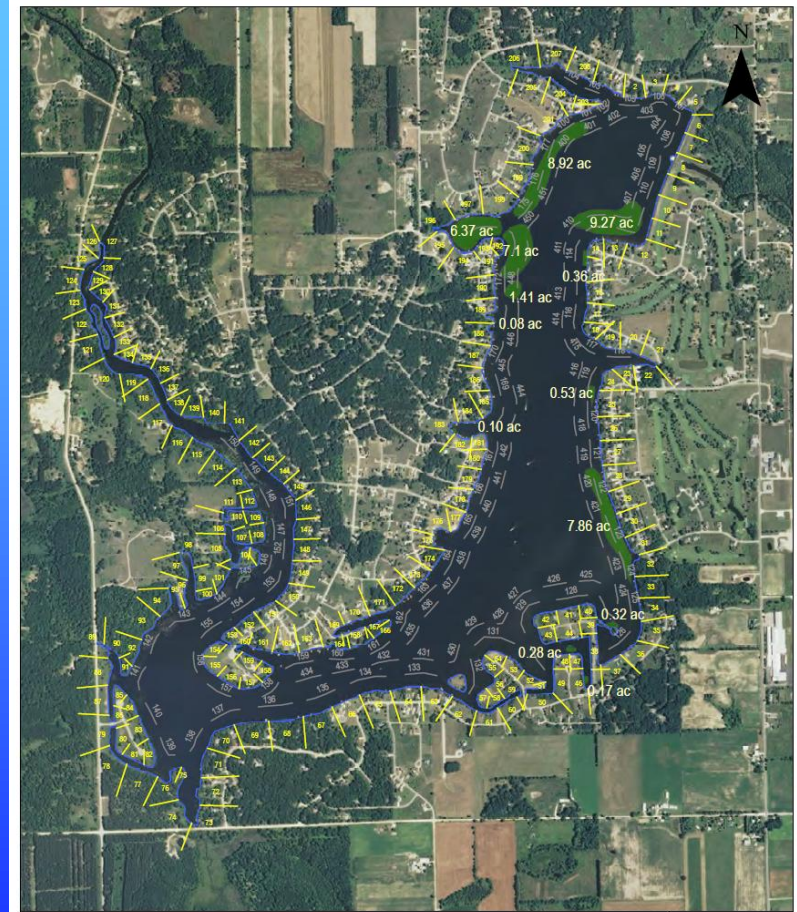
Lake Isabella - AROS Map

Lake Isabella, Isabella County, MI

0 750 1,500 2,250 3,000  
Feet

**ECT**

2200 Commonwealth Blvd, Suite 300  
Ann Arbor, MI 48105  
(734) 769-3004



Lake Isabella - Starry Stonewort

Lake Isabella, Isabella County, MI

0 750 1,500 2,250 3,000  
Feet

**ECT**

2200 Commonwealth Blvd, Suite 300  
Ann Arbor, MI 48105  
(734) 769-3004



## With vegetation survey results

- Communicate problem to stakeholders, agencies, and permitting program
- Assess treatment options based on density and distribution of starry stonewort
- Evaluate treatment efficacy
- Be prepared in anticipation of improved treatment technologies

It pays to invest in learning to do vegetation surveys or raise the budget to hire a consultant.

# Acknowledgements

## Aquatic pesticide applicators

Dick Pinagel and Steve Zulinski

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## Aquatic Nuisance Control Program Staff

Eric Bacon

Laura Esman

Matt Preisser

Jessica Koerner

Brett Wiseley

Tom Alwin

Amanda Whitscell

# Overview of hybrid watermilfoil



- Hybrids happen
- Identification not possible in field
- Hybrids are widespread in Michigan
- Hybrids vary in their response to herbicides
- Aquatic plant management responses
- Tolerance and resistance management

# Hybrids happen

Eurasian watermilfoil x Northern watermilfoil

*Myriophyllum spicatum* x *Myriophyllum sibiricum*



Hybrid watermilfoil

- EWM colonizes a lake with native watermilfoil, hybrid event occurs
- Hybrid watermilfoil colonizes a lake
- Data suggest multiple hybridization events in Michigan
- Changes over time within a lake can be rapid

# Identification not possible in field



Characters in the field are not reliable

Genetic identification is the only reliable method of identification of watermilfoil



# Hybrid watermilfoils are widespread in Michigan

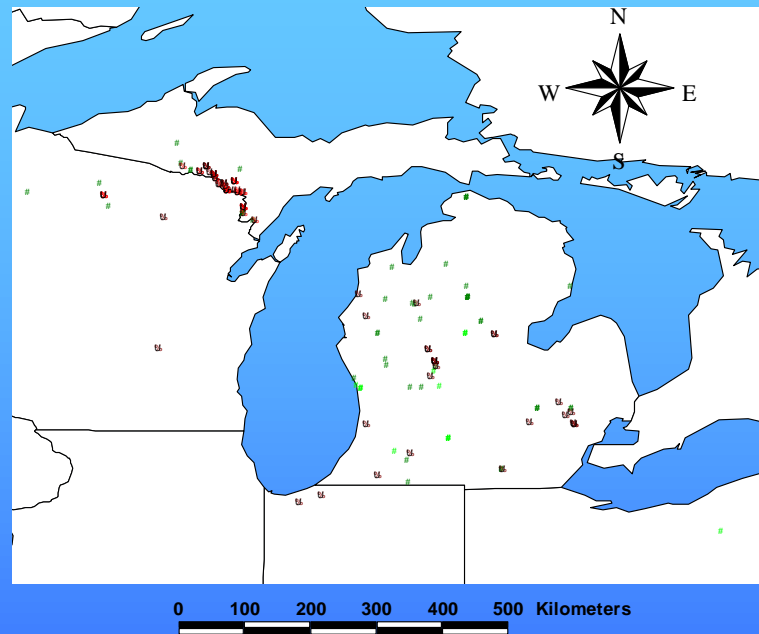


Figure 5. Geographic distribution of EWM (circles) and hybrid watermilfoils (squares) in the Great Lakes basin. The two different shades of green and red correspond to the two different genetic groups of EWM and hybrids, respectively, identified in this study (see "Comparison of ITS and AFLPs" for more details). In addition to samples from this project (Lower Peninsula of Michigan), the map includes lakes sampled around the Great Lakes basin in order to illustrate the genetic diversity present at the basin-scale.

- Among the lakes from which watermilfoil has been sampled and analyzed genetically, 25-50 percent have a hybrid watermilfoil biotype
- Lower and Upper Peninsula of Michigan

# Hybrid watermilfoils vary in their response to herbicides

- Variation in response to different herbicides among hybrids
  - 2,4-D, fluridone, triclopyr, contacts
- In comparison to EWM and among hybrids
- Some hybrids respond typically
- Some hybrids respond atypically
- Currently lack predictive capability
- Changes in response can occur quickly

# Aquatic plant management responses to herbicide tolerance


- Increase rate of 2,4-D from the standard 100 lb/acre
  - Application rate on the new product label for Navigate is water volume based, which will help at depth
- Modifications of the 6-bump-6 ppb fluridone
- Use different active ingredient (triclopyr)
- Use contact herbicides
  - Challenges permitting requirements that limit offshore treatment with contact herbicides


# Tolerance and resistance management

- a new level of lake monitoring for watermilfoil management?

- ✓ Get genetic identification
  - ✓ submit samples to GVSU
- ✓ Get susceptibility analysis
  - ✓ expensive, proprietary, and not well developed
- ✓ Monitor field response late season after treatment and early season in year after treatment
- ✓ Consider monitoring 2,4-D treatments for changes in efficacy
- ✓ Monitor 2,4-D residues to check for target concentration

[www.gvsu.edu/wri/thum/milfoil-genetic-identification-services-15.htm](http://www.gvsu.edu/wri/thum/milfoil-genetic-identification-services-15.htm)

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STATE UNIVERSITY**

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Aquatic Plant Identifications

AWRI Home


Molecular Ecology Laboratory

Dr. Ryan Thum  
[thumr@gvsu.edu](mailto:thumr@gvsu.edu)  
Phone: 616-331-3989

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**Milfoil Genetic Identification Services**



**Procedures and Policies for  
Genetic Identification Submissions**

Two documents

1. Chain of custody record
2. Collection and shipping protocol



# Why invest in genetic analysis of watermilfoil?

	Hybrid identification is <u>unknown</u>	Hybrid identification is known
Herbicide treatment response is typical	No problem	No problem
Herbicide treatment response is <u>atypical</u>	Potential accountability problem	Prepared for next diagnostic steps as technology develops

# Efficacy is a criterion for denial of an Aquatic Nuisance Control permit

## **R 323.3108 Denial of a permit or a certificate of coverage.**

Rule 8. (1) The department shall deny a permit application, or a part of a permit application, in any of the following circumstances:

- (a) The proposed use of a pesticide is inconsistent with its label pursuant to FIFRA.
- (b) The proposed use of a pesticide is not registered by the Michigan department of agriculture pursuant to part 83 of 1994 PA 451 and the EPA pursuant to FIFRA.
- (c) The proposed use of a chemical, though in accordance with the label and otherwise in compliance with these rules or in combination with other aquatic management activities, is likely to result in economic loss, recreational damage, a public health hazard, unacceptable negative impacts to natural resources, or failure to provide control of the aquatic nuisance, as determined by the department.

# Tracking watermilfoil management

## ANC 2012 treatment report revisions

**Section D – Aquatic Plant Management** (If the total treatment area for this waterbody is less than 10 acres you are not required to fill out Section D and you may skip to Section E).

1. Do you or a lake management consultant have a recent Aquatic Vegetation Survey or other lake management report that is not required by the ANC permit? ☐ Yes ☐ No

If so, and you are willing, please submit a copy of the field map and survey summary or lake management report.

2. If you or the lake management consultant is managing watermilfoil, have you obtained a genetic analysis of the watermilfoil population(s)? ☐ Yes ☐ No

If yes, please provide the following information as well as a map of the sample locations:

Determination of genetic analysis: ☐ Hybrid ☐ Non-hybrid

Date(s) of sample(s): \_\_\_\_\_ Number of sample locations: \_\_\_\_\_

# Tracking watermilfoil management ANC 2012 treatment report revisions

HERBICIDE RESISTANCE MANAGEMENT QUESTIONS:	CHECK ONE	IF YES, PLEASE EXPLAIN:
Do you have an herbicide tolerance/resistance management plan for this waterbody?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Has native watermilfoil occurred in this waterbody historically?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Has Eurasian watermilfoil occurred in this waterbody historically?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Have you monitored field response to herbicides?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Have you obtained an herbicide susceptibility analysis (e.g., PlanTest)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Are you field testing different chemical protocols?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Are you rotating active ingredients so as to avoid herbicide resistance issues?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Have you obtained a laboratory assay for response to treatment (e.g., EfficTEST)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

# Acknowledgements

- Dr. Ryan Thum, Grand Valley State University
- Dr. Michael Netherland, US Army ERDC
- Dr. Mark Heilman, SePRO
- Dr. Doug Pullman, Aquest
- Paul Hausler and Pam Tynning, Progressive AE
- Aquatic Nuisance Control Program staff
  - Tom Alwin, Eric Bacon, Amanda Whitscell, Brett Wiseley



# DEQ – Aquatic Nuisance Control Program

## Contact information

e-mail: [deq-wrd-anc@michigan.gov](mailto:deq-wrd-anc@michigan.gov)

telephone: 517-241-1554

web address:

[www.michigan.gov/deqinlandlakes](http://www.michigan.gov/deqinlandlakes)

