

Scanning the horizon: identifying new aquatic invasive species and where they may arrive in Michigan

Alisha Davidson

Michigan Lake and Stream Associations



Aquatic Invasive Species (AIS)



- Over 180 AIS in the Great Lakes
- Historically, many AIS arrived via opening of canals (St. Lawrence Seaway)
- Recently, many AIS arrived via ballast water
- Currently, many AIS arrive via trade (aquarium and water garden stores; online orders)



Common invaders from the Great Lakes



Aquatic Invasive Species (AIS)



- Vector: how a species is transported from one place to another



How do we manage AIS?



- Management involves
 - ✓ prevention
 - ✓ EDRR (early detection and rapid response)
 - ✓ control

How do we manage AIS?

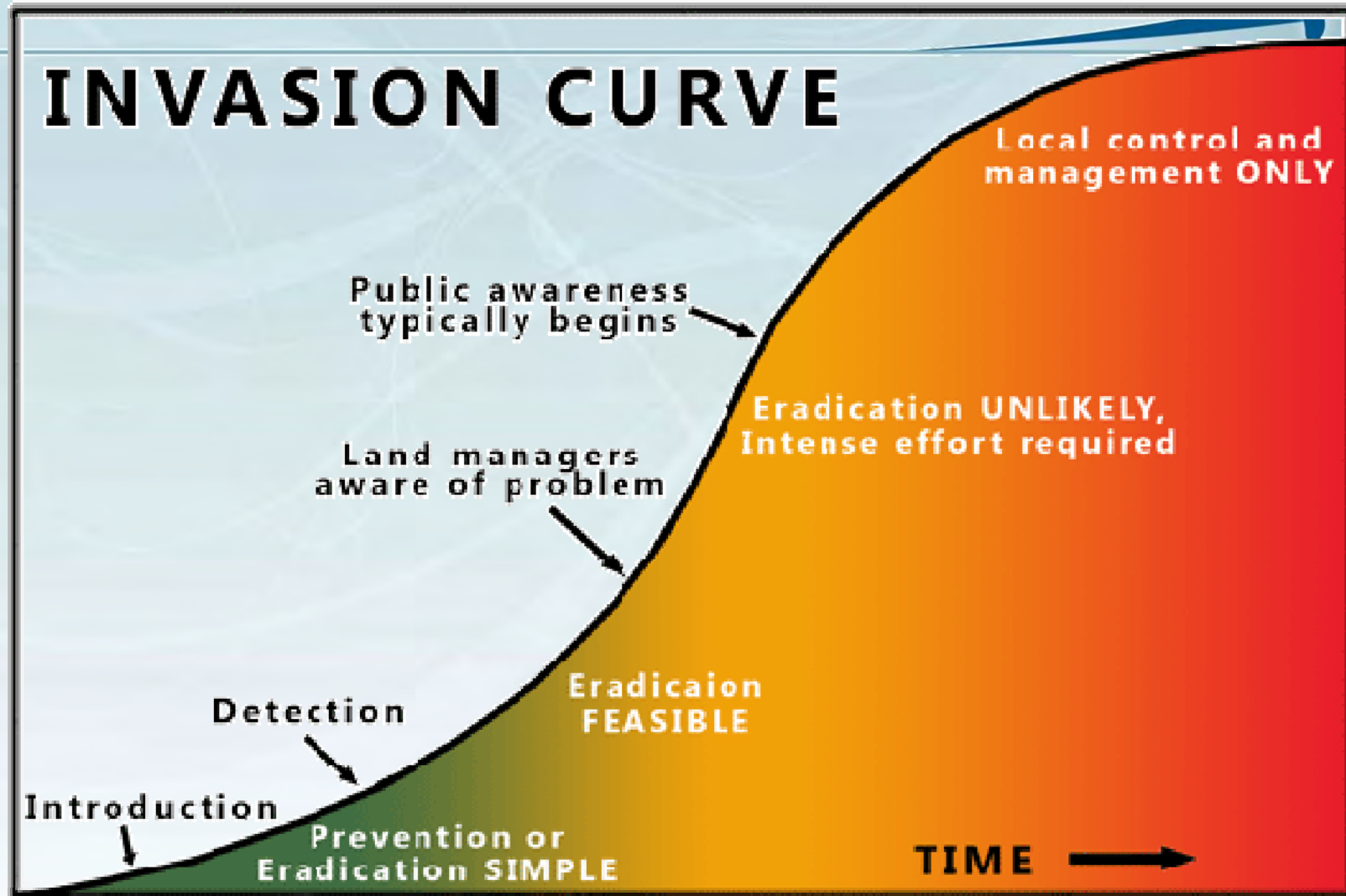


- Management involves
 - ✓ prevention
 - ✓ **EDRR (early detection and rapid response)**
 - ✓ control
- EDRR uses risk estimates to prioritize active monitoring and other management actions

The screenshot shows the homepage of the Great Lakes Early Detection Network. At the top, there is a logo and the title "Great Lakes Early Detection Network". Below the title is a navigation menu with links for "Home", "Members", "Alerts", "Maps", "In Depth", and "Contact Us". The main content area features a map of the Great Lakes region. To the left of the map, there is a text block that reads "We are an invasive species network offering ..." followed by a list of services: "- Customized alerts", "- Verification services", and "- Data integration and mapping services". To the right of the map, there are three prominent buttons: "Report An Invasive Species" (orange), "Sign Up For Alerts" (yellow), and "Verify Reports" (green).

INVASION CURVE

AREA INFESTED ↑



CONTROL COSTS ↑

TIME →

Lag Phase

Exponential Growth

Carrying Capacity

Project Overview



- Great Lakes Restoration Initiative project, “Mapping Cumulative Risks to Prioritize Prevention Efforts”
- Goals:
 - Identify WHAT species may arrive
 - Identify HOW and WHERE species may arrive
- Allow prioritization of locations for monitoring (early detection & rapid response)



Project Overview



- Approach:
 - Develop watchlist (the “WHAT”)
 - Species assessments (the “HOW”)
 - Map vector intensity (the “WHERE”)

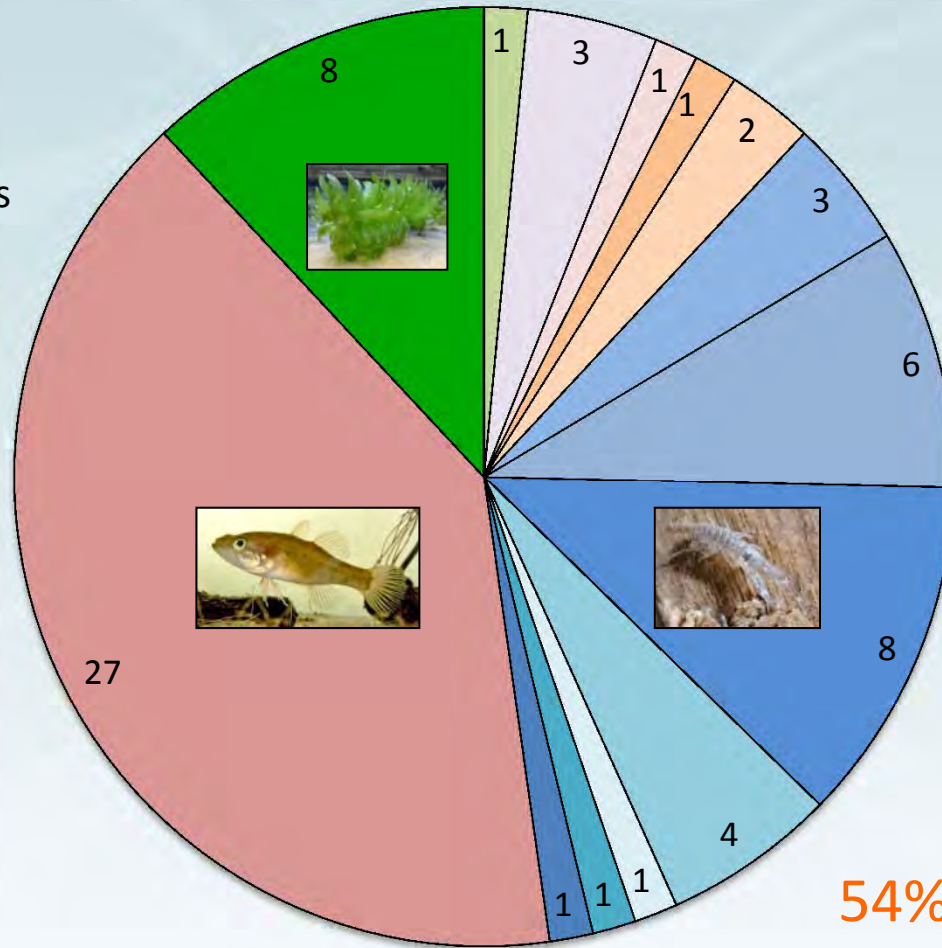
Project Overview



- Approach:
 - **Develop watchlist (the “WHAT”)**
 - Species assessments (the “HOW”)
 - Map vector intensity (the “WHERE”)

Watchlist species composition (n = 67)

- Bryozoans
- Rotifers
- Platyhelminthes
- Polychaetes
- Bivalves
- Cladocerans
- Copepods
- Amphipods
- Mysids
- Tanaids
- Crabs
- Crayfishes
- Fishes
- Plants



54% Ponto-Caspian

Water hyacinth*

- *Eichhornia crassipes*
- Found in Detroit River, Lake St. Clair, Wisconsin, Illinois
- One of the world's “worst” aquatic weeds
- Forms dense stands that threaten biodiversity and increase sedimentation
- Impedes recreation



Parrot feather*

- *Myriophyllum aquaticum*
- Found in Wayne County, Indiana
- Can outcompete native species, lead to anoxic conditions
- Impedes recreation



European frog-bit*



- *Hydrocharis morsus-ranae*
- Found in Lake Erie, Detroit River, Lake St. Clair, Saginaw Bay, Alpena area, Munuscong Bay
- Crowds out and shades native plants
- Can lead to low oxygen conditions
- Impedes recreation

Zander, pikeperch

- *Sander lucioperca*
- Found in North Dakota
- Intentional release of eggs or adults
- Eggs may be transferred in organic material
- A top predator that can prey on Great Lakes species including brown trout, perch and salmonids



Project Overview



- Approach:
 - Develop watchlist (the “WHAT”)
 - **Species assessments (the “HOW”)**
 - Map vector intensity (the “WHERE”)

Great Lakes Watchlist Species Assessment

```
graph TD; A[Great Lakes Watchlist Species Assessment] --- B[Potential for Introduction]; A --- C[Potential for Establishment]; A --- D[Potential for Impact];
```

Potential for
Introduction

Potential for
Establishment

Potential for
Impact

Potential for Introduction

- Shipping
- Hitchhiking/fouling
- Unauthorized intentional release
- Stocking/planting/escape from recreational culture
- Escape from commercial culture
- Dispersal



Introduction – how will it get here?

POTENTIAL INTRODUCTION VIA UNAUTHORIZED INTENTIONAL RELEASE

3a) Is this species sold at aquarium/pet/garden stores (“brick & mortar” or online), catalogs, biological supply companies, or live markets (e.g., purchased for human consumption, bait, ornamental, ethical, educational, or cultural reasons) and as a result may be released into the Great Lakes basin?

Yes, this species is available for purchase.	100
No, this species this species is rarely/never sold.	0
Unknown	U

-

3b) How easily is this species obtained within the Great Lakes region (states/provinces)?

This species is widely popular, frequently sold, and/or easily obtained within the Great Lakes region.	Score x 1
This species is widely popular, and although trade, sale, and/or possession of this species is prohibited, it is frequently sold on the black market within the Great Lakes region.	Score x 0.5
This species is not very popular or is not easily obtained within the Great Lakes region.	Score x 0.1
Unknown	U

-

Establishment – will it survive?

1) How would the physiological tolerance of this species (survival in varying temperature, salinity, oxygen, and nutrient levels) be described?



This species has broad physiological tolerance. It has been reported to survive in wide ranges of temperature (0°C-30°C), salinity (0-16 parts per thousand), oxygen (0-saturated), AND nutrient (oligotrophic-eutrophic) levels.	9
This species has somewhat broad physiological tolerance. It has been reported to survive in a wide range of temperature, salinity, oxygen, OR nutrient levels. Tolerance to other factors is narrower, unknown, or unreported.	6
This species has narrow physiological tolerance. It has been reported to survive in limited ranges of temperature, salinity, oxygen, and nutrient levels.	3
Unknown	U

•

2) How likely is it that any life stage of this species can overwinter in the Great Lakes (survive extremely low levels of oxygen, light, and temperature)?

Likely (This species is able to tolerate temperatures under 5°C and oxygen levels ≤ 0.5 mg/L)	9
Somewhat likely (This species is able to tolerate some of these conditions OR has adapted behaviorally to avoid them)	6
Somewhat unlikely (This species is able to tolerate conditions close to those specified, but it is not known as an overwintering species)	3
Unlikely	0
Unknown	U

Impact – what will it do?

E1) Does the species pose some hazard or threat to the health of native species (e.g., it magnifies toxin levels; is poisonous; is a pathogen, parasite, or a vector of either)?



Yes, and it has impacted threatened/endangered species, resulted in the reduction or extinction of one or more native populations, affects multiple species, or is a reportable disease	6
Yes, but negative consequences have been small (e.g., limited number of infected individuals, limited pathogen transmissibility, mild effects on populations and ecosystems)	1
Not significantly	0
Unknown	U

-

E2) Does it out-compete native species for available resources (e.g., habitat, food, nutrients, light)?

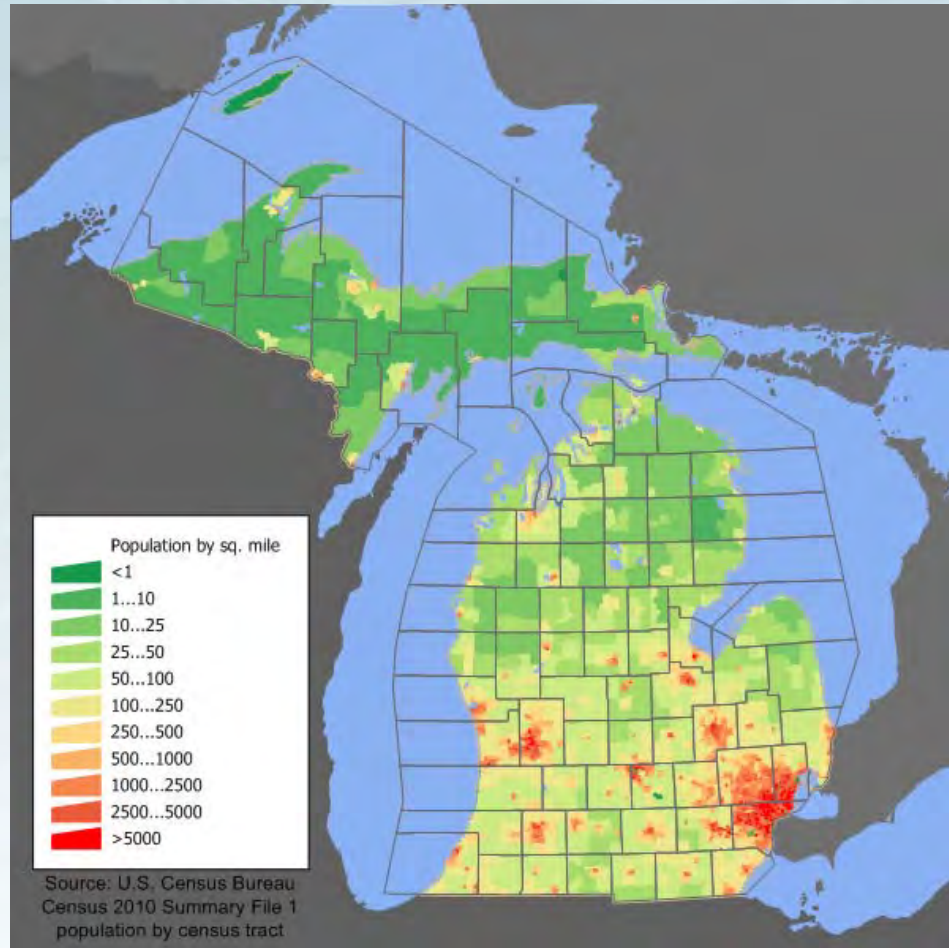
Yes, and it has resulted in significant adverse effects (e.g., impacted threatened/endangered species or caused critical reduction, extinction, behavioral changes including modified spawning behavior) on one or more native populations	6
Yes, and it has caused some noticeable stress to (e.g., decrease in growth, survival, fecundity) or decline of at least one native population	1
Not significantly	0
Unknown	U

-

Project Overview



- Approach:
 - Develop watchlist (the “WHAT”)
 - Species assessments (the “HOW”)
 - **Map vector intensity (the “WHERE”)**



Vectors included in map

- Shipping
- Hitchhiking/fouling
- Unauthorized intentional release
- Stocking/planting/escape from recreational culture
- Escape from commercial culture
- Dispersal



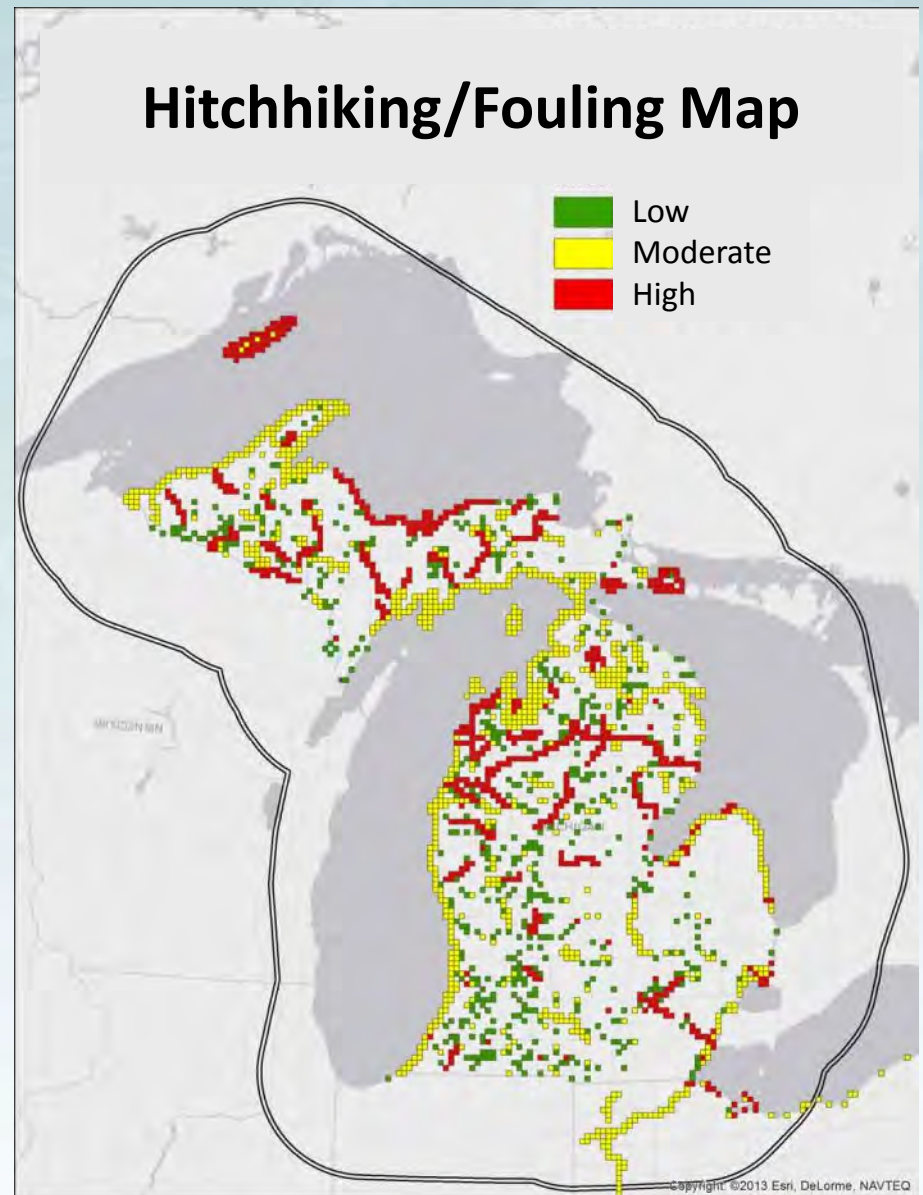
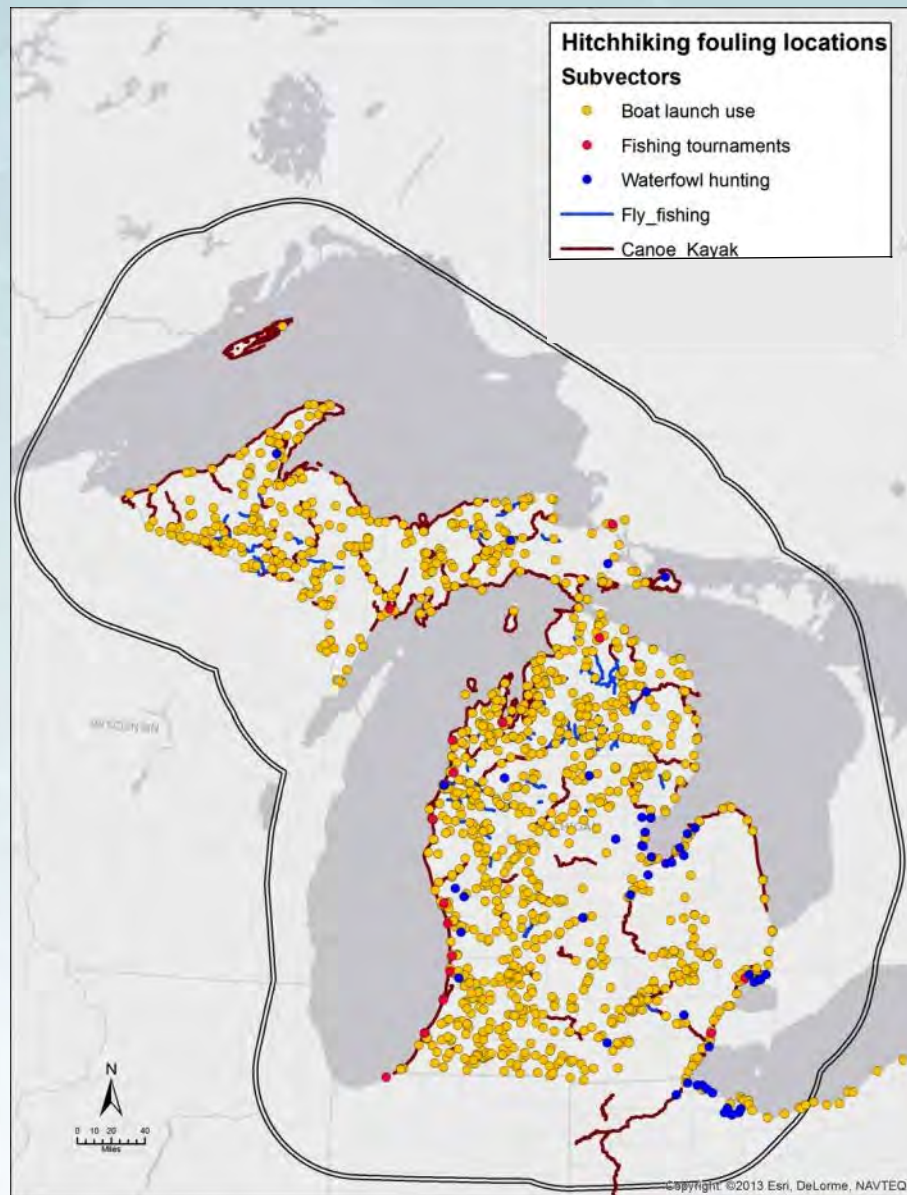
Vector Data Sources

1. Shipping (ballast water discharge volumes)

Vector Spatial Data Sources

2. Hitchhiking/fouling

- a. Recreational boating (launch size)
- b. Tournament fishing (% out of state)
- c. Fly fishing (popularity)
- d. Canoe/kayaking (popularity)
- e. Waterfowl hunting (popularity)



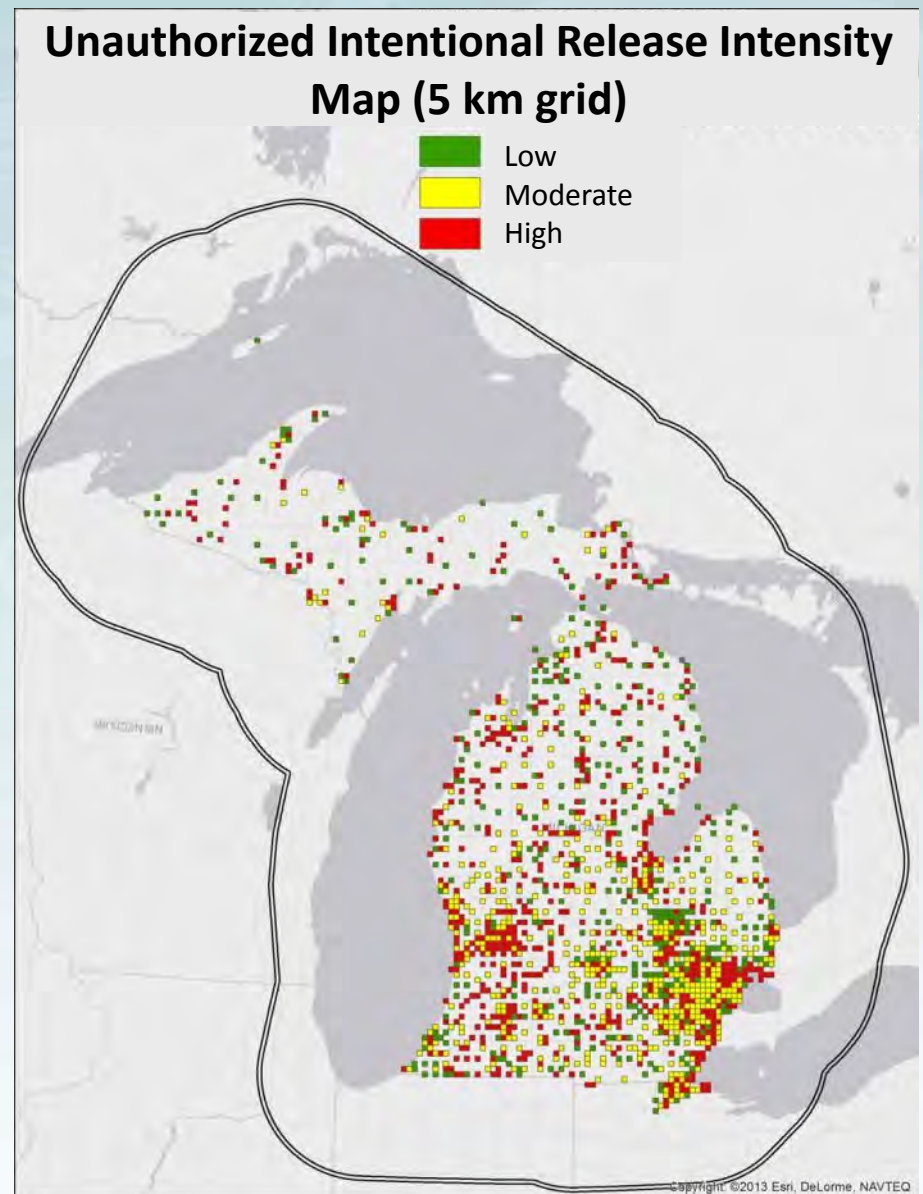
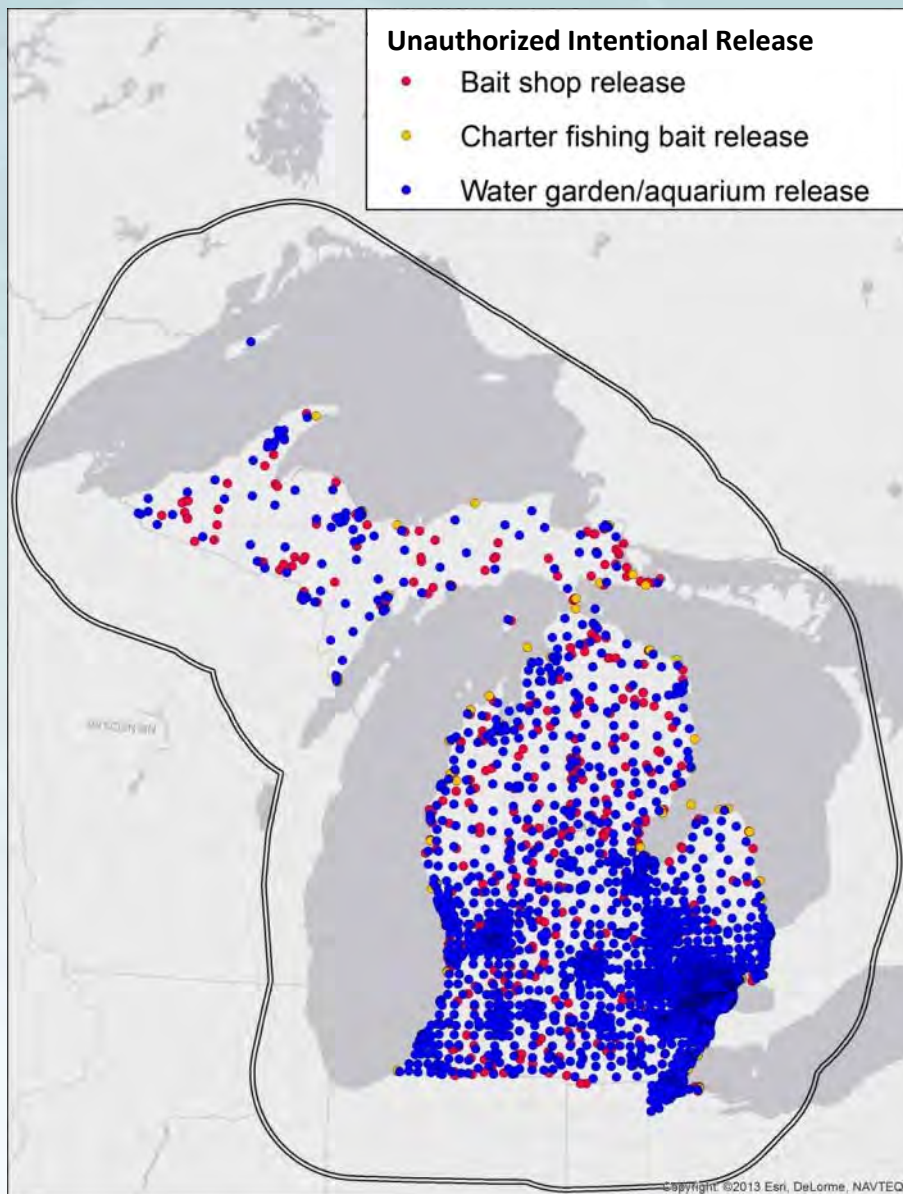
Vector Spatial Data Sources

3. Unauthorized intentional release

a. Aquarium release (4.8% * pop.)

b. Bait release (shop locations)

c. Charter fishing (# boats @ marina)



Vector Spatial Data Sources

4. Stocking/Planting/Escape from recreational culture
 - a. Water garden shops (shop locations)

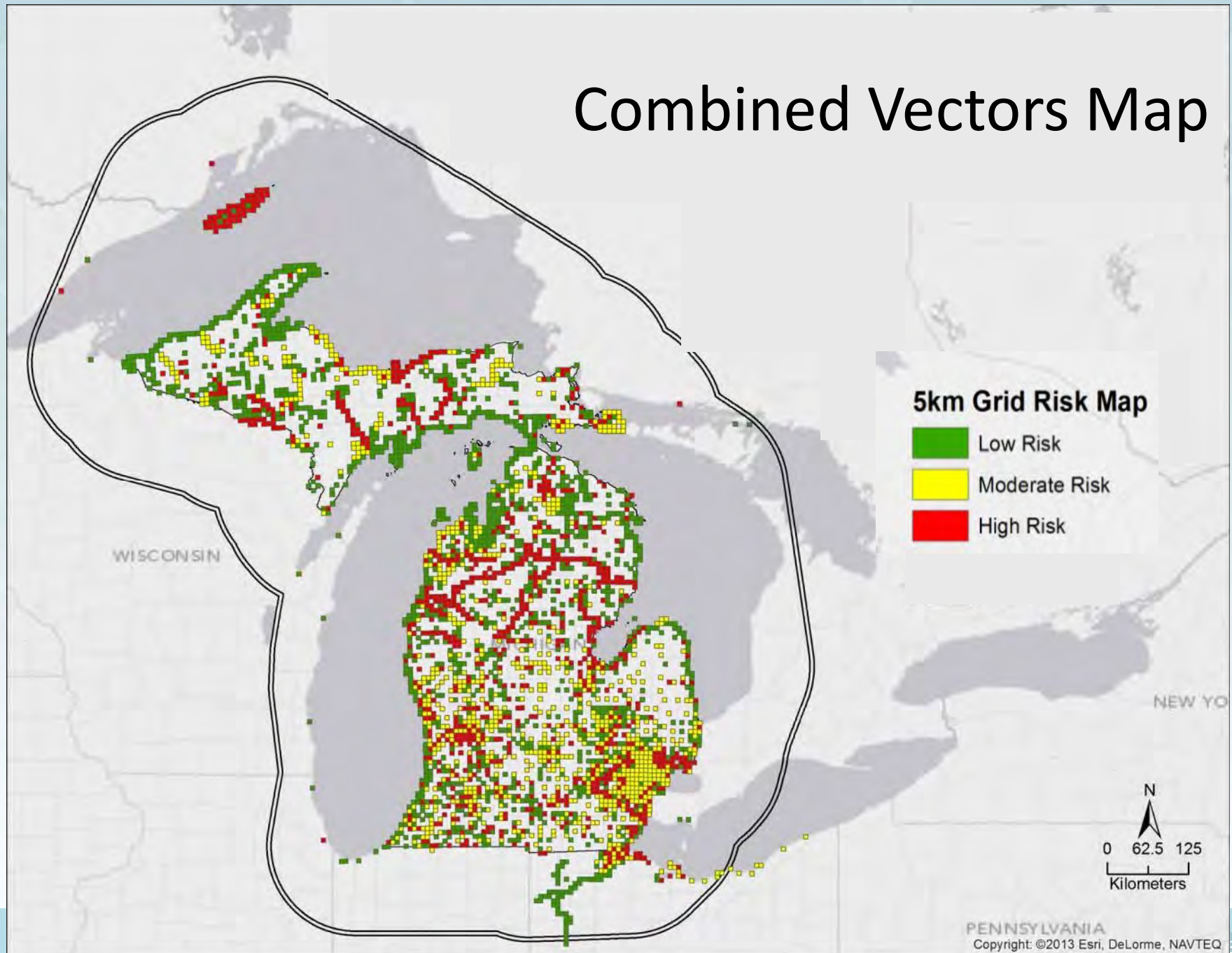
Vector Spatial Data Sources

- 5. Escape from commercial culture
 - a. Aquaculture facilities (facility locations)

Vector Spatial Data Sources

6. Dispersal (point of entry w/in 100 km buffer zone)

Combined Vectors Map



Applications

- Final maps & layers to be available for managers
 - By taxonomic/functional groups
 - By vector
 - By region
- Guide planning and monitoring decisions
- Inform user groups
- Flexibility to be a “living” framework

Community involvement



- If you see something new – report it!
- Government agencies depend on lake users to be their eyes and ears on the lakes
- Midwest Invasive Species Information Network (MISIN) www.misin.msu.edu
- Species information – can find information for most invasive species around the Great Lakes

Acknowledgements



Ed Rutherford
David Reid



Rochelle Sturtevant
Pat Charlebois



Pam Fuller



WAYNE STATE
UNIVERSITY

Donna Kashian
Abigail Fusaro



GLANSIS EXPERT REVIEW PANEL

Anthony Ricciardi (*McGill University, Chair*)
Sarah Bailey (*Fisheries and Oceans Canada*)
Hunter Carrick (*Penn State University*)
Susan Galatowitsch (*University of Minnesota*)
Jeff Gunderson (*Minnesota Sea Grant*)
Rex Lowe (*Bowling Green State University*)
Nicholas Mandrak (*Fisheries and Oceans Canada*)
Robin Scribailo (*Purdue University*)

Questions?

alishad@mlswa.org