Decision support tool to prioritize AIS prevention activities

Nick Phelps

Director, Minnesota Aquatic Invasive Species Research Center

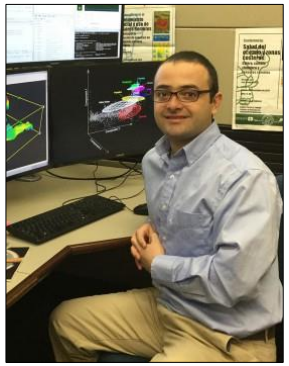
Associate Professor, Dept of Fisheries, Wildlife and Conservation Biology

University of Minnesota

Great Lakes Panel on Aquatic Nuisance Species

June 14, 2021

Dr. Eva Enns
U of MN



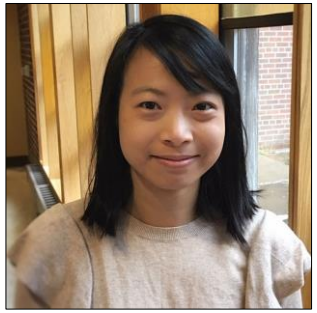
Dr. Luis Escobar
Virginia Tech

Dr. Robert Haight
US Forest Service

EPI-interactive

Adam Doll
MN DNR

Dr. Meggan Craft
U of MN



Dr. Zoe Kao
U of MN

Dr. Amy Kinsley
U of MN

Dr. Matteo Convertino
Hakkaido University

Dr. Huijie Qiao
Chinese Academy
of Sciences

Dr. Kaushi
Kanankege
U of MN

Megan
Tomamichel
U of Georgia

Meg Duhr
MAISRC

Objective

Develop eco-epidemiological models to inform risk-based management activities that will prevent the spread of aquatic invasive species.

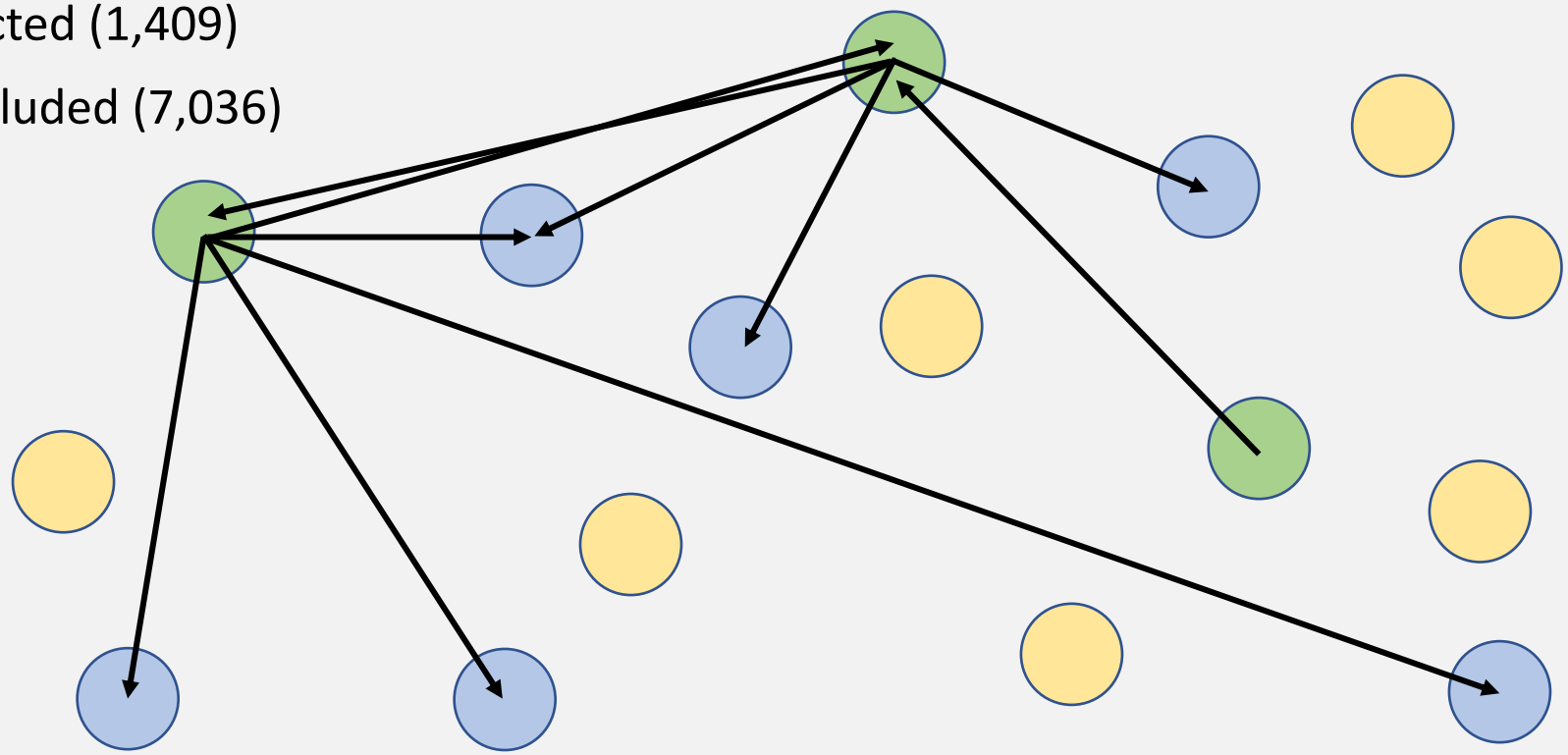
J. Johnson

Data Sources

Boater movement

Lakes in the known network based on 1,666,704 reported movements:

- = Inspected (737)
- = Connected (1,409)
- = Not included (7,036)

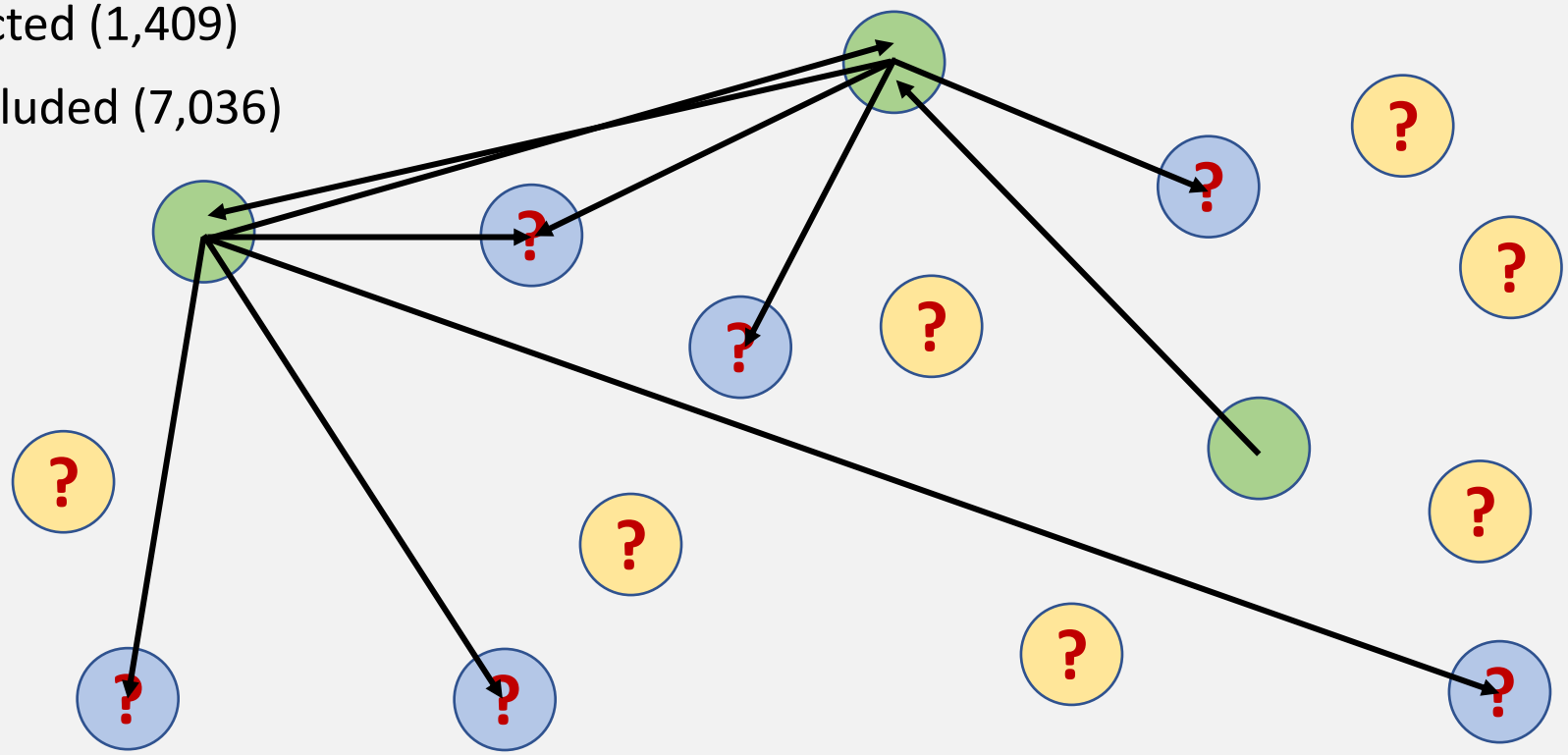


Data Sources

Boater movement

Lakes in the known network based on 1,666,704 reported movements:

- = Inspected (737)
- = Connected (1,409)
- = Not included (7,036)



Data Sources

Boater movement

Biol Invasions
https://doi.org/10.1007/s10530-021-02563-y

ORIGINAL PAPER

Network connectivity of Minnesota waterbodies and implications for aquatic invasive species prevention

Szu-Yu Zoe Kao · Eva A. Enns · Megan Tomamichel · Adam Doll · Luis E. Escobar · Huijie Qiao · Meggan E. Craft · Nicholas B. D. Phelps

Received: 18 November 2020 / Accepted: 1 May 2021
© The Author(s) 2021

Data Sources

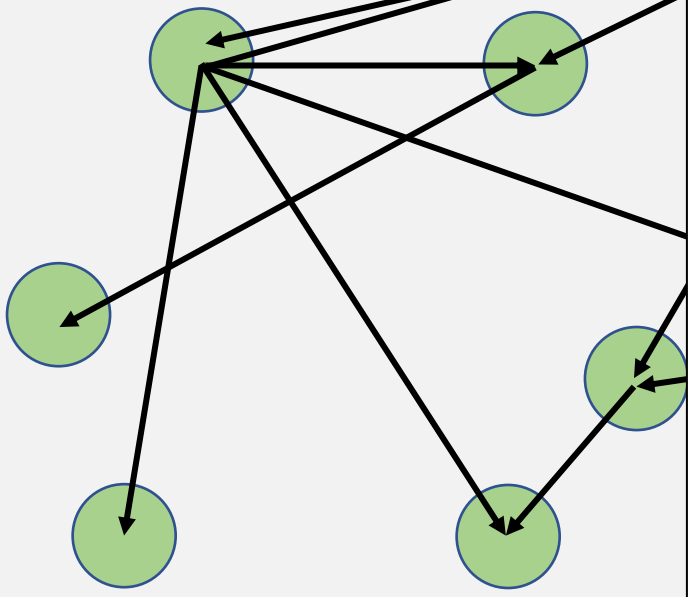
Boater movement

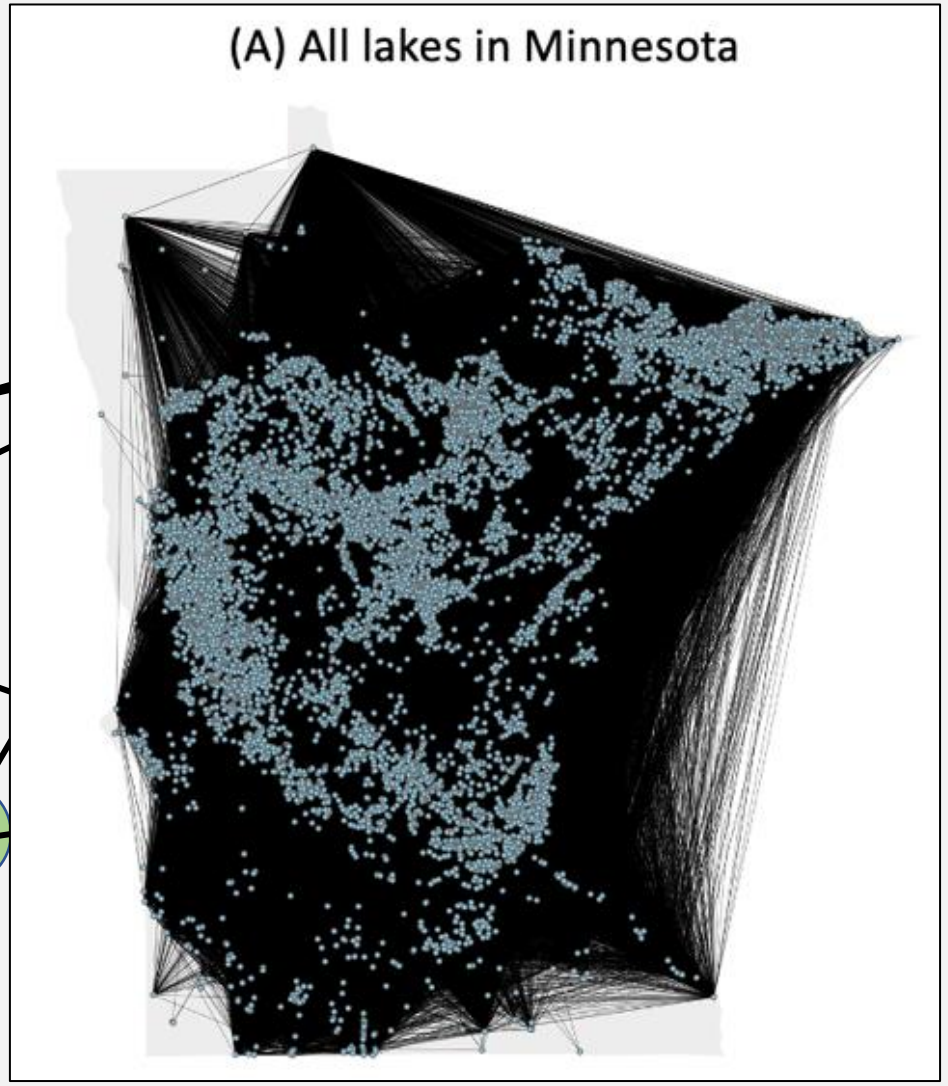
Estimated boater network:

= “Inspected” (9,182)

= Not inspected (0)

= Not included (0)

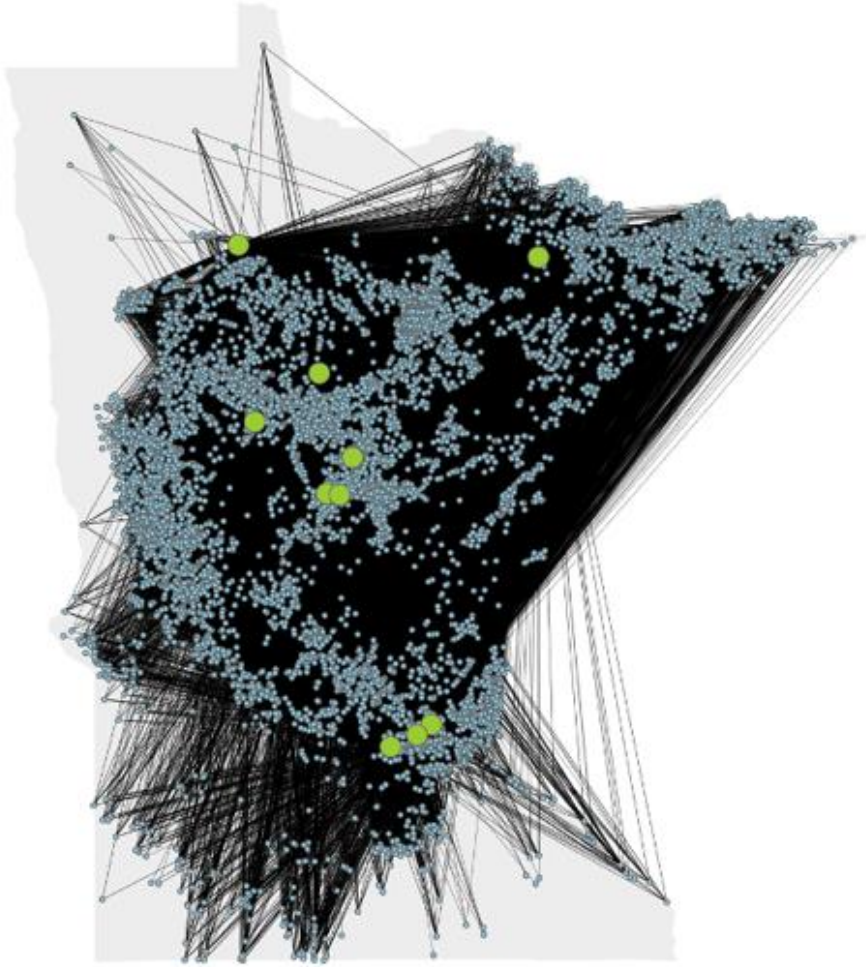




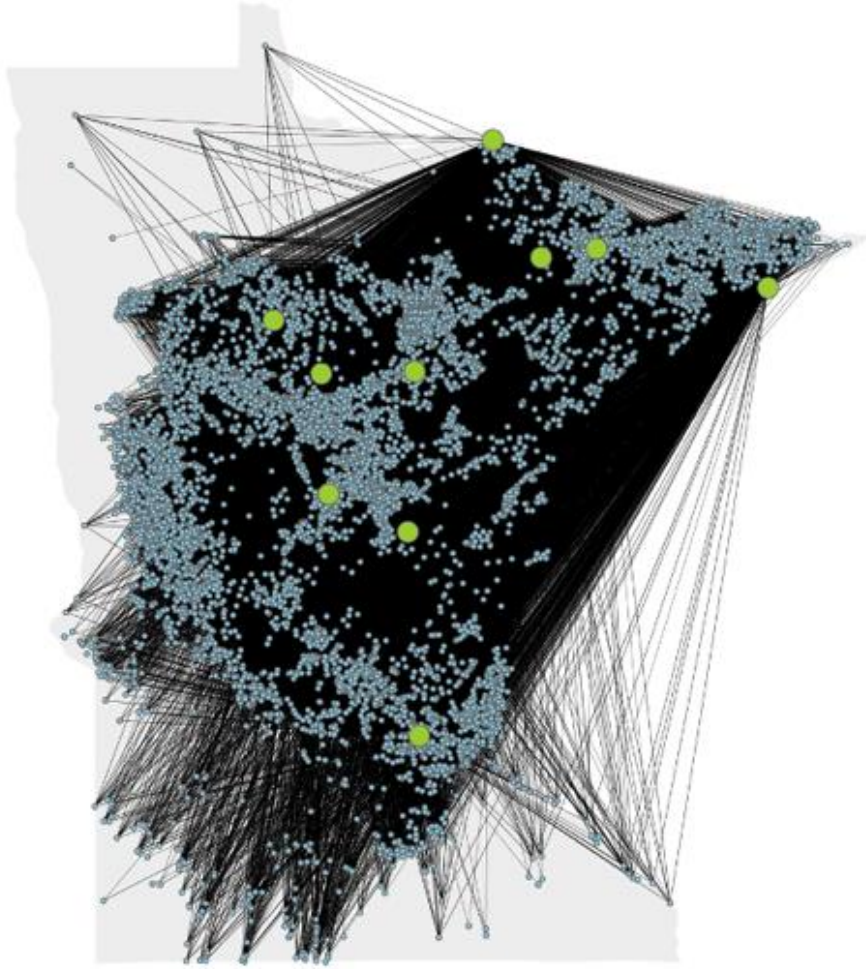
Data Sources

Boater movement

(B) Top 10 most connected lakes



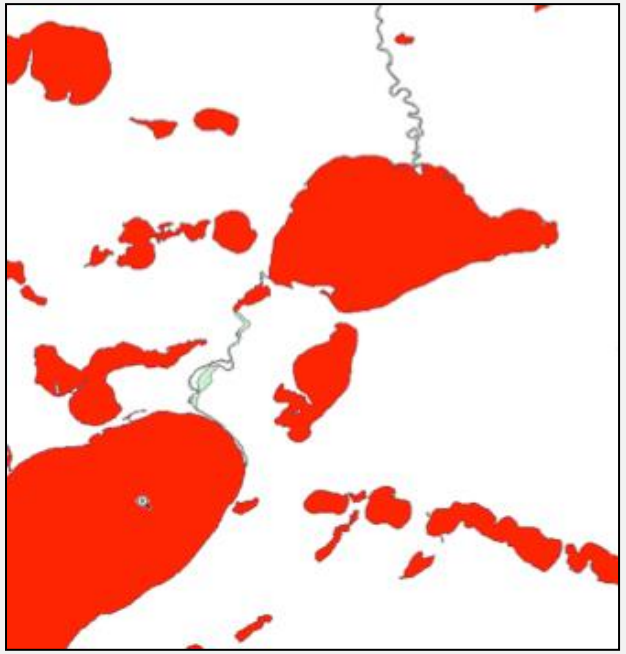
(C) Top 10 lakes with highest centrality



Data Sources

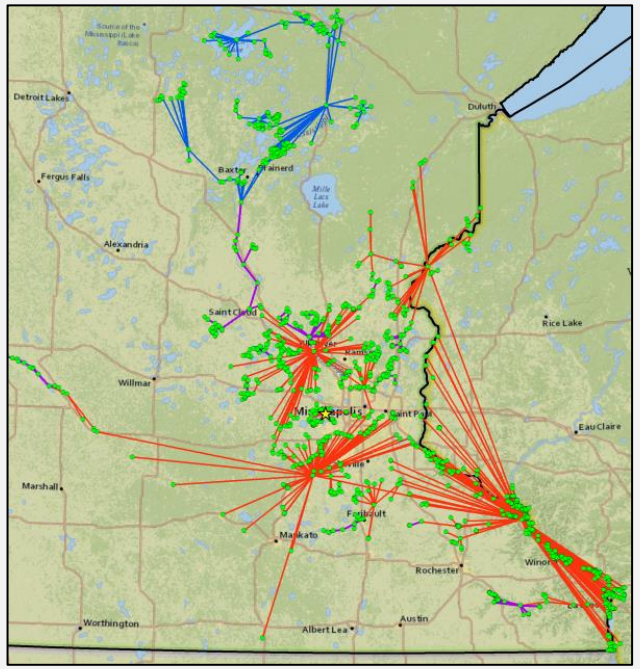
Water connectivity

Waterbody ID



Verification

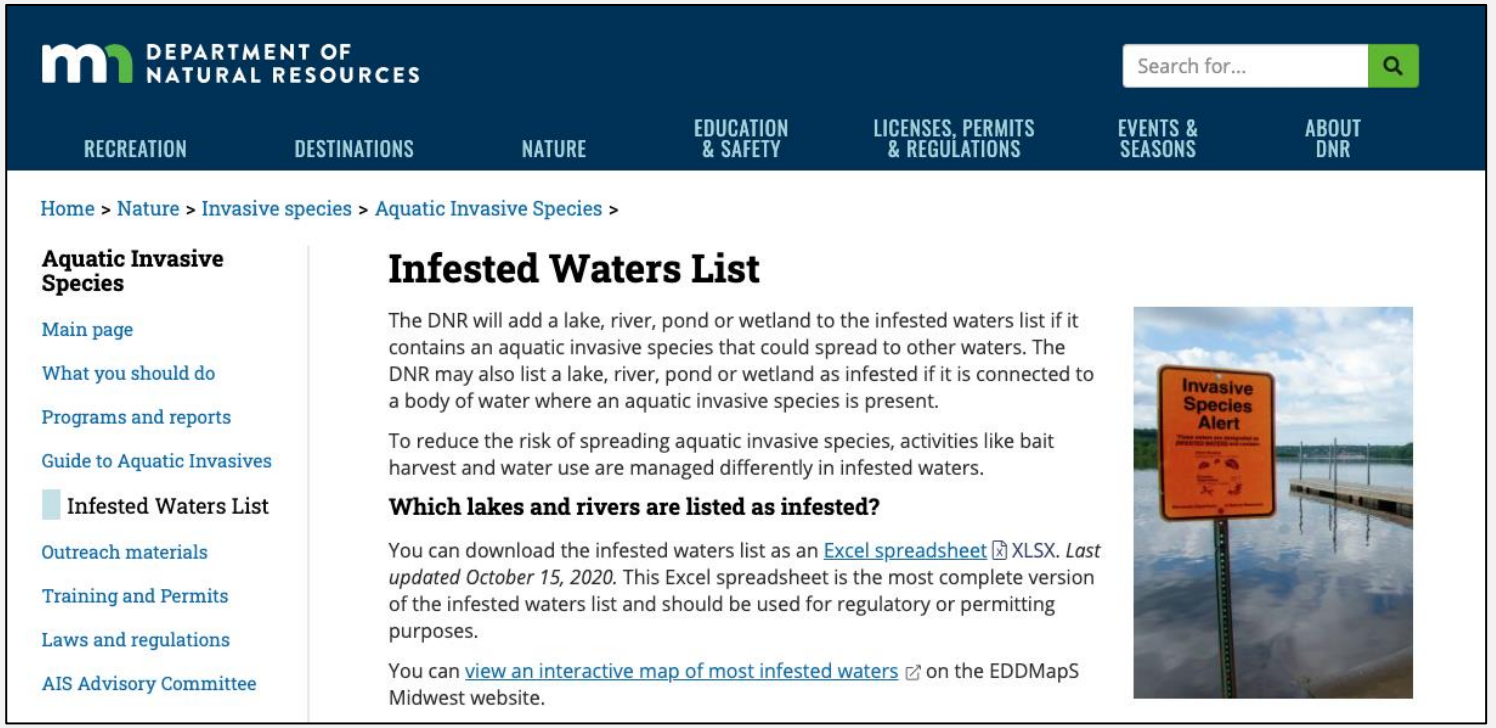
Connectivity network



Data Sources

Infested waters list

- Lakes confirmed to be infested by the MN DNR are incorporated into the model
- Models are updated weekly to account for new infestations



DEPARTMENT OF NATURAL RESOURCES

Search for...

RECREATION | DESTINATIONS | NATURE | EDUCATION & SAFETY | LICENSES, PERMITS & REGULATIONS | EVENTS & SEASONS | ABOUT DNR

Home > Nature > Invasive species > Aquatic Invasive Species >

Aquatic Invasive Species

- Main page
- What you should do
- Programs and reports
- Guide to Aquatic Invasives
- Infested Waters List
- Outreach materials
- Training and Permits
- Laws and regulations
- AIS Advisory Committee

Infested Waters List

The DNR will add a lake, river, pond or wetland to the infested waters list if it contains an aquatic invasive species that could spread to other waters. The DNR may also list a lake, river, pond or wetland as infested if it is connected to a body of water where an aquatic invasive species is present.

To reduce the risk of spreading aquatic invasive species, activities like bait harvest and water use are managed differently in infested waters.

Which lakes and rivers are listed as infested?

You can download the infested waters list as an Excel spreadsheet XLSX. *Last updated October 15, 2020.* This Excel spreadsheet is the most complete version of the infested waters list and should be used for regulatory or permitting purposes.

You can view an interactive map of most infested waters on the EDDMapS Midwest website.

Creating models to inform:

1. Introduction risk for surveillance
2. Prioritization for watercraft inspections

Infested waters list

Water connectivity

Boater movement

"At-risk" boats

+ much more!

Making models accessible and useable for managers

https://AISexplorer.umn.edu

AIS explorer

Data-driven approach to informed decision making

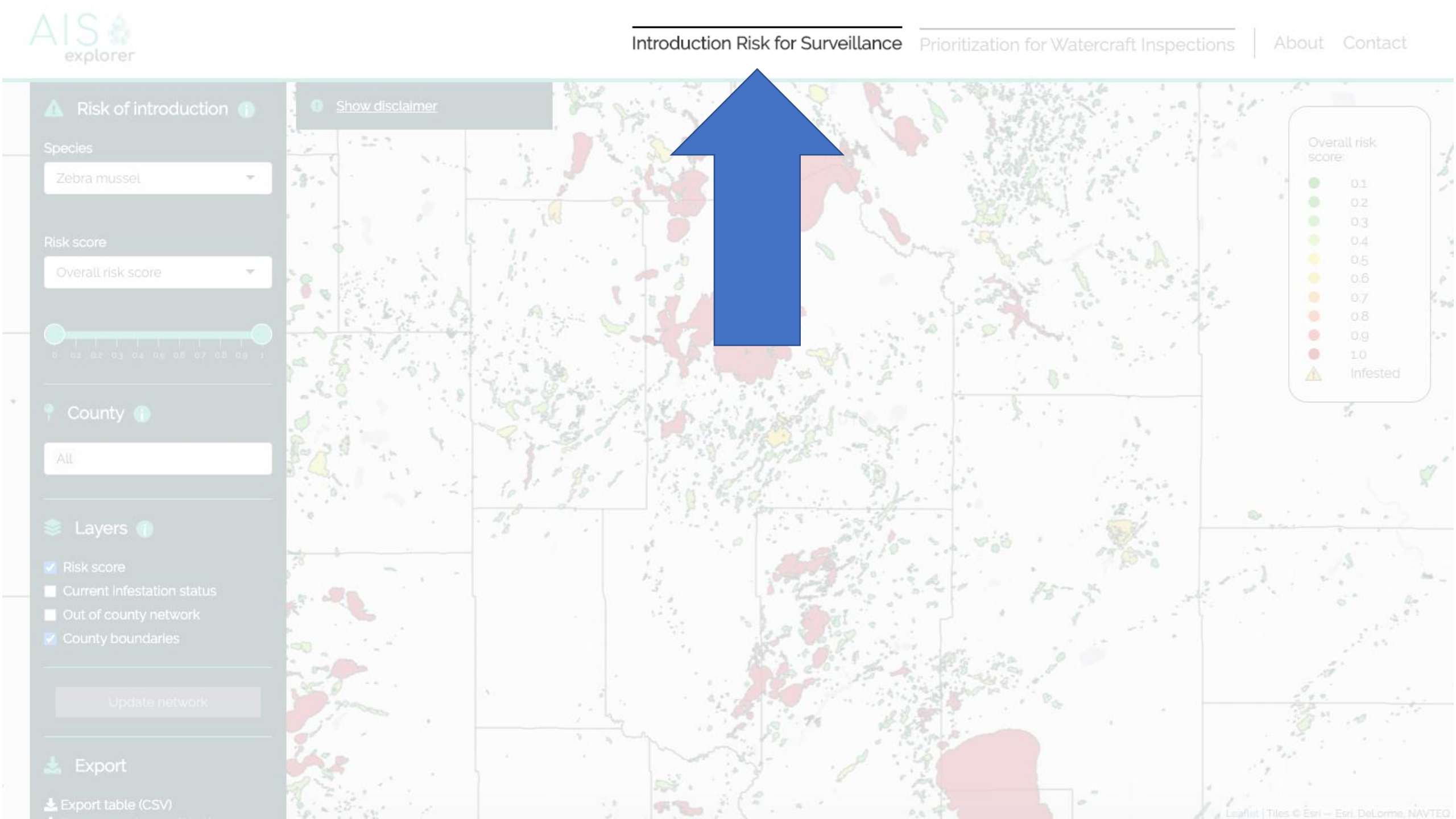
START

Minnesota Aquatic Invasive Species Research Center
University of Minnesota
Driven to Discover℠

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Funding provided by the Minnesota State Legislature, and the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Powered by EPI-interactive


AIS explorer
Introduction Risk for Surveillance
Prioritization for Watercraft Inspections
About
Contact
Risk of introduction
Species
Zebra mussel
Risk score
Overall risk score
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
County
All
Layers
Risk score
Current infestation status
Out of county network
County boundaries
Update network
Export
Export table (CSV)
Show disclaimer
Overall risk score
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Infested
Leaflet | Tiles © Esri — Esri, DeLorme, NAVTEQ

Risk of introduction

Species

Zebra mussel

Risk score

Overall risk score

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

County

All

Layers

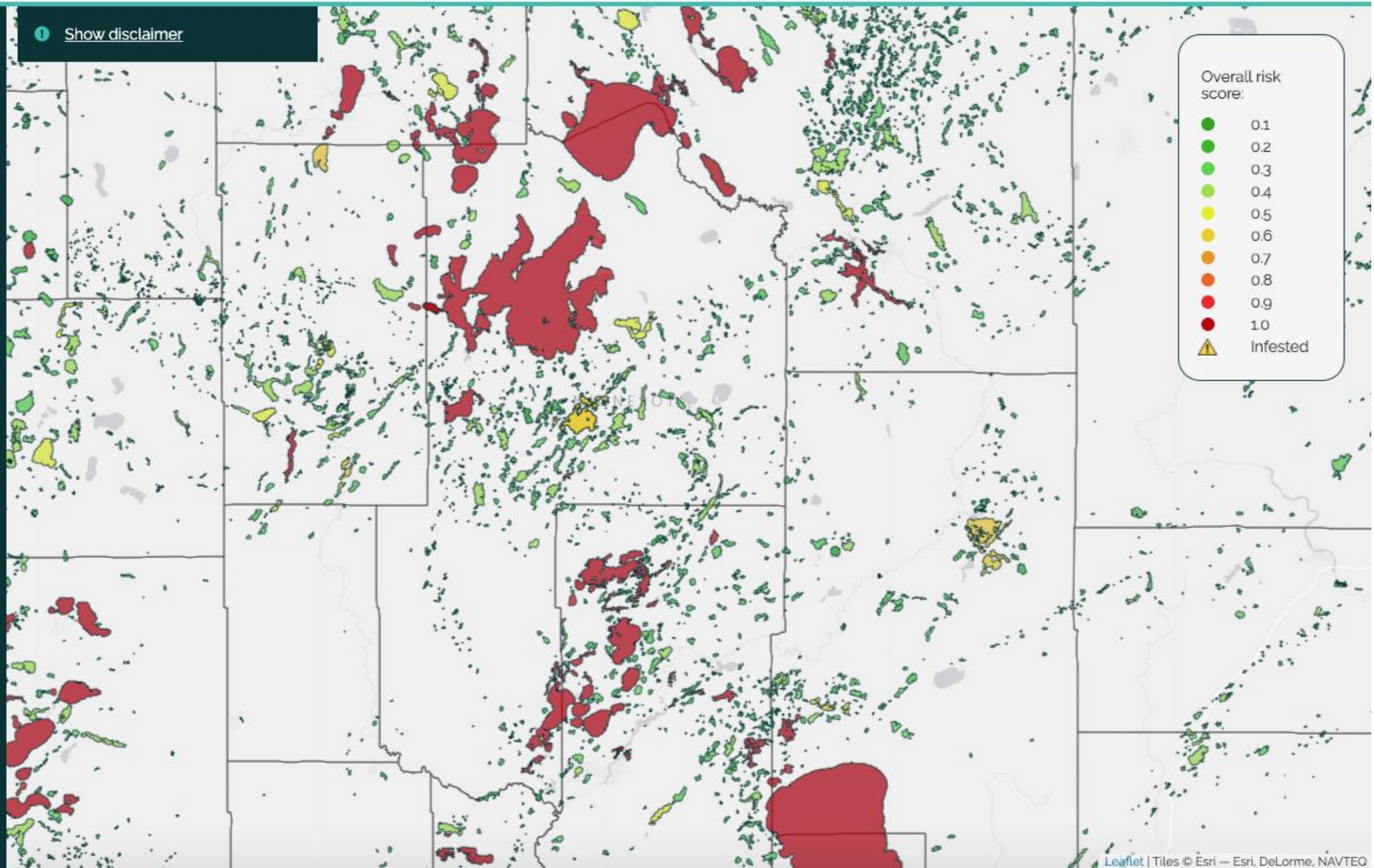
- [x] Risk score
- [ ] Current infestation status
- [ ] Out of county network
- [x] County boundaries

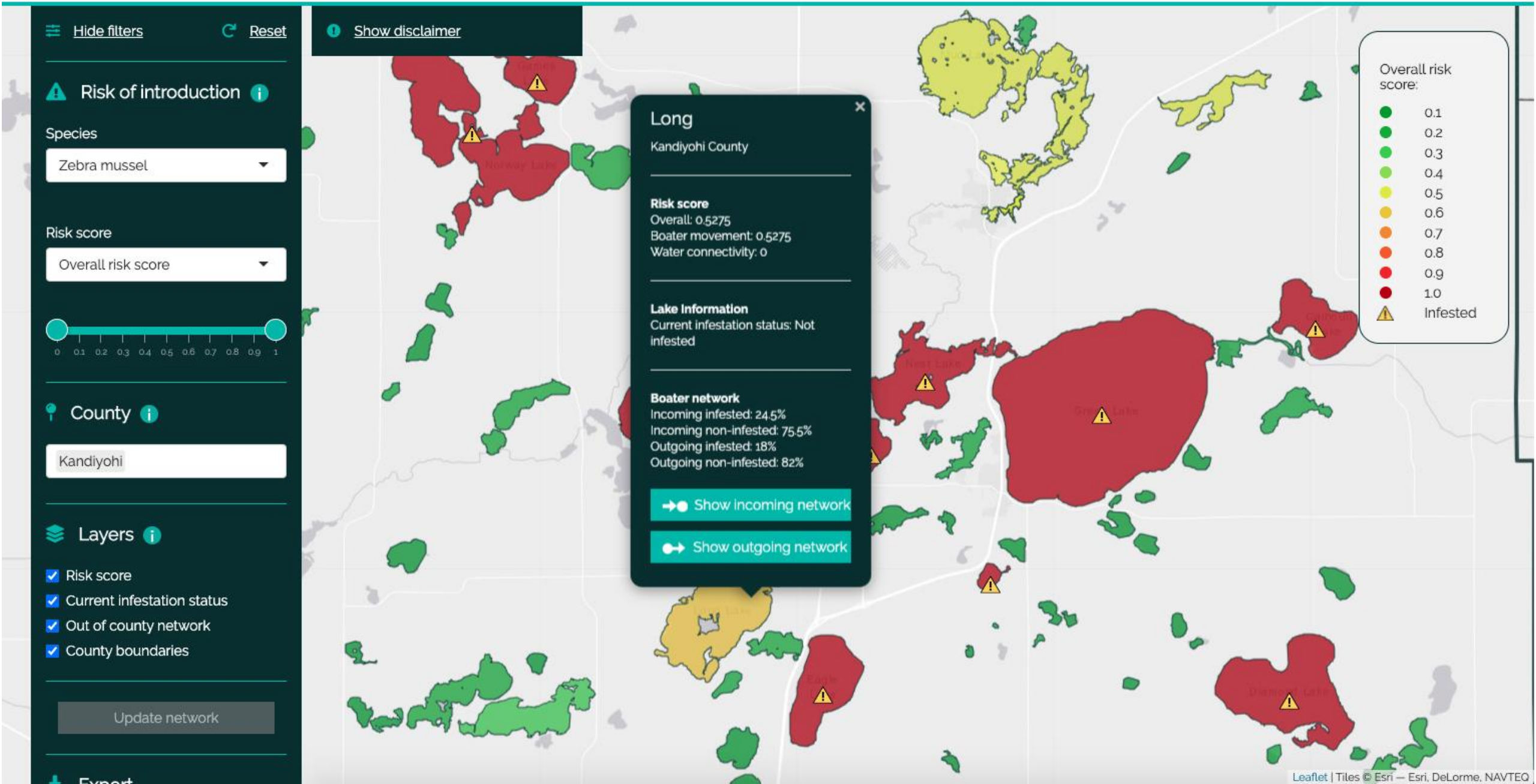
Update network

Export

Export table (CSV)

Show disclaimer




Hide filters
Reset
Show disclaimer
Risk of introduction
Species
Zebra mussel
Risk score
Overall risk score
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
County
Kandiyohi
Layers
Risk score
Current infestation status
Out of county network
County boundaries
Update network
Export
Long
Kandiyohi County
Risk score
Overall: 0.5275
Boater movement: 0.5275
Water connectivity: 0
Lake Information
Current infestation status: Not infested
Boater network
Incoming infested: 24.5%
Incoming non-infested: 75.5%
Outgoing infested: 18%
Outgoing non-infested: 82%
Show incoming network
Show outgoing network
Overall risk score:
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Infested
Leaflet | Tiles © Esri — Esri, DeLorme, NAVTEQ

Hide filters | Reset

Show disclaimer

Risk of introduction

Species

Zebra mussel

Risk score

Overall risk score

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

County

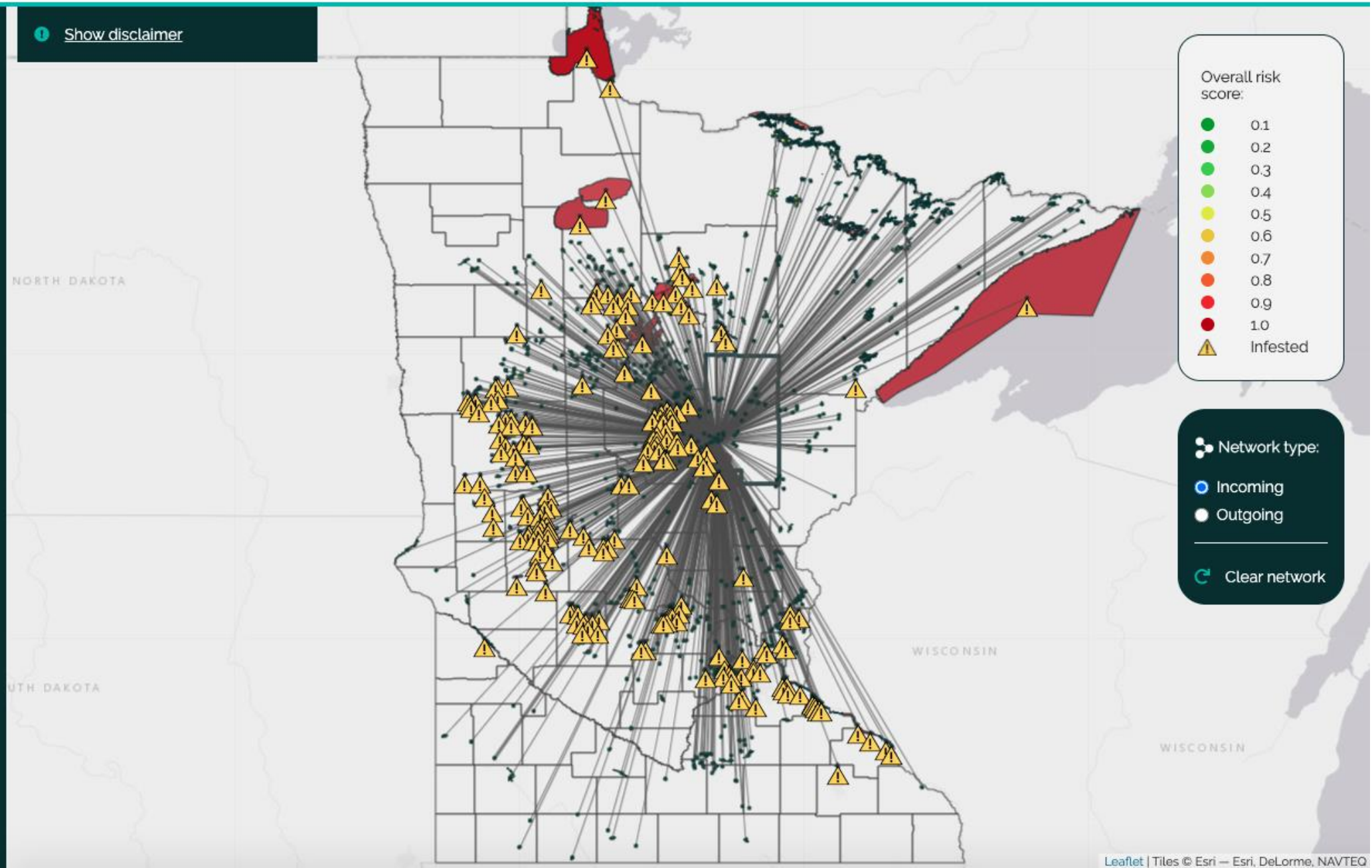
Aitkin

Layers

- [x] Risk score
- [x] Current infestation status
- [x] Out of county network
- [x] County boundaries

Update network

Export



County

Aitkin

Customize included lakes

Risk species

- [x] Zebra mussel
- [ ] Starry stonewort
- [ ] Eurasian watermilfoil
- [ ] Spiny waterflea

Run

Percentage of boats to inspect

0 10 20 30 40 50 60 70 80 90 100

Export

Export chart image (PNG)
Export map image (PNG)
Export table (CSV)

Aitkin County

Number of lakes: 240

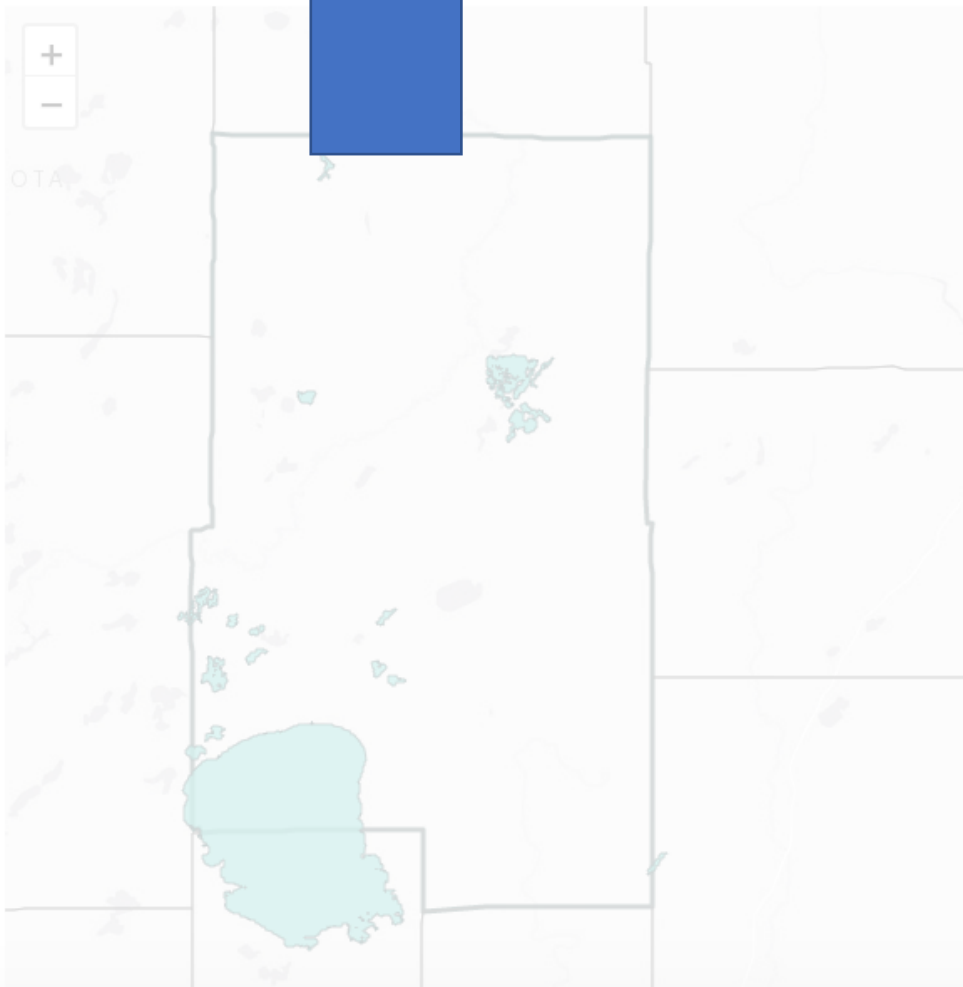
17 Inspection stations needed to inspect 60% of the risky boats in Aitkin County

Rank	Name	DOW Number	Status	Percentage of the risky boats inspected
1	Mille Lacs	48000200	Infested	25.7%
2	Farm Island	01015900	Not Infested	34.6%
3	Round	01020400	Not Infested	40%
4	Big Pine	01015700	Infested	44.7%
5	Big Sandy	01006200	Infested	47%
6	Minnewawa	01003300	Not Infested	49%
7	Hill	01014200	Not Infested	50.3%
8			Not	

Map of Inspection St

Chart

Lakes with proposed inspection stations



County

Aitkin

Customize included lakes

Risk species

- [x] Zebra mussel
- [ ] Starry stonewort
- [ ] Eurasian watermilfoil
- [ ] Spiny waterflea

Run

Percentage of boats to inspect

0 10 20 30 40 50 60 70 80 90 100

Export

Export chart image (PNG)
Export map image (PNG)
Export table (CSV)

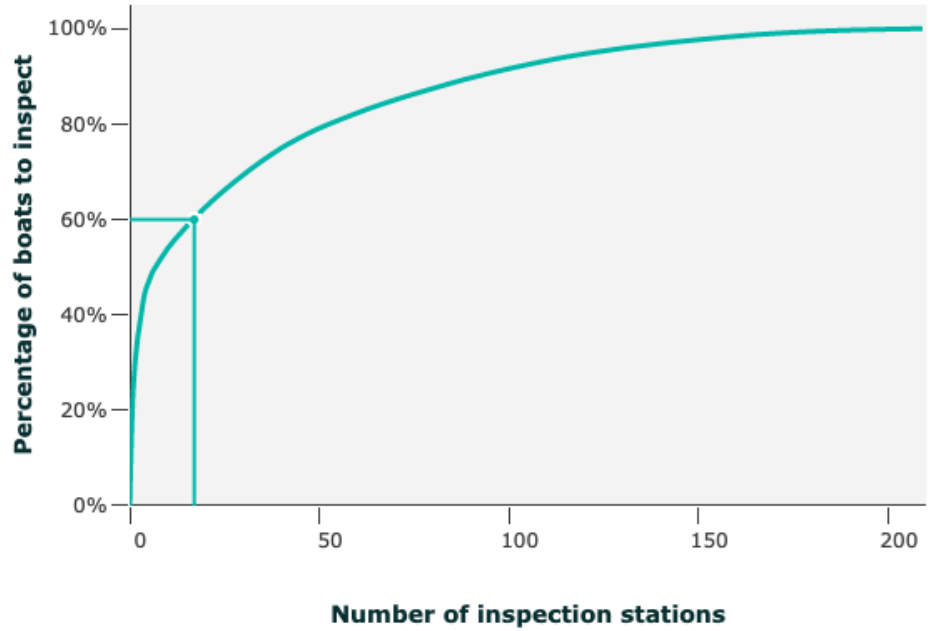
Aitkin County

Number of lakes: 240

17 Inspection stations needed to inspect 60% of the risky boats in Aitkin County

Rank	Name	DOW Number	Status	Percentage of the risky boats inspected
1	Mille Lacs	48000200	Infested	25.7%
2	Farm Island	01015900	Not Infested	34.6%
3	Round	01020400	Not Infested	40%
4	Big Pine	01015700	Infested	44.7%
5	Big Sandy	01006200	Infested	47%
6	Minnewawa	01003300	Not Infested	49%
7	Hill	01014200	Not Infested	50.3%
8			Not	

Map of Inspection Stations — Chart



County

Aitkin

Customize included lakes

Risk species

- [x] Zebra mussel
- [ ] Starry stonewort
- [ ] Eurasian watermilfoil
- [ ] Spiny waterflea

Run

Percentage of boats to inspect

0 10 20 30 40 50 60 70 80 90 100

Export

Export chart image (PNG)
Export map image (PNG)
Export table (CSV)

Aitkin County

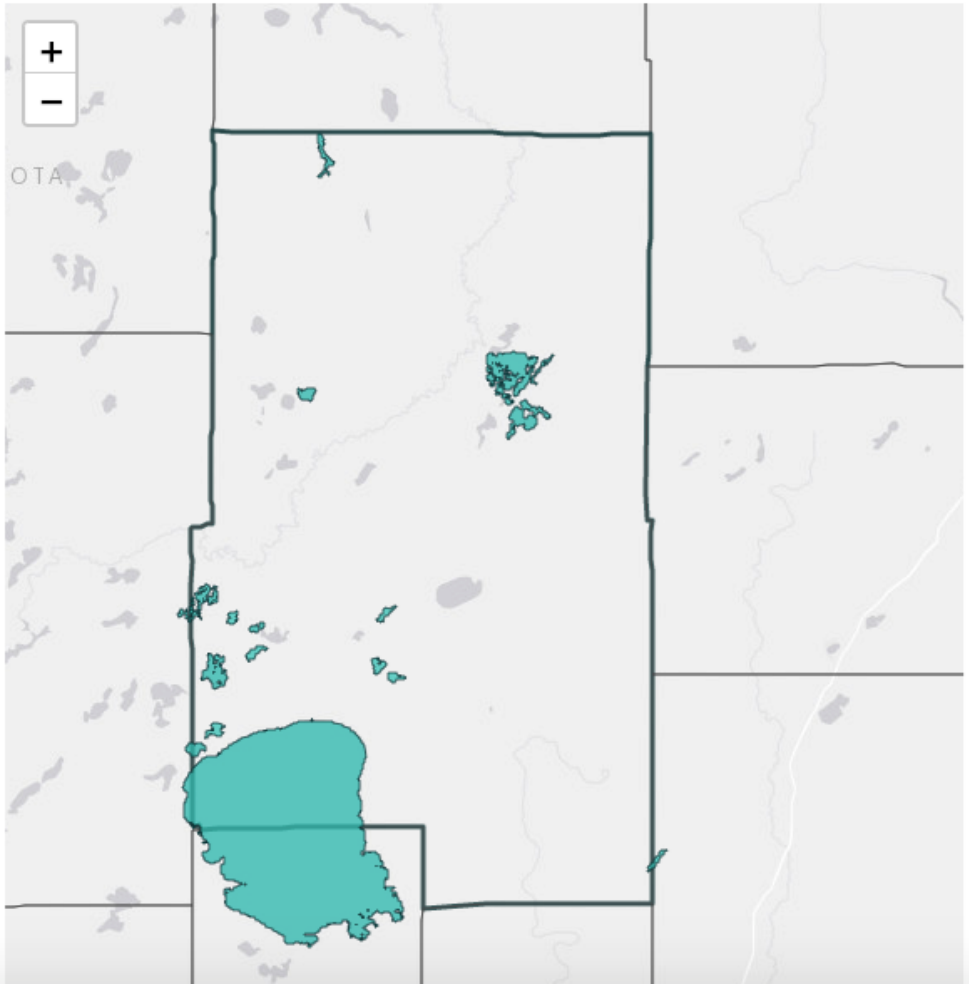
Number of lakes: 240

17 Inspection stations needed to inspect 60% of the risky boats in Aitkin County

Rank	Name	DOW Number	Status	Percentage of the risky boats inspected
1	Mille Lacs	48000200	Infested	25.7%
2	Farm Island	01015900	Not Infested	34.6%
3	Round	01020400	Not Infested	40%
4	Big Pine	01015700	Infested	44.7%
5	Big Sandy	01006200	Infested	47%
6	Minnewawa	01003300	Not Infested	49%
7	Hill	01014200	Not Infested	50.3%
8	[illegible]	[illegible]	Not	[illegible]

Map of Inspection Stations | Chart

Lakes with proposed inspection stations



County

Aitkin

Customize included lakes

Risk species

- [x] Zebra mussel
- [x] Starry stonewort
- [x] Eurasian watermilfoil
- [x] Spiny waterflea

Run

Percentage of boats to inspect

0 10 20 30 40 50 60 70 80 90 100

Export

Export chart image (PNG)
Export map image (PNG)
Export table (CSV)

Aitkin County

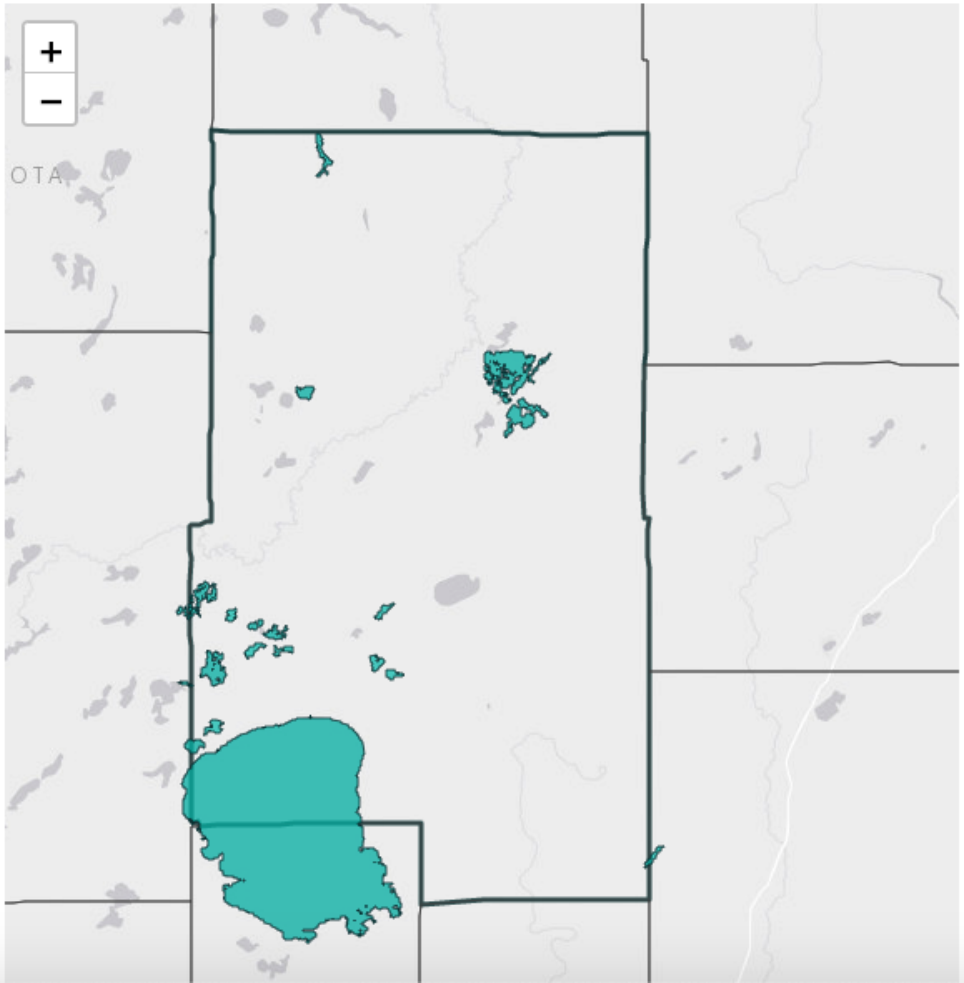
Number of lakes: 240

19 Inspection stations needed to inspect 60% of the risky boats in Aitkin County

Rank	Name	DOW Number	Status	Percentage of the risky boats inspected
1	Mille Lacs	48000200	Not Infested	25.9%
2	Farm Island	01015900	Not Infested	32.6%
3	Round	01020400	Not Infested	37.1%
4	Big Pine	01015700	Not Infested	41.1%
5	Big Sandy	01006200	Not Infested	43.6%
6	Minnewawa	01003300	Not Infested	45.7%
7	Long / Tame Fish	18000200	Not Infested	47.3%
8	Hill	01014300	Not Infested	48.8%

Map of Inspection Stations | Chart

Lakes with proposed inspection stations



County

Aitkin

Customize included lakes

Risk species

- [x] Zebra mussel
- [x] Starry stonewort
- [x] Eurasian watermilfoil
- [x] Spiny waterflea

Run

Percentage of boats to inspect

0 10 20 30 40 50 60 70 80 90 100

Export

Export chart image (PNG)
Export map image (PNG)
Export table (CSV)

Aitkin County

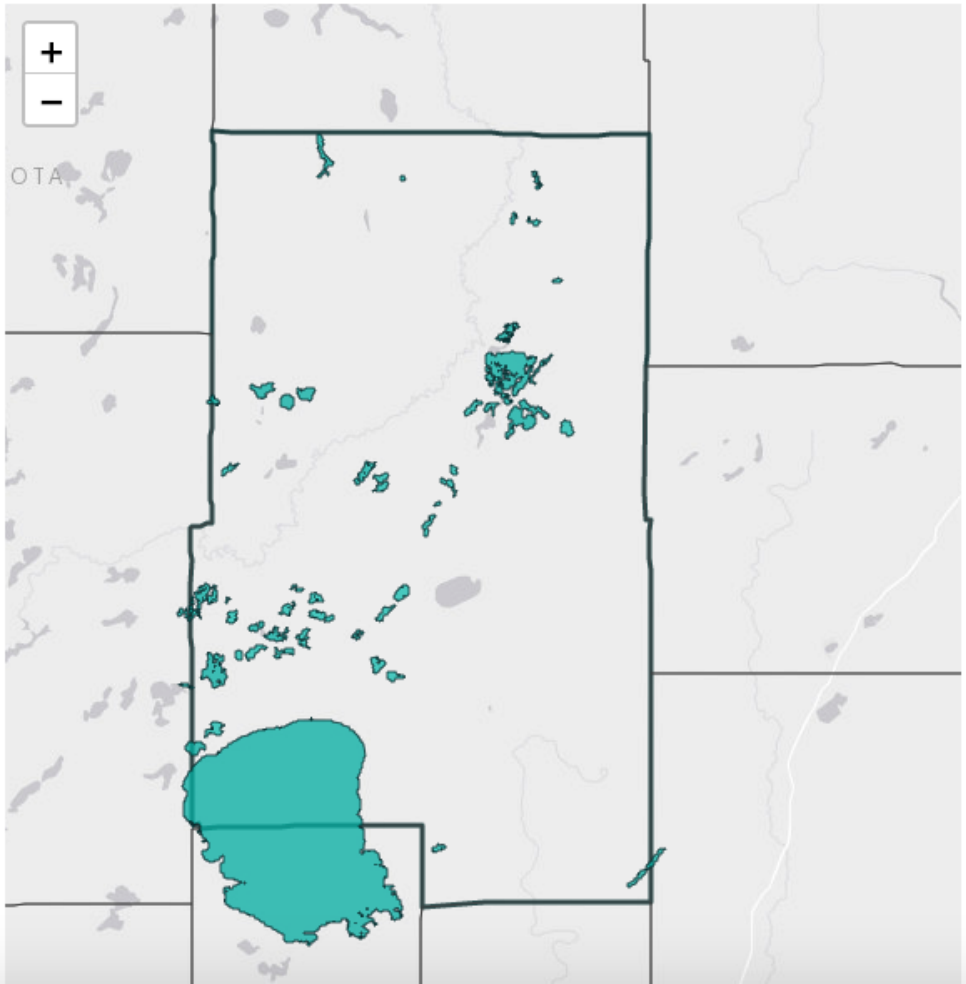
Number of lakes: 240

52 Inspection stations needed to inspect 80% of the risky boats in Aitkin County

Rank	Name	DOW Number	Status	Percentage of the risky boats inspected
1	Mille Lacs	48000200	Not Infested	25.9%
2	Farm Island	01015900	Not Infested	32.6%
3	Round	01020400	Not Infested	37.1%
4	Big Pine	01015700	Not Infested	41.1%
5	Big Sandy	01006200	Not Infested	43.6%
6	Minnewawa	01003300	Not Infested	45.7%
7	Long / Tame Fish	18000200	Not Infested	47.3%
8	Hill	[illegible]	Not	[illegible]

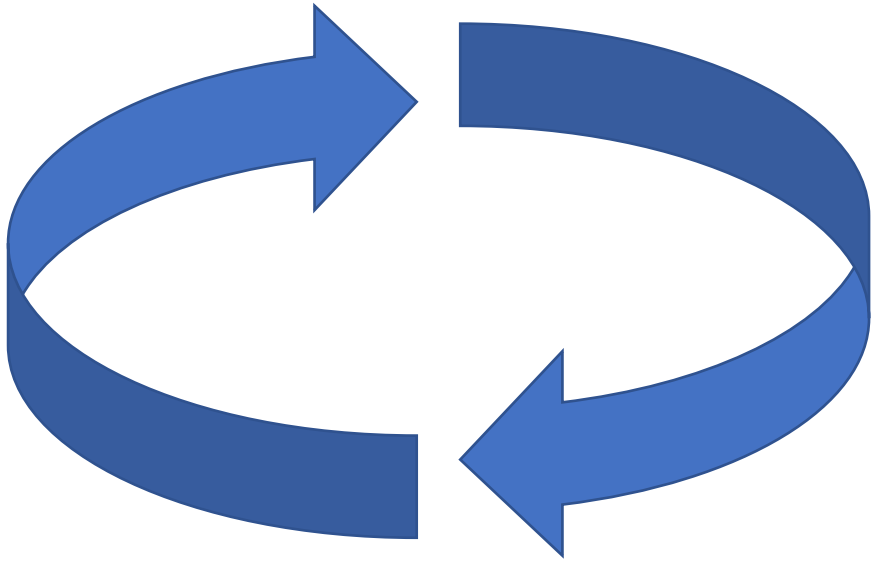
Map of Inspection Stations — Chart

Lakes with proposed inspection stations



Co-creation

- Managers identified need
- Project meetings with managers throughout process
- Iterative feedback on tool development



Outreach

- Four webinars since November 2020
  - IMC, UMISC, MLRA, AIS Detectors
- Local management online workshops
  - 33 LGU participants
  - MN DNR AIS staff meetings
  - Many one-on-one interactions to assist with planning
- Other states and countries

Future Directions

- Add complexity with existing data
- Create multi-state networks
- Multi-county cooperation for watercraft inspections
- Incorporate prevention activities to reduce risk
- Incorporate environmental suitability
- Consider risk-based allocation of local/state funds

…and much more!

Questions??

phelp083@umn.edu
@FishDoc_UMN

AIS explorer https://AISexplorer.umn.edu

Minnesota Aquatic Invasive Species Research Center
University of Minnesota
Driven to Discover℠

Environment and Natural Resources Trust Fund