

The Kettle Lakes of Cortland and Onondaga Counties

Anthropogenic Influences on Aquatic Invasions



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SUNY College of Environmental Science and Forestry
20 August, 2012 – 5833 Meetinghouse Road, Tully, NY

Tonight's Agenda....

Invasion Ecology – Major Concepts

Kettle Lake Research

What we've learned from the 2011 data

Look to the Future

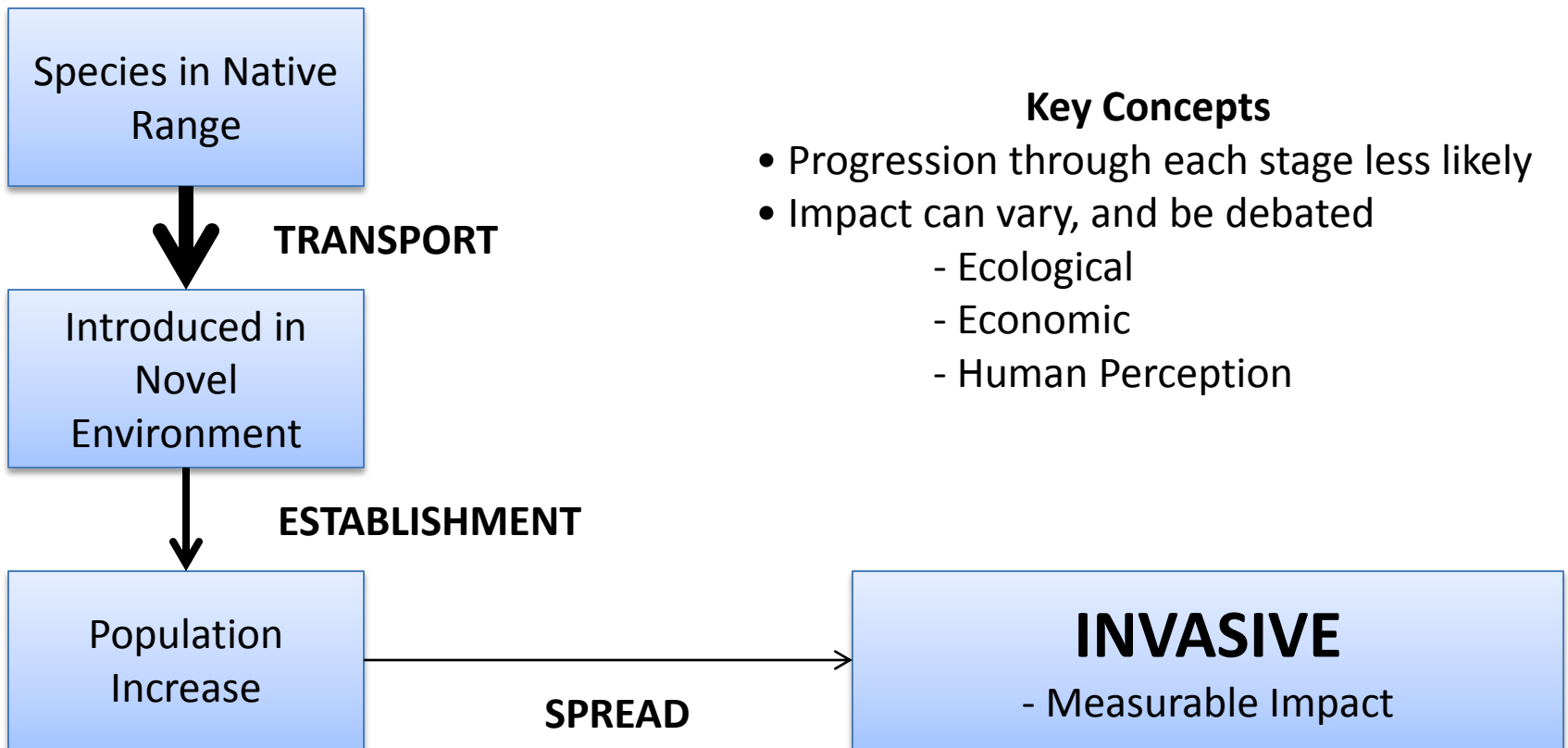
Management Solutions?

Information and Case Studies

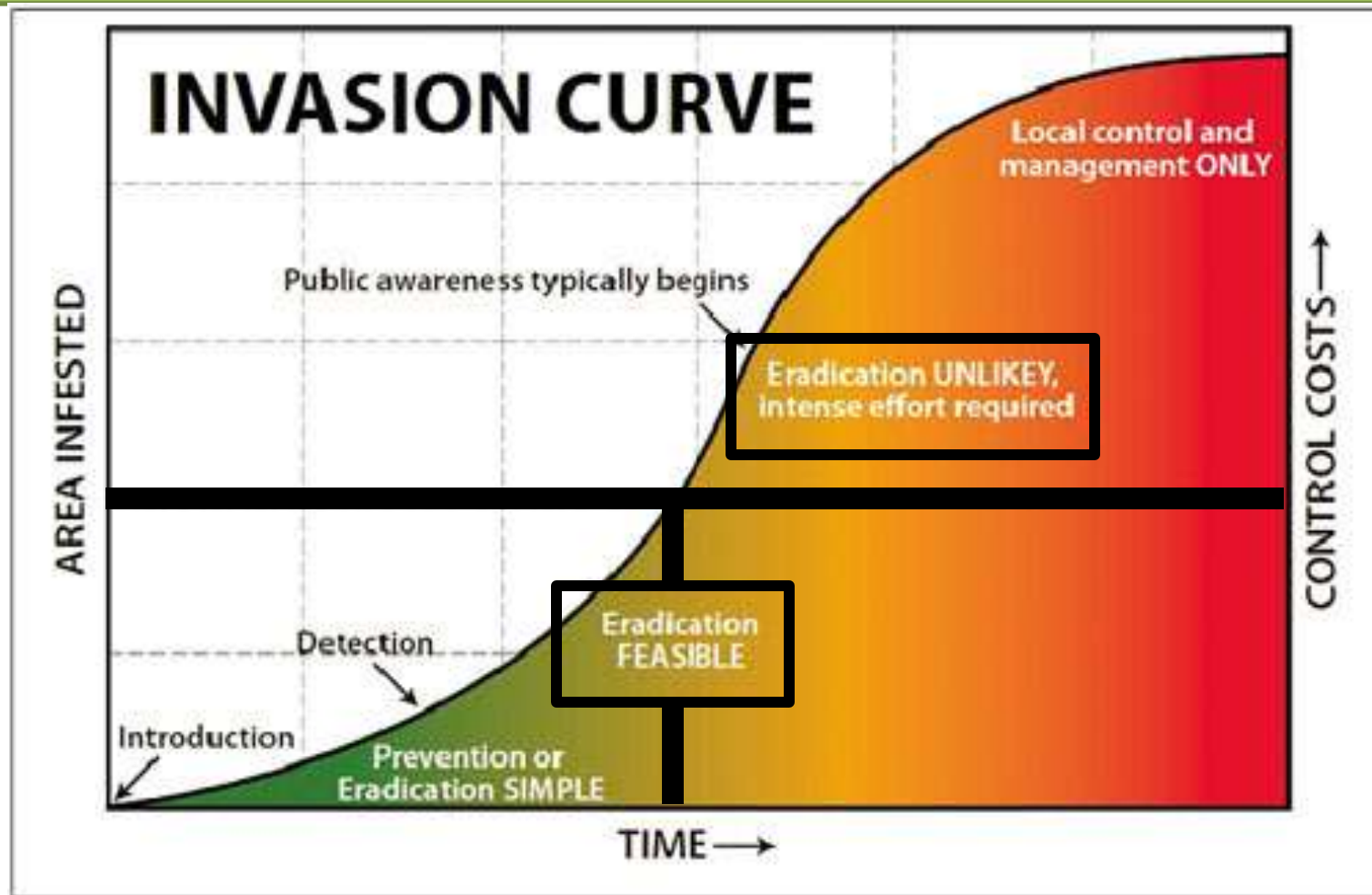
General Discussion and Dialogue

The Invasion Pathway

General Framework of Species Invasions

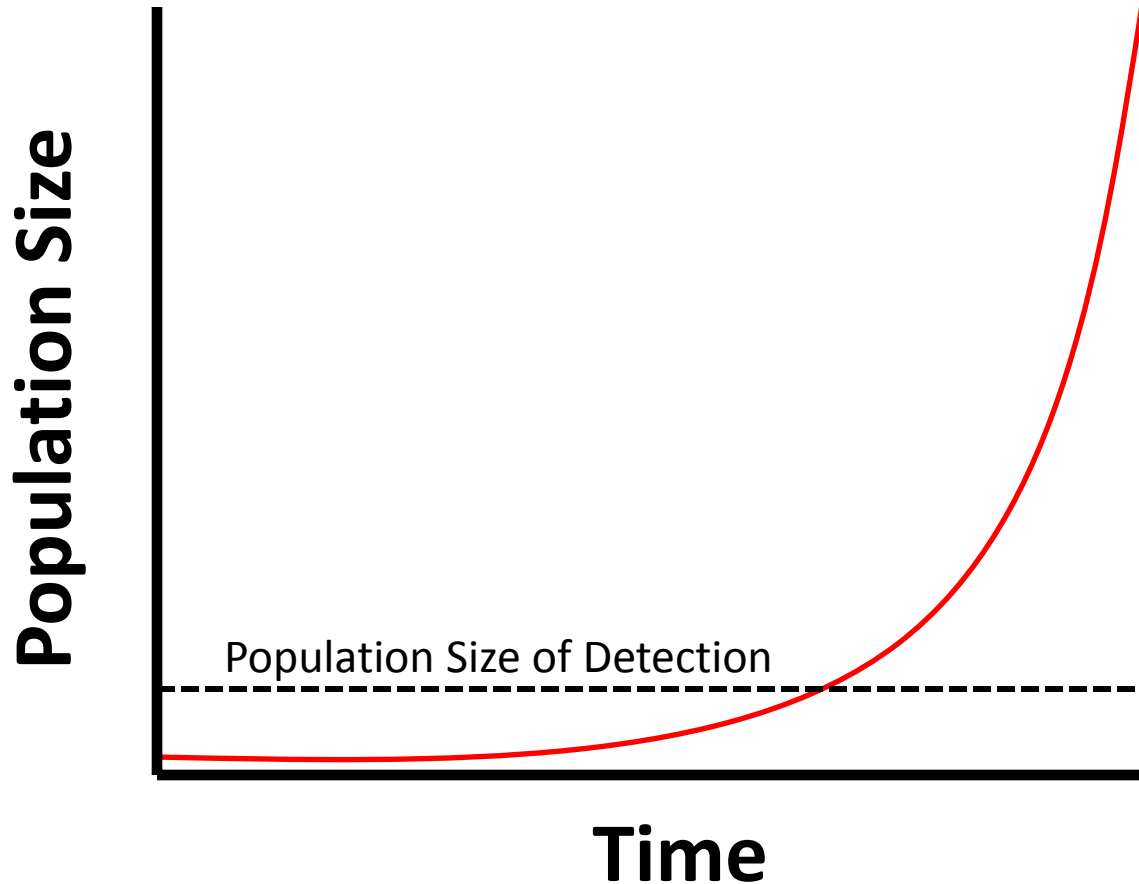


Incorporating Management into Invasion Process



Early Detection is Key for Eradication

The Problem of “Lag”



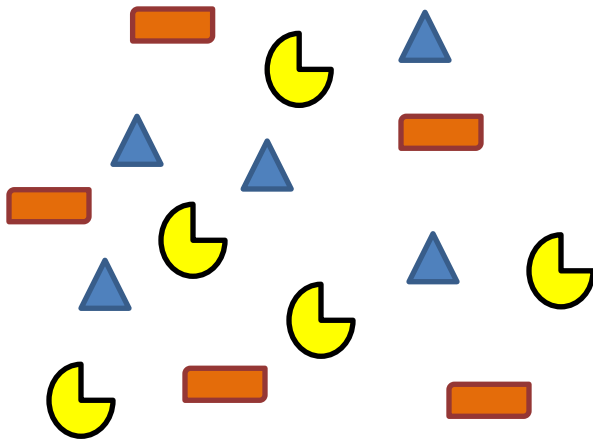
- Often populations too large for eradication once detected
- Lag times poorly understood and largely unpredictable

Ecological Effects of Invasive Spp.

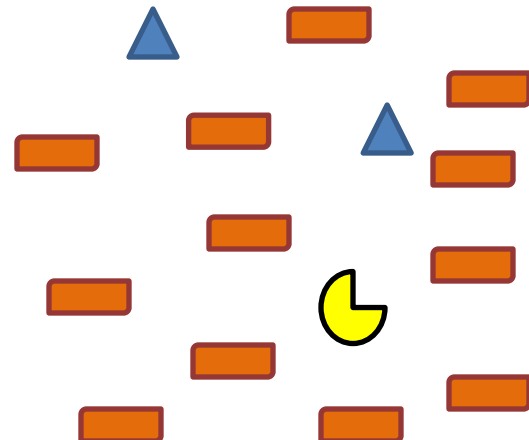
What are the effects of invasive species on **species richness** and **species diversity**?

Species Richness = number of species present

Species Diversity = incorporates species richness, along with evenness/abundance measures



Community 1
Richness = 3
Diversity = High

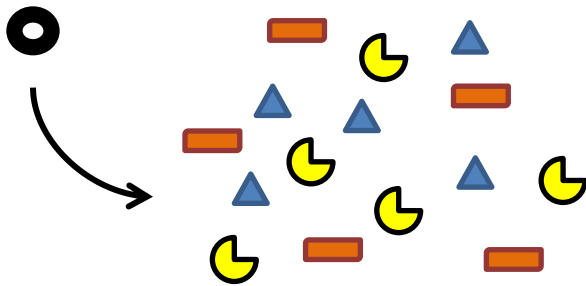


Community 2
Richness = 3
Diversity = Low

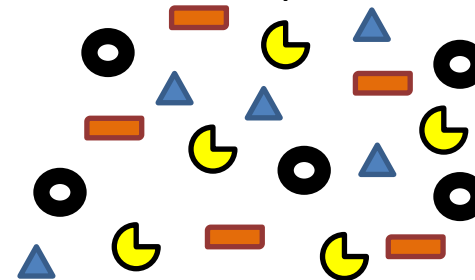
Ecological Effects of Invasive Spp.

Viewpoint 1:

- Invasive species will **increase** overall species richness and species diversity



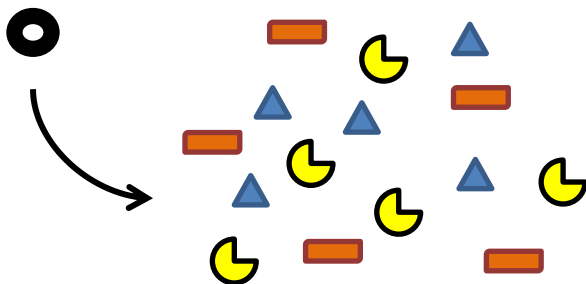
Richness = 3
Diversity = High



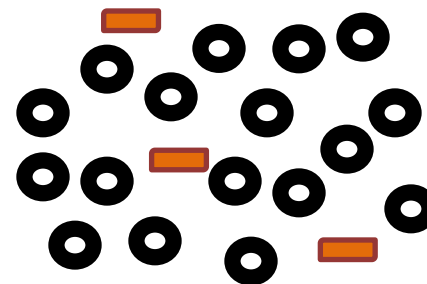
Richness = 4
Diversity = High

Viewpoint 2:

- Invasive species will **decrease** overall species richness and species diversity



Richness = 3
Diversity = High



Richness = 2
Diversity = Low

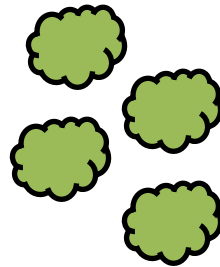
What Factors Lead to Successful Invasions?

Propagule pressure:

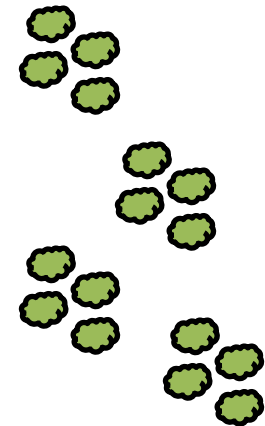
no. of individuals introduced during a single introduction event, and the no. of discrete introduction events

Likelihood
of Invasion

=



+



What Factors Lead to Successful Invasions?

Disturbance:

Broadly defined as any change from normal environmental conditions.

- temporary or permanent
- natural or anthropogenic



SCIENCEPHOTO LIBRARY

What Factors Lead to Successful Invasions?

Disturbance:

- Can create open space for non-native species to colonize
- Lower the competitive ability of native species by altering conditions
- Create competitive advantage for non-native species

In freshwater aquatic ecosystems:

Anthropogenic Disturbance > Natural Disturbance



Septic system failure



Near-lake Development



Initial lake construction

Propagule Pressure or Disturbance....

.....Which is more important?

- Often a strong correlation between human population density and the no. of invasive species present (McKinney 2001)
 - More humans, greater amounts of disturbance

True, but...

- Increased human population density leads to increased propagule pressure

Kettle Lake District of Central New York

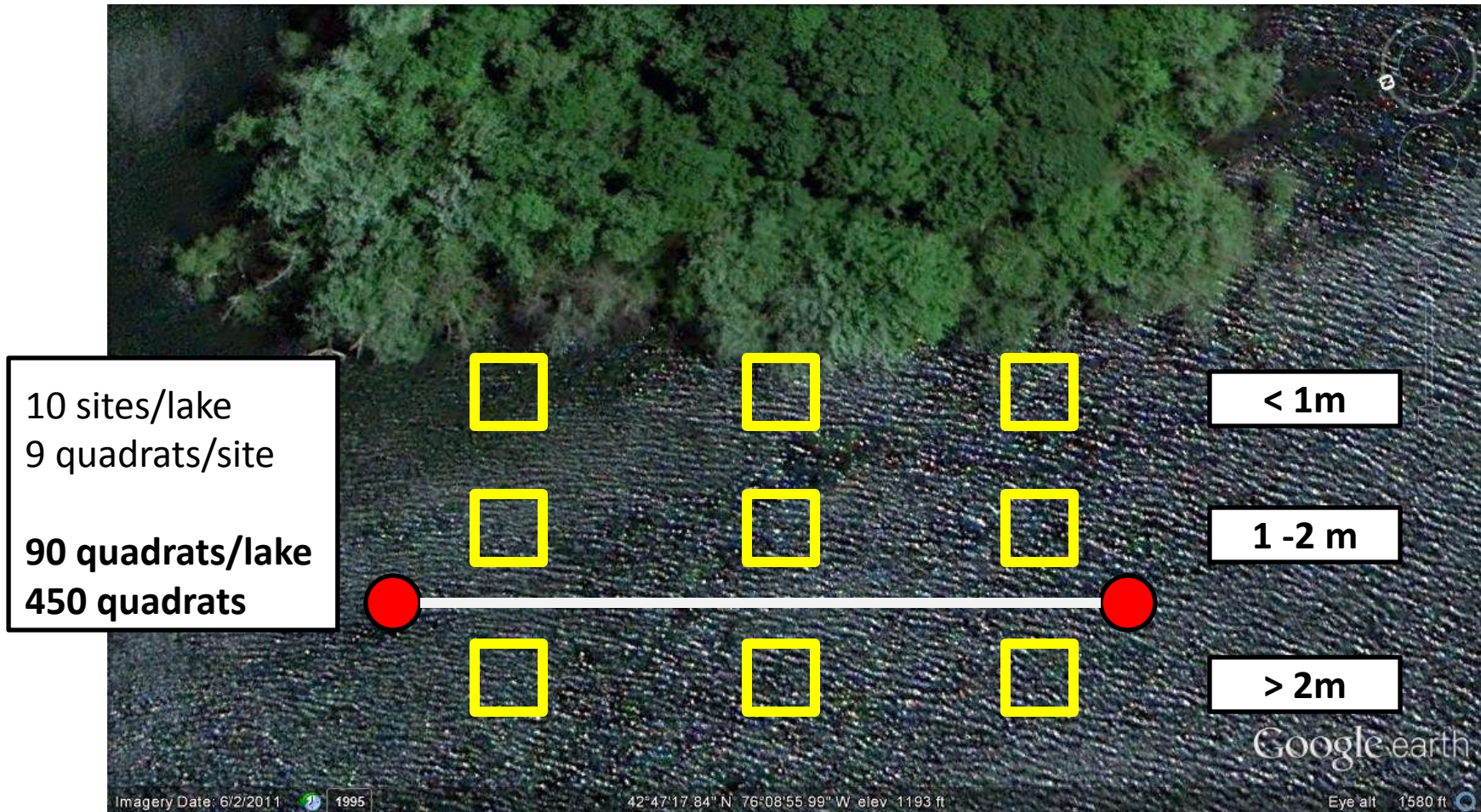
Unique opportunity to test the importance of propagule pressure and disturbance with a *field study* due to existing gradients in access and development

- Able to quantify each separately
- Relate to macrophyte (aka “pond weed”) abundance and community assemblage



Macrophyte Abundance and Community Assemblage

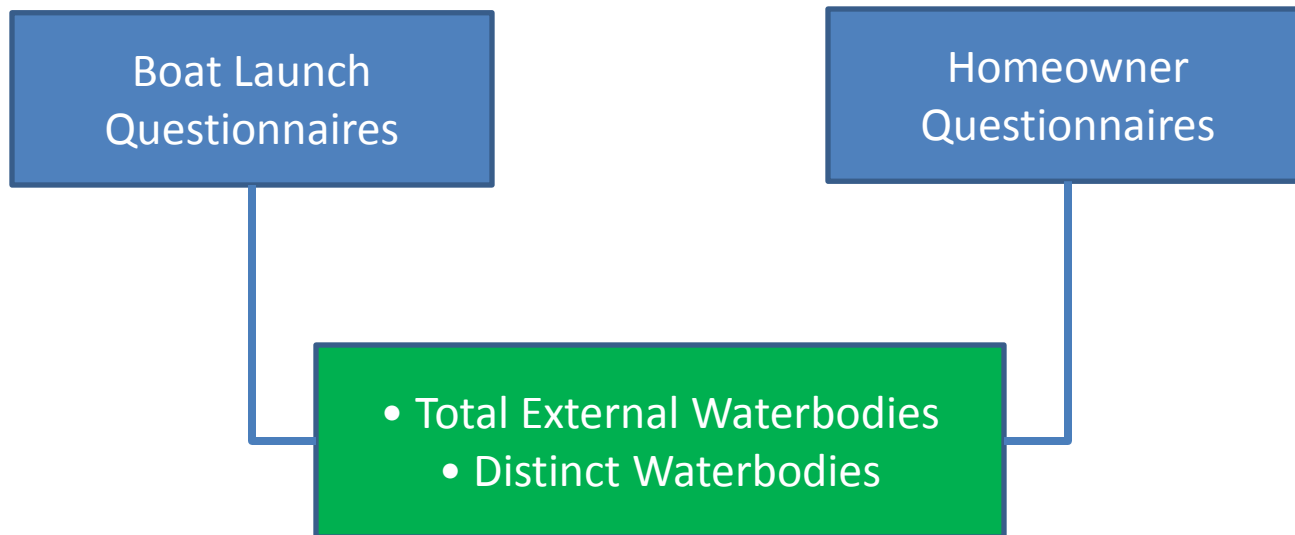
Field Sampling Method:



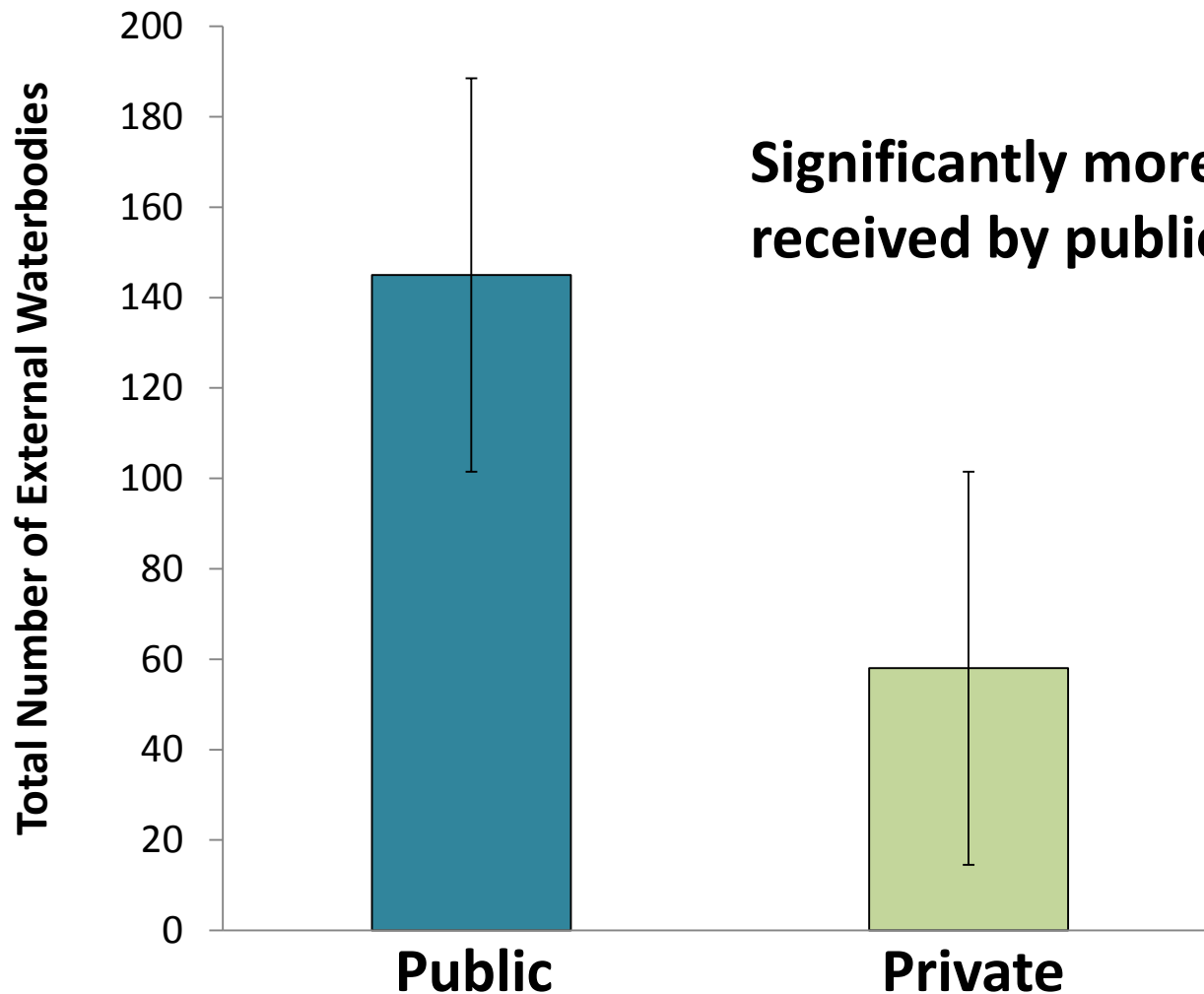
Research Hypothesis -- *Propagule Pressure*

Propagule Pressure:

- (1) *The presence of a boat launch will result in great external water body exposure.*
- (2) *Public access lakes will have greater abundances of invasive species due to increased propagule pressure (e.g., external water body exposure).*



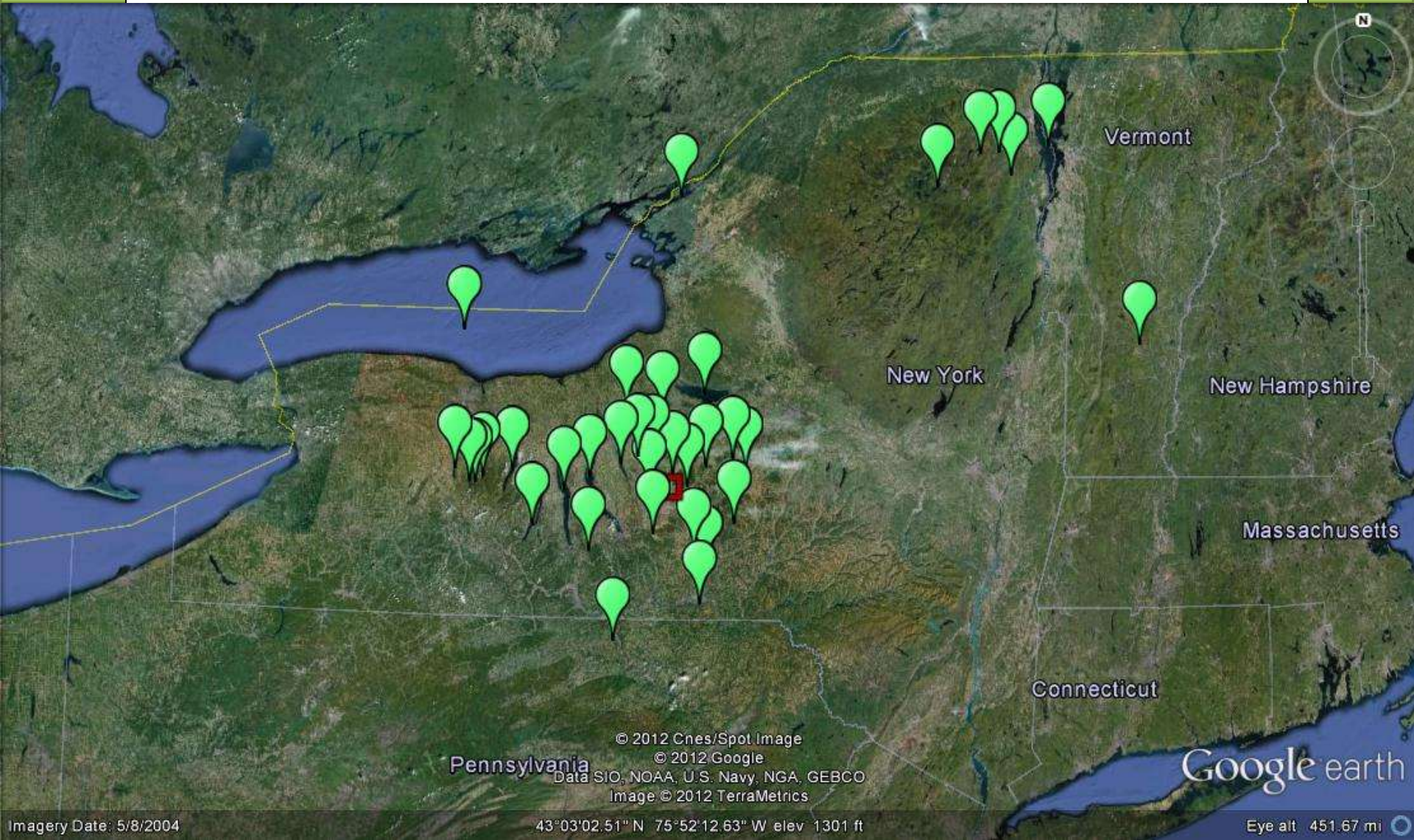
Results -- *Propagule Pressure*



Significantly more external boat traffic received by public access lakes

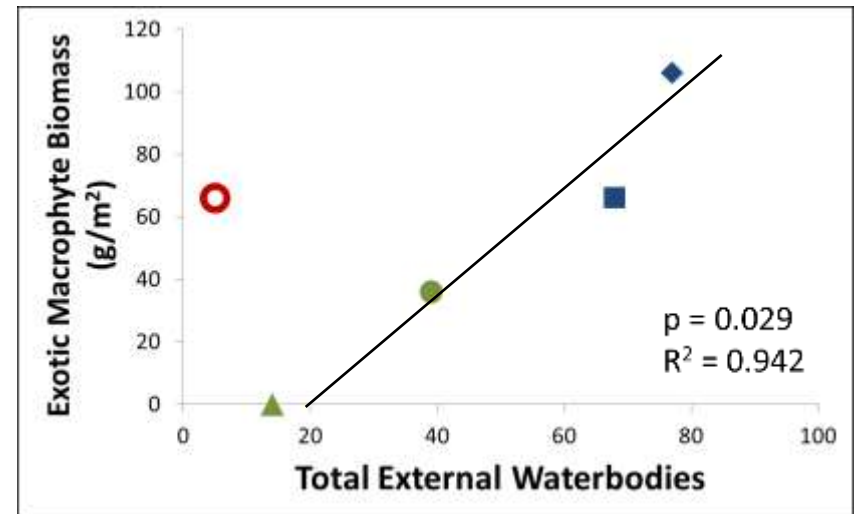
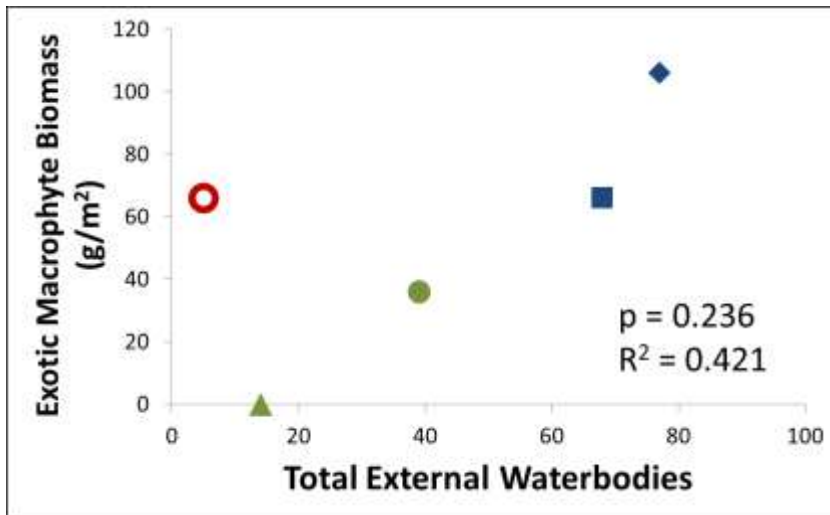
Results -- *Propagule Pressure*

Does this increase in boat traffic relate to exotic macrophyte biomass?



Results -- *Propagule Pressure*

◆ Little York Lake ■ Tully Lake ▲ Song Lake ● Crooked Lake ○ Gatehouse Pond



- No significant relationship between exotic macrophyte biomass (g/m²) and total external waterbodies
- When Gatehouse Pond (former public access) is excluded from the analysis, strong relationship

Research Hypothesis -- *Disturbance*

Disturbance:

(1) *Increased disturbance will result in increased abundances of invasive species.*

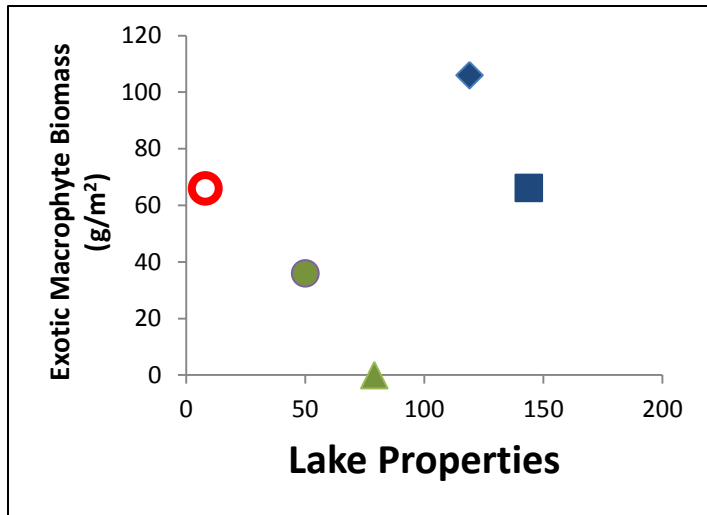
- *Dwelling density (no./km)*
- *Septic system maintenance*

- Determined the number of dwellings using Google Earth
- History of septic system maintenance determined through Homeowner Questionnaires

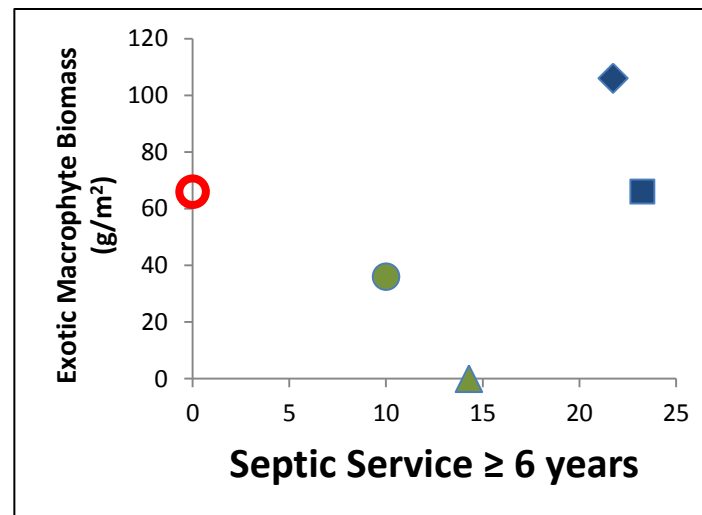
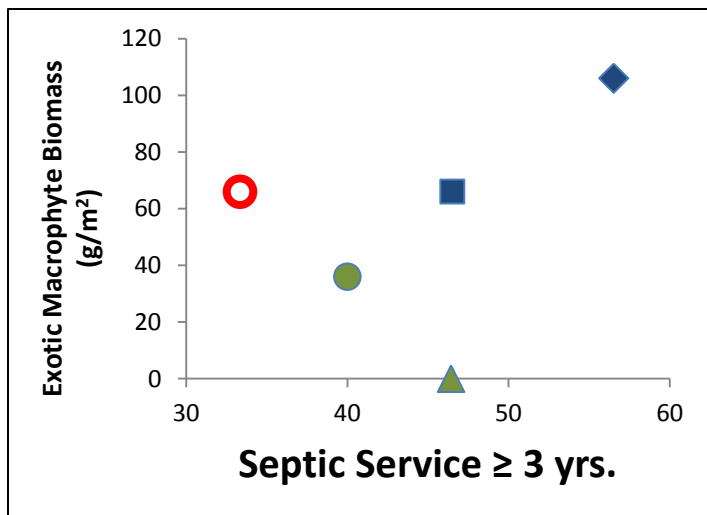


Results -- *Disturbance*

◆ Little York Lake ■ Tully Lake ▲ Song Lake ● Crooked Lake ○ Gatehouse Pond



No significant relationship with any of the estimates of disturbance



Research Hypothesis --

Native Spp. Richness and Diversity

Species Richness and Diversity:

(1) Public access lakes will have reduced native species richness and diversity as a result of increased abundances of invasive species.

EstimateS *Statistical Estimation
of Species Richness
and Shared Species
from Samples*

Version 8.2

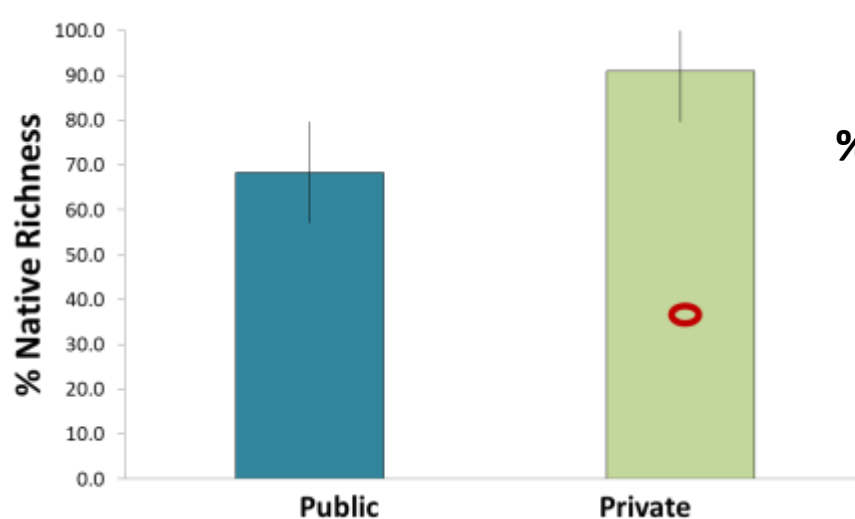
Developed by R.K. Colwell, University of Connecticut

Software that calculates a variety of biodiversity estimates

- Species richness and diversity

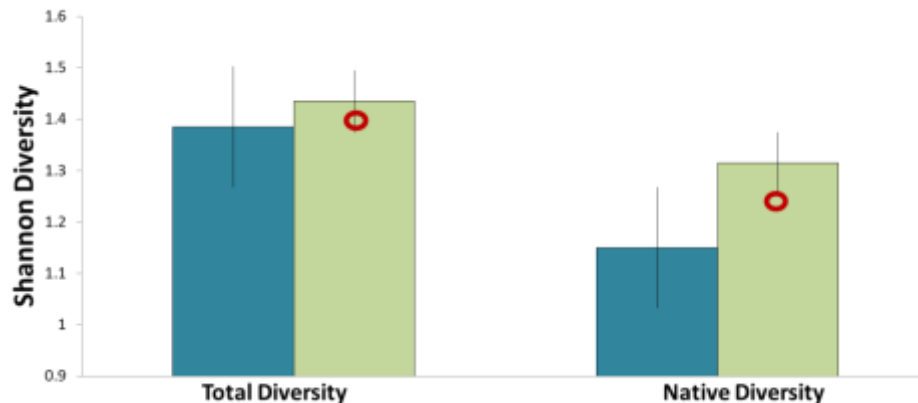
Results --

Native Spp. Richness and Diversity



% Native Richness = percentage of native species out of total species richness

DECREASED native spp. richness in public access lakes



Total spp. diversity and native spp. diversity LOWER in public access lakes

Results Summary

Propagule Pressure:



(1) The presence of a boat launch will result in great external water body exposure.

(2) Public access lakes will have greater abundances of invasive species due to increase propagule pressure (e.g., external water body exposure).

Disturbance:



(1) Increased estimates of disturbance will result in increased abundances of invasive species.

Species Richness and Diversity:



(1) Public access lakes will have reduced native species richness and diversity as a result of increased abundances of invasive species.

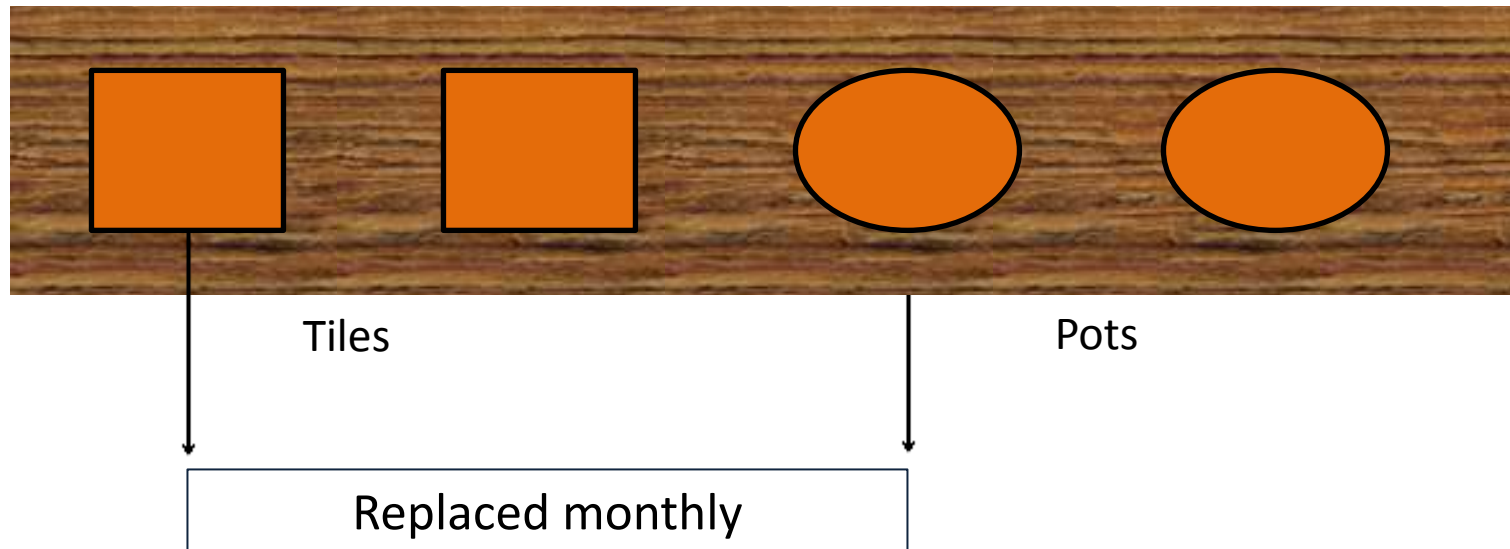
Continuing Work

2012

Continuing Boat Launch Questionnaires

Macrophytes – same as 2011; another season's worth of data.

Benthic invertebrates – placement of artificial substrates to passively sample invertebrate community



Management Options

Prevention, Prevention, Prevention

Strategies:

(1) Voluntary cleaning stations

Advantage: low cost, rapid installation

Disadvantage: compliance



Management Options

Prevention, Prevention, Prevention

Strategies:

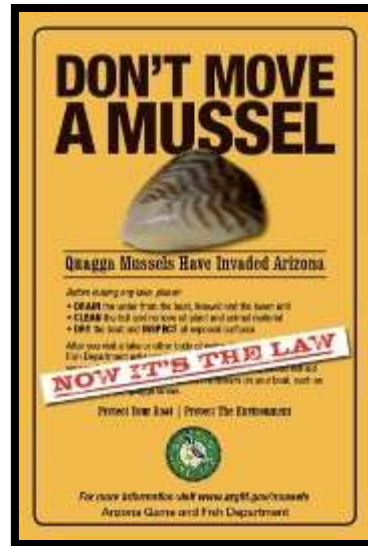
(2) Educational campaigns

Advantage: can personalize message to target audience (e.g., anglers)

Disadvantage: potential time and resources to initiate



Courtesy of Crescent Lake Assoc.



Courtesy Arizona Game and Fish



Courtesy of OSMB

Management Options

Prevention, Prevention, Prevention

Strategies:

(3) Mandatory cleaning stations

Advantage: likely most effective

Disadvantage: large resource/time demand; implementation



Courtesy of Minnesota DNR



Courtesy of Missouri River Fly Fishing Blog

Case Study 1

Strategies from Minnesota

Developed a Statewide Management Plan in 2009:

- Purpose is to have a framework in place to “*coordinate and guide*” efforts that prevent introductions, limit spread, and assist in management

Element I. Prevention

Desired Outcome: Participants will actively seek to prevent the introduction of new invasive species in Minnesota

Element II. Early Detection, Rapid Response, and Containment

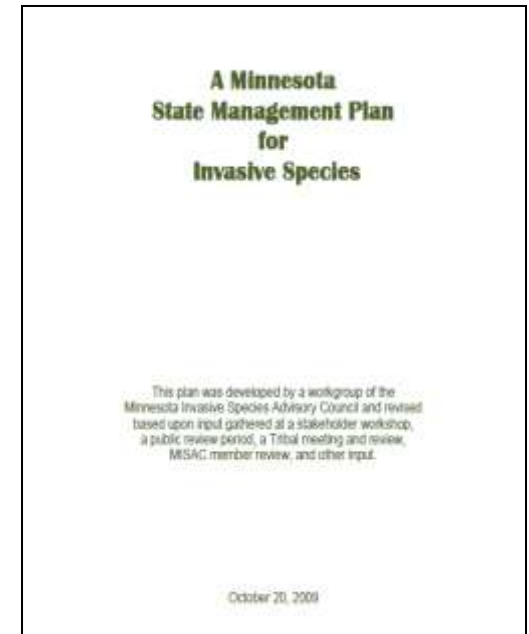
Desired Outcome: Participants will work to detect new invasive species infestations and support the infrastructure necessary to rapidly eradicate, or suppress, and contain high priority infestations.

Element III. Management of Invasive Species

Desired Outcome: Participants will work to reduce the impacts caused by established invasive species to Minnesota’s ecology, society, and economy.

Element IV. Leadership and Coordination

Desired Outcome: Participants will seek to collaborate with intrastate, interstate, and international partners to help coordinate invasive species related efforts.



What about New York State?

NYS does have a management plan:

Aquatic Nuisance Species State Management Plan (ANS SMP)

Goal 1. Provide effective and efficient ANS program management.

Goal 2. Prevent the introduction of new AIS into the waters of New York State and enforce ANS Laws and Regulations.

Goal 3. Control the spread of ANS species to new water bodies within the state, and mitigate adverse ecological, societal, and economic impacts resulting from an ANS introduction.

Goal 4. Involve and motivate the general public to take steps to prevent new ANS introductions and control the spread of ANS through education.

Goal 5. Encourage, promote, and support ANS research in New York State

Strong language and goals like Minnesota – why don't we hear more about these plans?

What about New York State?

Appears that *implementation* of the ANS state management plan has been difficult

Obstacles: (summarized from NYS DFWMR)

- Coordinator allocated 15% of available staff time to work on ANS-related activities
= **33 days per year**
- ANS management never a DEC or DFWMR “high program priority”
 - viewed as an outside mandate
- Financial austerity occurring though NYS
- Lack of coordinated public support or interest
 - many separate groups interested, but little coordination
 - most interested groups are local lake associations, concerned on local level never reaching statewide “critical mass”

Area for improvement on a regional scale

Case Study 2

Adirondack Park Calls on State Government

Spiny water flea (*Bythotrephes longimanus*) recently discovered in Lake George and Champlain Canal

- Fear amongst environmental organizations and park residents about spread into ADK

Adirondack Council – called on Governor Cuomo to establish boat washing/inspections stations at **ALL** state boat launches in the park.

“Recreational boaters and anglers, especially those who live in the Adirondacks, want to be part of the solution, not the problem.....but we have to give them the information and equipment they need to prevent the introduction of destructive, non-native species to the lakes and rivers we all enjoy”

- Brian L. Houseal, Adirondack Council Executive Director



Courtesy US Army Corp Engineers



Courtesy MA DCR



Courtesy Minnesota Sea Grant

Case Study 3

Otsego Lake and Zebra Mussels

Otsego Lake

- Cooperstown, NY
- 74 mi² watershed
- approx. 5,000 people
- public boat launch



Courtesy of SUNY Oneonta Biological Station

Concern about zebra mussel (and other) invasions lead to multiple actions:

2001 – DEC grant (to SWCD) to buy 2 high pressure steam power washers

2003 – Public boat launch inspections

- May thru October = all incoming boats and trailers inspected



Courtesy of USGS

Zebra mussels discovered in lake summer of 2007

Case Study 4

A Partnership between a Lake Association and Academia

Saratoga Lake and Paul Smith's College

- Monitoring boats launched on the lake for all taxa of invasive species

**All boats that enter or leave the boat launch
Are inspected, with support from Paul Smith's
College Adirondack Watershed Steward
Program**



Photos courtesy of The Saratogian

Courtesy vicsailor.com

Acknowledgements and Funding

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Crooked Lake – Tom Cappa, Niles Brown

Tully Lake – Dan Johnston, Chris Kruth

Song Lake – Carl and Marjorie Grillo, Tony George, Tarki and Joe Heath

Gatehouse Pond – Geoff Eckerlin, Mark and Suzanne Drumm

Resources

Minnesota State Information:

http://files.dnr.state.mn.us/natural_resources/invasives/state_invasive_species_plan.pdf

http://www.dnr.state.mn.us/grants/aquatic_invasive/watercraft_inspections.html

- Grants available in Minnesota for DNR to monitor boat launches
- Interesting information about programs and types of organizations eligible

New York State Information:

<http://www.glc.org/ans/documents/SMP-Briefing-Paper-Draft-Aug31-07-web.pdf>

Otsego Lake Information:

http://www.otsegosoilandwater.com/Otsego_Lake_Management_Plan.pdf