

Prioritizing Invasive Dreissenid Mussel Monitoring



Photo from Science History Institute,
Philadelphia, PA



https://en.wikipedia.org/wiki/Johnny_Horizon

Prioritizing Invasive Dreissenid Mussel Monitoring

Parker has the game

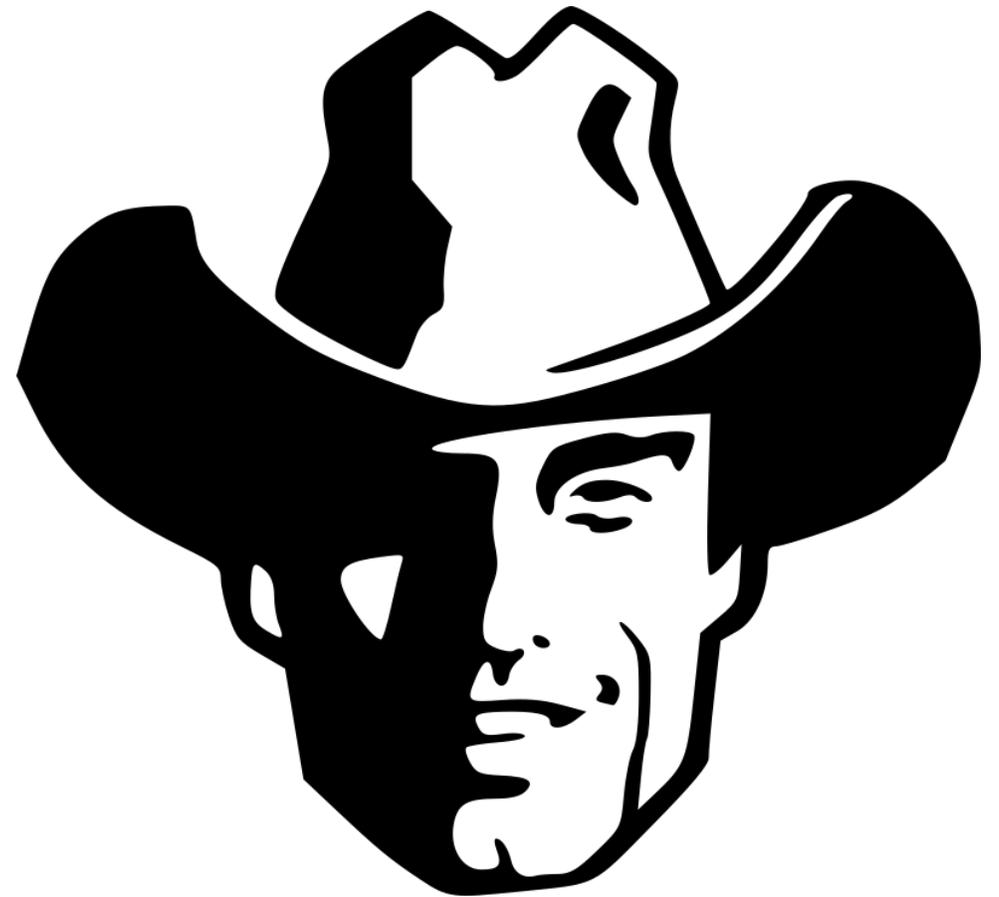
for the genius in you.
SQUARE OFF™ — it takes a keen eye, quick wit, and flying fingers to win this great new puzzle battle! Off to a fast start, both players concentrate hard, madly maneuvering tiles on opposite grids, racing to form an unbroken line between 2 points.

for the detective in you.
CLUE® — more fun than reading a thriller or watching a mystery! The plot thickens in a spooky old mansion. A victim turns up. Suspicious characters lurk about. Weapons and clues are discovered. You have to solve who did what, to whom, with what, and where!

for the scientist in you.
JOHNNY HORIZON ENVIRONMENTAL TEST KIT — detect pollution in your own neighborhood or anywhere you go! Everything you need for 10 easy, scientific tests — 6 for water 4 for air. Test for things like phosphates and coliform bacteria. Help save the environment!



The advertisement features three columns of text and three corresponding product images. Below the text are three photographs of young boys: one in a blue suit looking thoughtful, one in a brown plaid jacket and hat looking through a magnifying glass, and one in a white lab coat looking at a test tube.



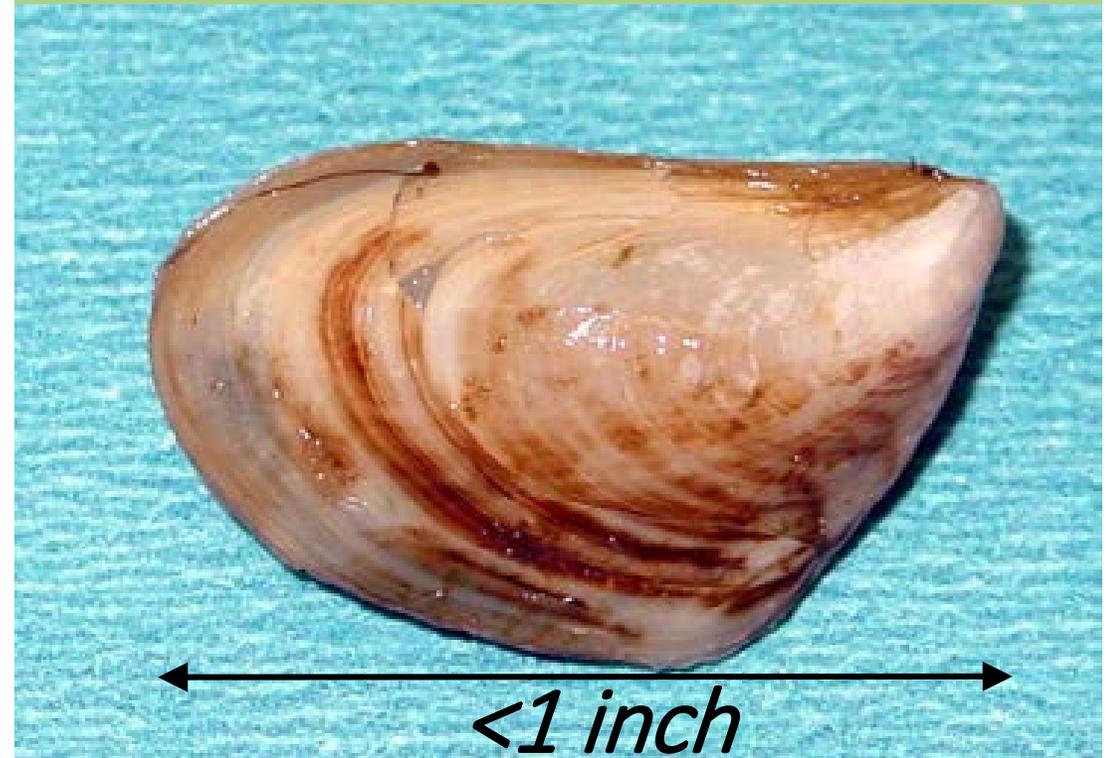
https://en.wikipedia.org/wiki/Johnny_Horizon

Prioritizing Invasive Dreissenid Mussel Monitoring

Zebra



Quagga



ENVIRONMENT, NATURE, NEWS

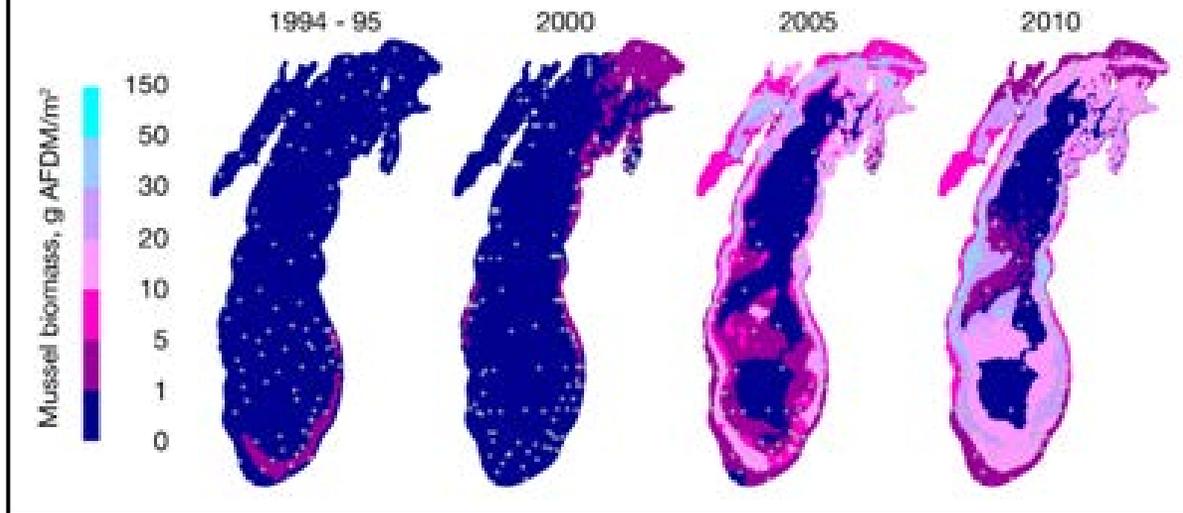
Quadrillions of invasive mussels are damaging the Great Lakes, documentary shows



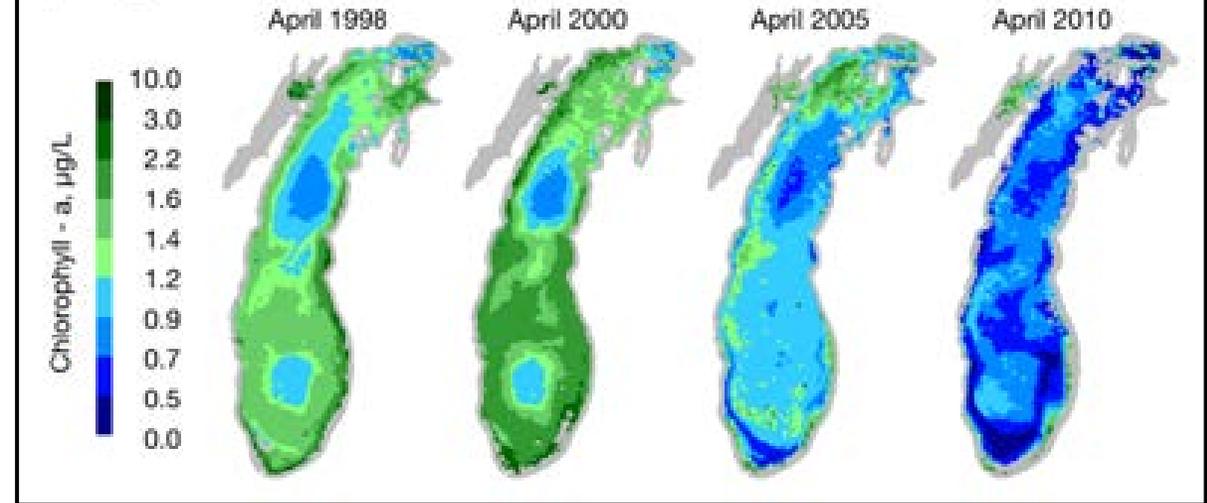
<https://www.wpr.org/environment/drebert-melnick-documentary-quagga-mussels-great-lakes>

Invasive Mussels and the Productivity of Lake Michigan

2. Estimated Mussel Biomass**
(grams of ash-free dry mass per square meter)



4. April Mean Phytoplankton Abundance*
(micrograms of chlorophyll per liter of water)



Mussel Biomass

Phytoplankton

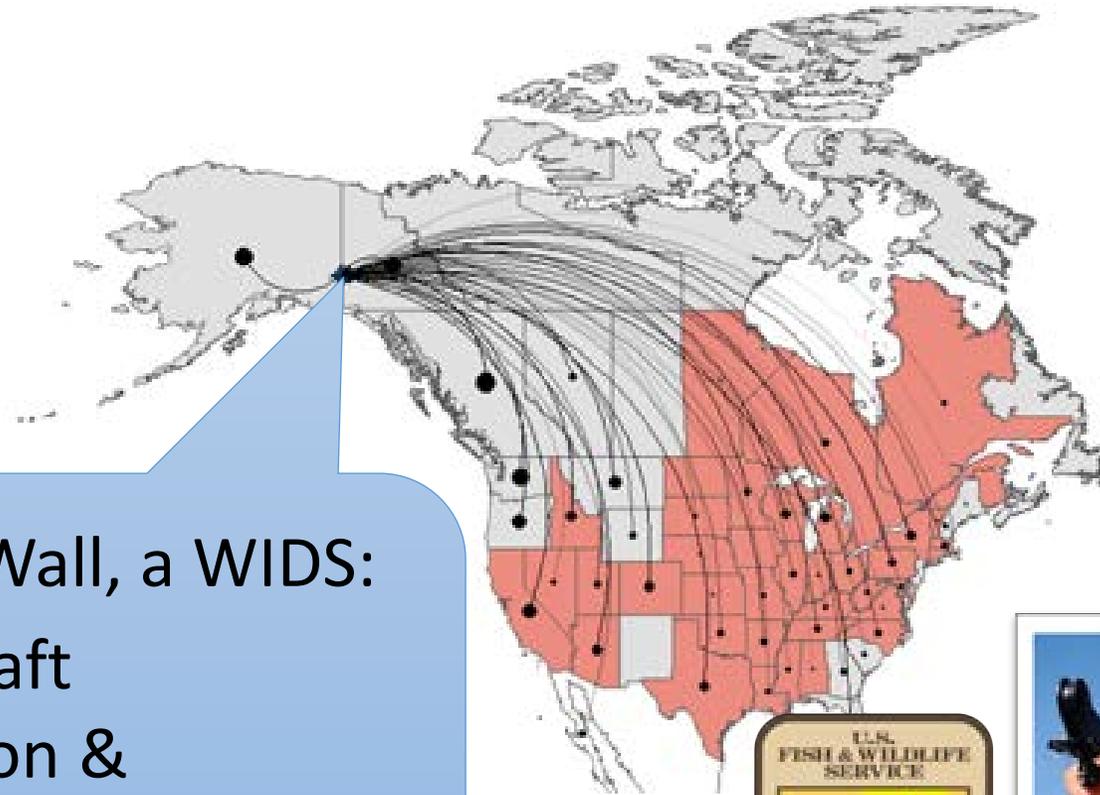
HOW: are we Responding?

ALCAN Station

Reported Last State of Use for Watercraft Inspected at the Alcan Port of Entry in 2024



Not a Wall, a WIDS:
Watercraft
Inspection &
Decontamination
Station



Number of Watercraft

- 25
- 50
- 75
- 100

State ZQM Status

- Unknown
- ZQM Detected
- ZQM Not Detected



Lake Vulnerability

n = ~ 1 million

STATE OF ALASKA

PRESS RELEASE

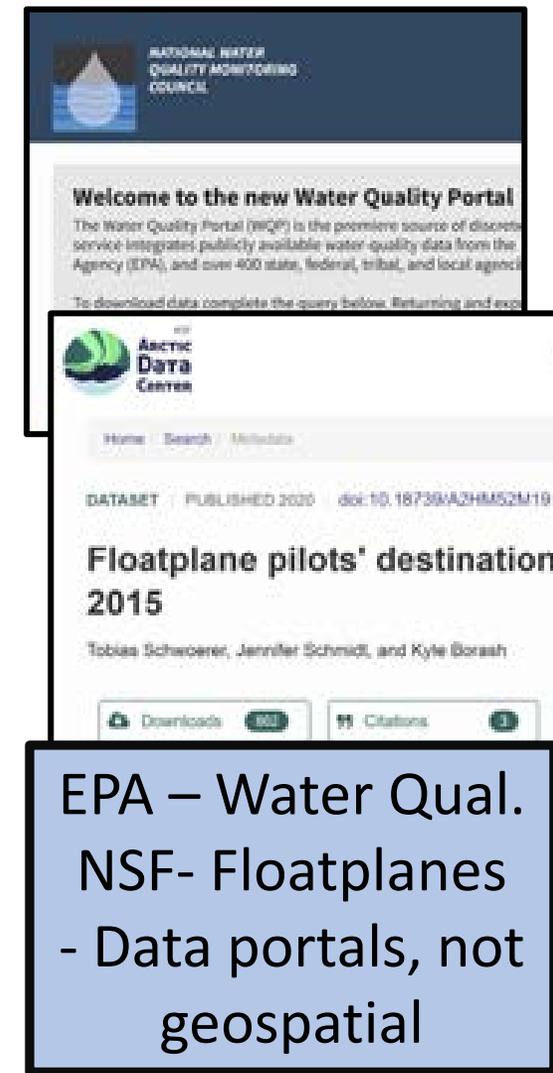
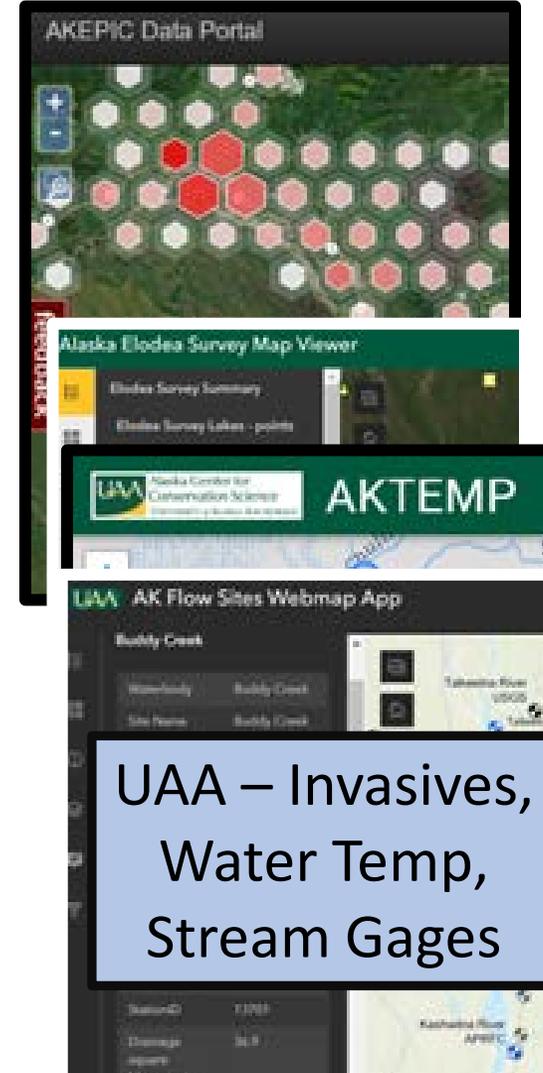
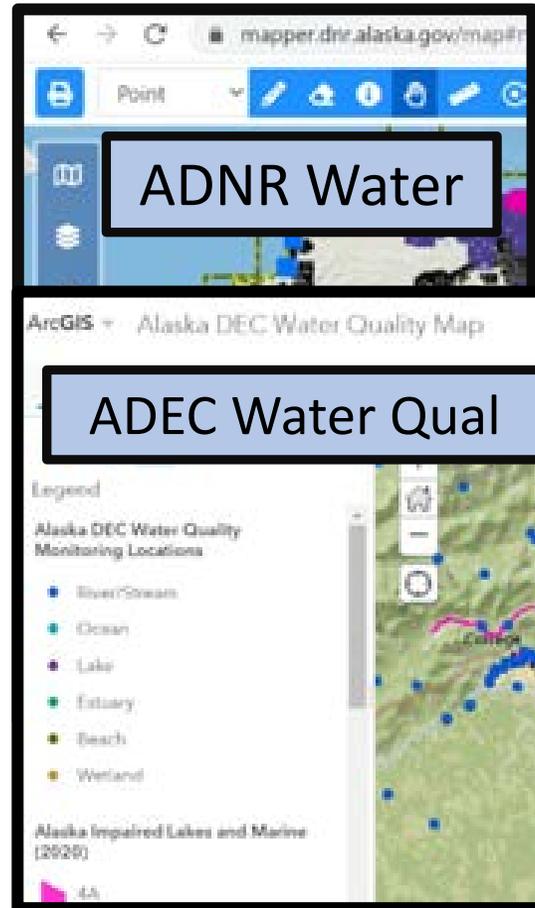
For Immediate Release

Invasive Zebra Mussels Hitchhike to AK on Aquarium Products
Alaskans who purchased marimo moss balls asked to call hotline



Zebra Mussel on a Marimo Moss Ball

Currently Many, Many Portals



WHERE: Values at Risk, Infestation & Spread Threats?

Waterbody Vulnerability

Pike

Elodea

Calcium

Dams

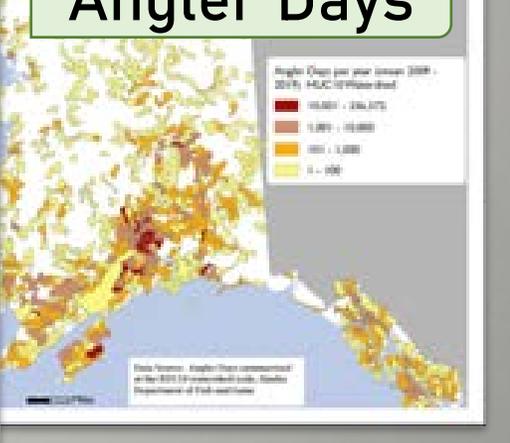
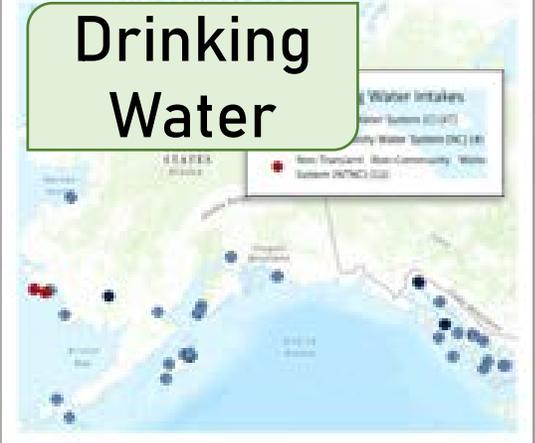
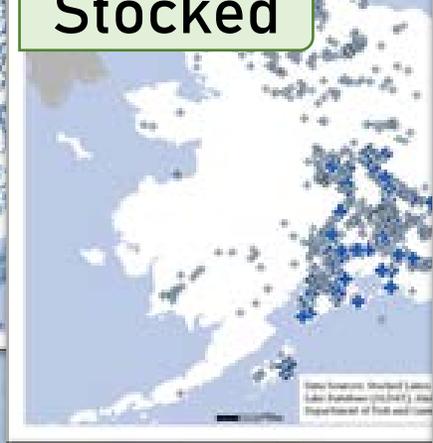
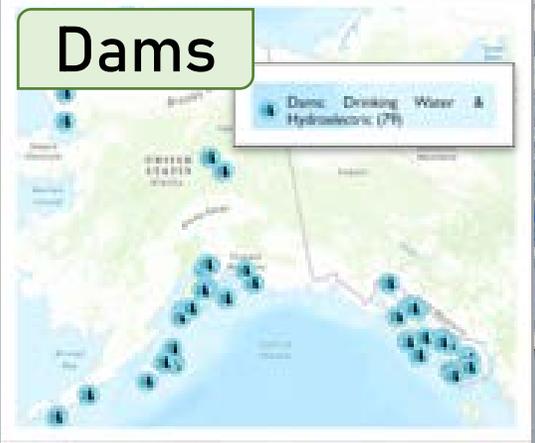
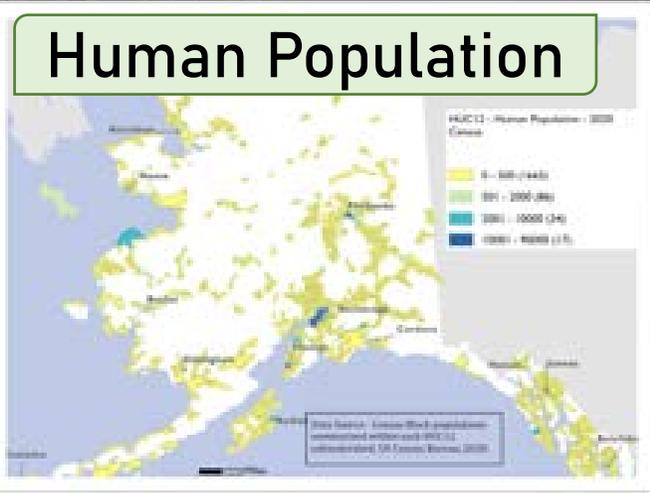
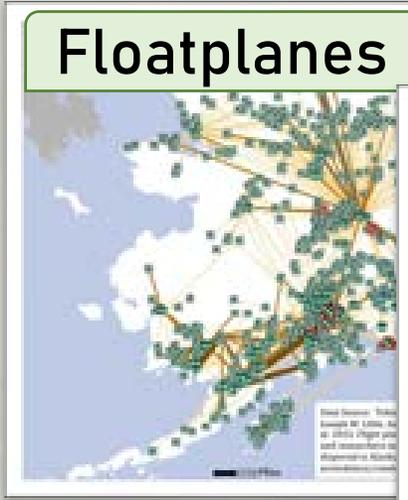
AWC

Stocked

Boat Ramps

Drinking Water

Angler Days



Lake Vulnerability Scoring - May 2025

Vulnerability Factor: Geospatial data layer	Weight	Score	Initial Scoring Method	Data Source	Elodea	Pike	Mussels
Elodea Presence	7	2	Present = 2	UAA - AKEPIC	14		
		1	Prior Cr				
Elodea in host watershed	3	1	Has F	UAA, AKEPIC	3		
Pike Status	8	3	Pike	ADFG			
		2	Uncc				
		1	Activ				
Pike in host watershed	4	1	Are t				

Vulnerability Scoring

Vulnerability Factor: Geospatial data layer	Weight	Score
Elodea Presence	7	2
Elodea in host watershed	3	1

Elodea	Pike	Mussels
14		
3		
1	1	

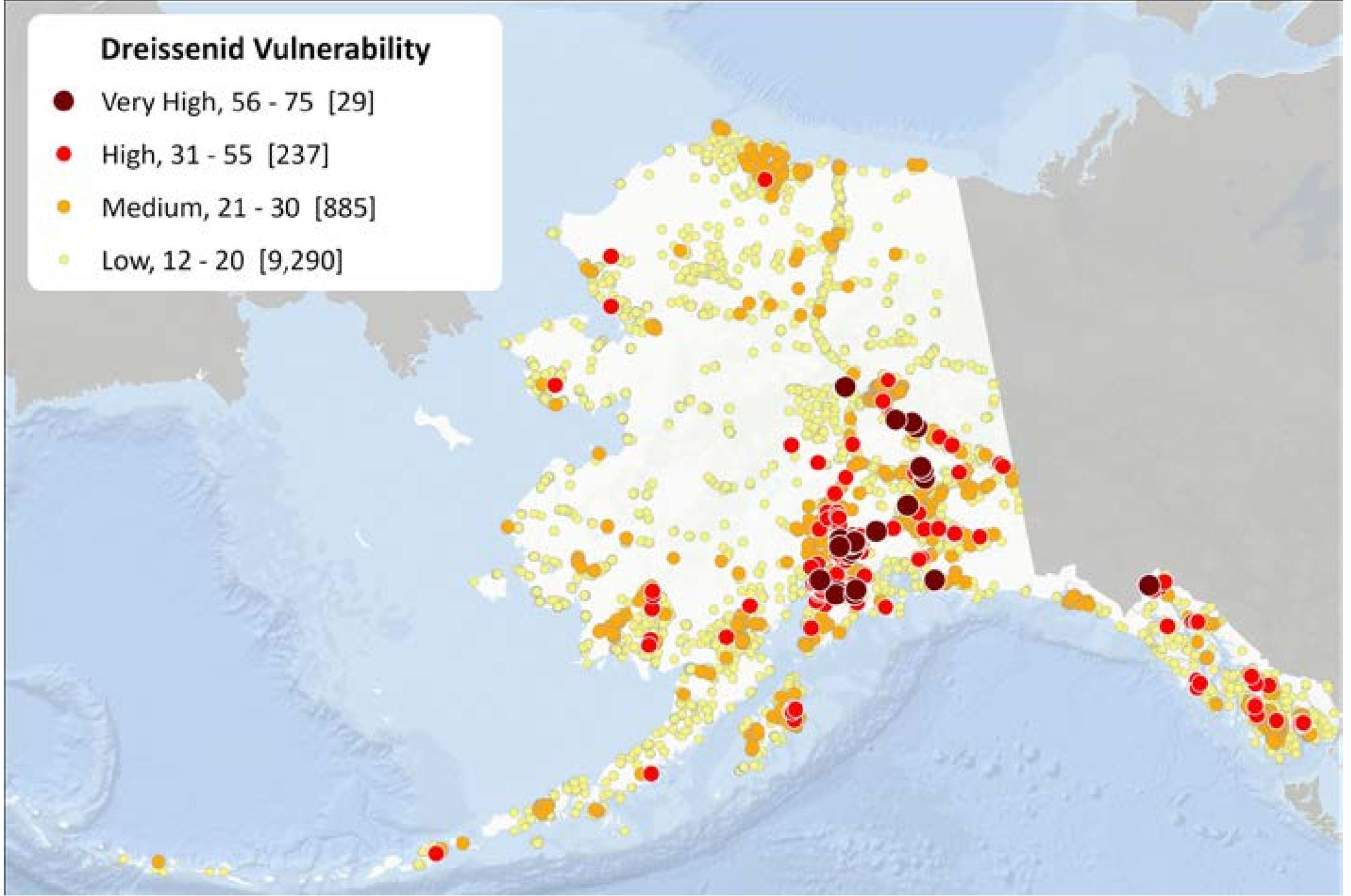
Distance to Road	3	3	1/2 mile to road = 0.75
		2	1 mile to road = 0.5
		1	Less than 5 miles to road = 0.25
Water Infrastructure	1	20	Is the lake a public drinking water supply or dammed for hydroelectric? Yes, then lake has critical infrastructure. Yes=1
Calcium Concentration Water Chemistry (Habitat Suitability)	4	4	Recent (year 2000-present) Calcium sample >20 mg/l (highly suitable)
		3	Recent (year 2000-present) Calcium sample 12 - 20 mg/l (moderate)
		2	Modeled Calcium concentration >20mg/l (highly suitable)
		1	Modeled Calcium concentration 12-20 mg/l (moderately suitable)

	79	90	98
1.26	1.11	1.02	
100	100	100	

USGS / UAF - model)	Elodea	Pike	Mussels
	79	90	98
Normalization factor (to max at 100)	1.26	1.11	1.02
Normalized Maximum Possible Scores	100	100	100

Dreissenid Vulnerability

- Very High, 56 - 75 [29]
- High, 31 - 55 [237]
- Medium, 21 - 30 [885]
- Low, 12 - 20 [9,290]



Lake Monitoring and Sampling Matrix

C a l c i u m	High >20 mg/l	0 No Priority	4 Monitor Low Priority	5 Monitor Medium Priority	6 Monitor High Priority	6 Monitor High Priority	7 Monitor Sample
	Moderate 12 - 20 mg/l	0 No Priority	4 Monitor Low Priority	4 Monitor Low Priority	5 Monitor Medium Priority	5 Monitor Medium Priority	7 Monitor Sample
	Low < 12 mg/l	0 No Priority	0 No Priority	4 Monitor Low Priority	4 Monitor Low Priority	4 - Monitor Low Priority	7 Monitor Sample
	Old Data (pre 2000)	0 No Priority	1 Sample Low Priority	2 Sample Medium Priority	3 Sample High Priority	3 Sample High Priority	7 Monitor Sample
	No Data	0 No Priority	1 Sample Low Priority	2 Sample Medium Priority	3 Sample High Priority	3 Sample High Priority	7 Monitor Sample
	Predicted High > 20 mg/l	0 No Priority	2 Sample Medium Priority	2 Sample Medium Priority	3 Sample High Priority	3 Sample High Priority	7 Monitor Sample
	Predicted Medium 12-20 mg/l	0 No Priority	1 Sample Low Priority	2 Sample Medium Priority	2 Sample Medium Priority	2 Sample Medium Priority	7 Monitor Sample
		Very Low	Low	Medium	High	Very High	Critical
Vulnerability (infrastructure, road access, boat launch, stocked, AWC, hydro connection)							
0	1	2	3	Sample - Collect water sample for calcium concentration analysis			
4	5	6	7	Monitor - Veliger plankton tow, shoreline survey, plates, benthic			

Monitoring and Sampling Targets

- 6 Monitor - High Priority
- 5 Monitor - Medium Priority
- 4 Monitor - Low Priority
- 3 Sample - High Priority
- 2 Sample - Medium Priority
- 1 Sample - Low Priority

Monitoring / Sampling

● Monitor - High Priority (36)

● Monitor - Medium Priority (36)

● Monitor - Low Priority (67)

■ Sample - High Priority (177)

■ Sample - Medium Priority (982)

■ Sample - Low Priority (9103)



Intermission





Invasive and Harmful Species

erves as a repository for data on non-native plants and animals in Alaska, with a specific focus on invasive
[Clearinghouse \(AKEPIC\)](#) is a database and mapping application that provides spatial information and ecological
in Alaska and neighboring Canadian Territories. Similarly, the [Alaska Aquatic Invasive Species Clearinghouse \(AAIS\)](#)
that provides temporal and spatial information for invasive aquatic species.

native species, habitats, and natural resources. Indeed, invasive species are considered to be one of the leading
"invasive species" means different things to different people. For ecologists, a species is "invasive" if it
Often, the word "invasive" refers to non-native species that negatively affect the region to which they are
uced by humans (whether intentionally or accidentally).



Non-Native Plants



Non-Native Plants



Aquatic Invasive Species



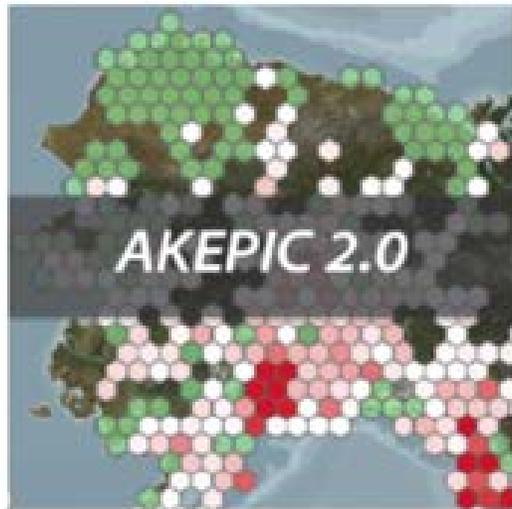
Kachemak Bay Community



Alaska Exotic Plants Information Clearinghouse (AKEPIC)

The Alaska Exotic Plants Information Clearinghouse (AKEPIC) is a collaborative effort between the University of Alaska Anchorage, the U.S. Forest Service, National Plant Material Center, and the Strategic Plan for Noxious Weeds associated with the project. AKEPIC supports the identification of non-native plant species in Alaska. Additionally, the data are used to track and monitor non-native plant species that are known to be present in Alaska (Continental Districts, and the University of Alaska Anchorage).

ACC tracks all non-native plant species that are known to be present in Alaska (Continental Districts, and the University of Alaska Anchorage).



Non-native Plant Data 2.0



Non-native Plant List



Elodea Survey Web App



Non-native Plant Data 2.0



Non-native Plant List



Elodea Survey Web App

Legend

Basemap Gallery

Details

Layers

Info

Filter

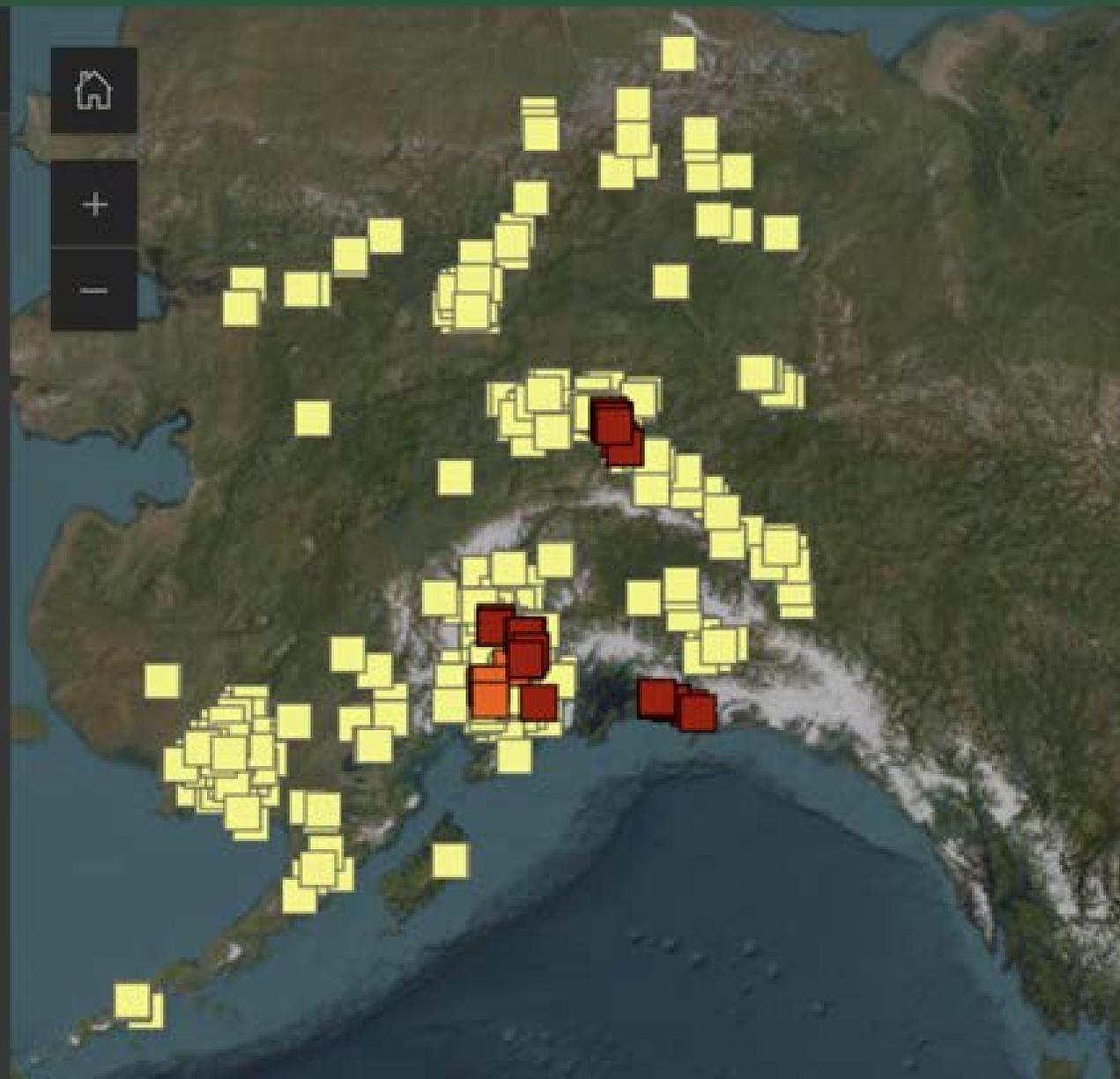
Legend



Elodea Survey Summary

Survey Lakes - points

- Survey, Elodea still present
- Survey, Elodea treatment
- Survey, no Elodea detected





Alaska Elodea Survey Map Viewer

Info

AKEPIC Data: NULL

Zoom to

MSDB_ID	681,788
Municipality Or County	Matanuska-Susitna Borough
Observers	Swenson, N.
Occurrence Status	1
Original Site Code	Flat Lake513
Precision	0-100
Project	NULL
Description	

2,000 ft

1 of 4



Invasive and Harmful Species

The Alaska Center for Conservation Science serves as a repository for data on non-native plants and animals in Alaska and the Aleutian Islands. The [Alaska Exotic Plants Information Clearinghouse \(AKEPIC\)](#) is a database and mapping application that provides risk assessments for non-native plant species in Alaska and neighboring Canadian Territories. Similarly, the [Alaska Aquatic Species Information Clearinghouse \(AKEAIC\)](#) is a database and mapping application that provides temporal and spatial information for invasive aquatic species in Alaska.

Invasive species can have strong impacts on native species, habitats, and natural resources. Indeed, invasive species are one of the greatest threats to native species worldwide. The term "invasive species" means different things to different people. For ecologists, it refers to a species that establishes and spreads rapidly to new areas. Often, the word "invasive" refers to non-native species that negatively impact native species and that have usually been introduced by humans (whether intentionally or accidentally).



Aquatic Invasive Species



Non-Native Plants



Aquatic Invasive Species



Kachemak Bay Community



Alaska Aquatic Invasive Species Clearinghouse (AK Aqua)

The Alaska Aquatic Invasive Species Clearinghouse (AK Aqua) is a database and mapping application that provides temporal and geospatial information for invasive aquatic species in Alaska. Taxa are primarily intended to support the identification of a variety of research and modeling activities.

The AK Aqua products are the result of funding from KBNERR, and ACCS, in support of the project. The UAA administrator of the mapping application.



Alaska Aquatic Invasive Species Clearinghouse



Aquatic Invasive Species List



Dreissenid Mussel Web App



Alaska Aquatic Invasive Species Clearinghouse



Aquatic Invasive Species List



Dreissenid Mussel Web App



Legend

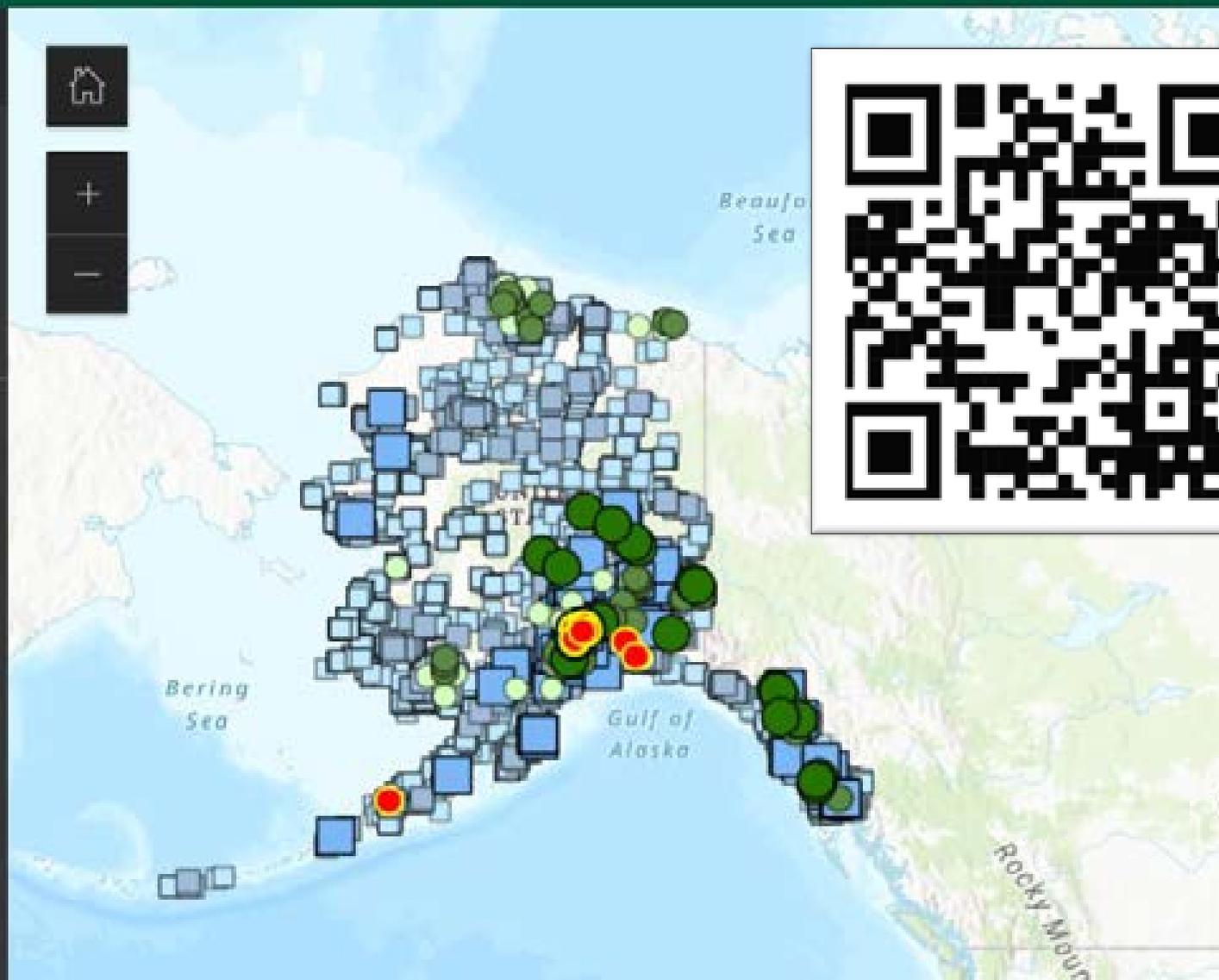


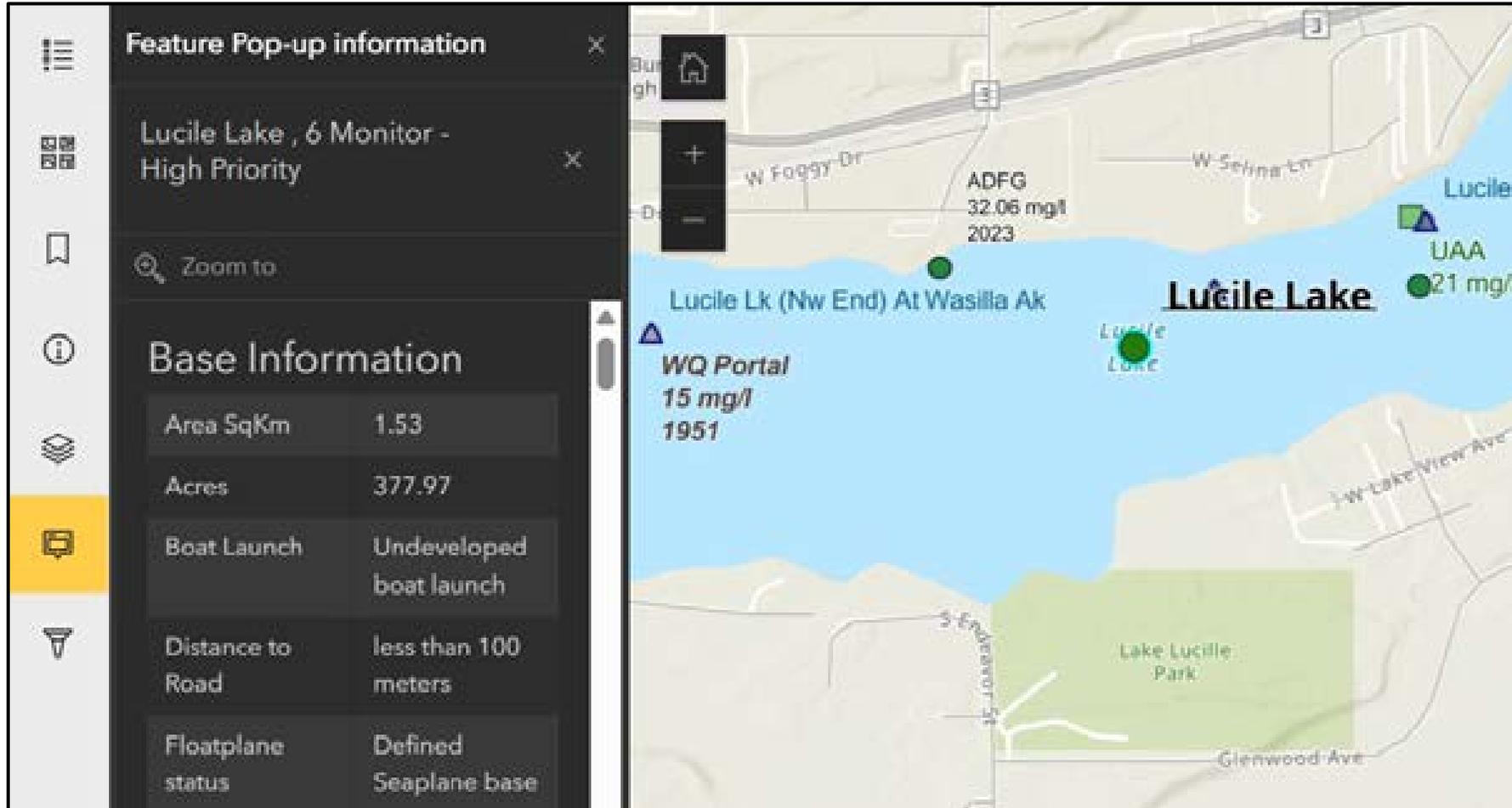
Mussel Field Monitoring - Survey 123

 Survey Point

Prioritized Lakes: Mussel Monitoring and Calcium Sampling

-  6 Monitor - High Priority
-  5 Monitor - Medium Priority
-  4 Monitor - Low Priority
-  3 Sample - High Priority
-  2 Sample - Medium Priority
-  1 Sample - Low Priority





- > 50 Attributes
- Access
 - Boat Ramps
 - Floatplanes
- Suitability
 - Calcium
- Values
 - AWC
 - Stocked

Filter - Lakes

0.24

Anadromous Waters Catalog

Yes, in AWC

Boat Launch

Pike Status

0

Pike Status

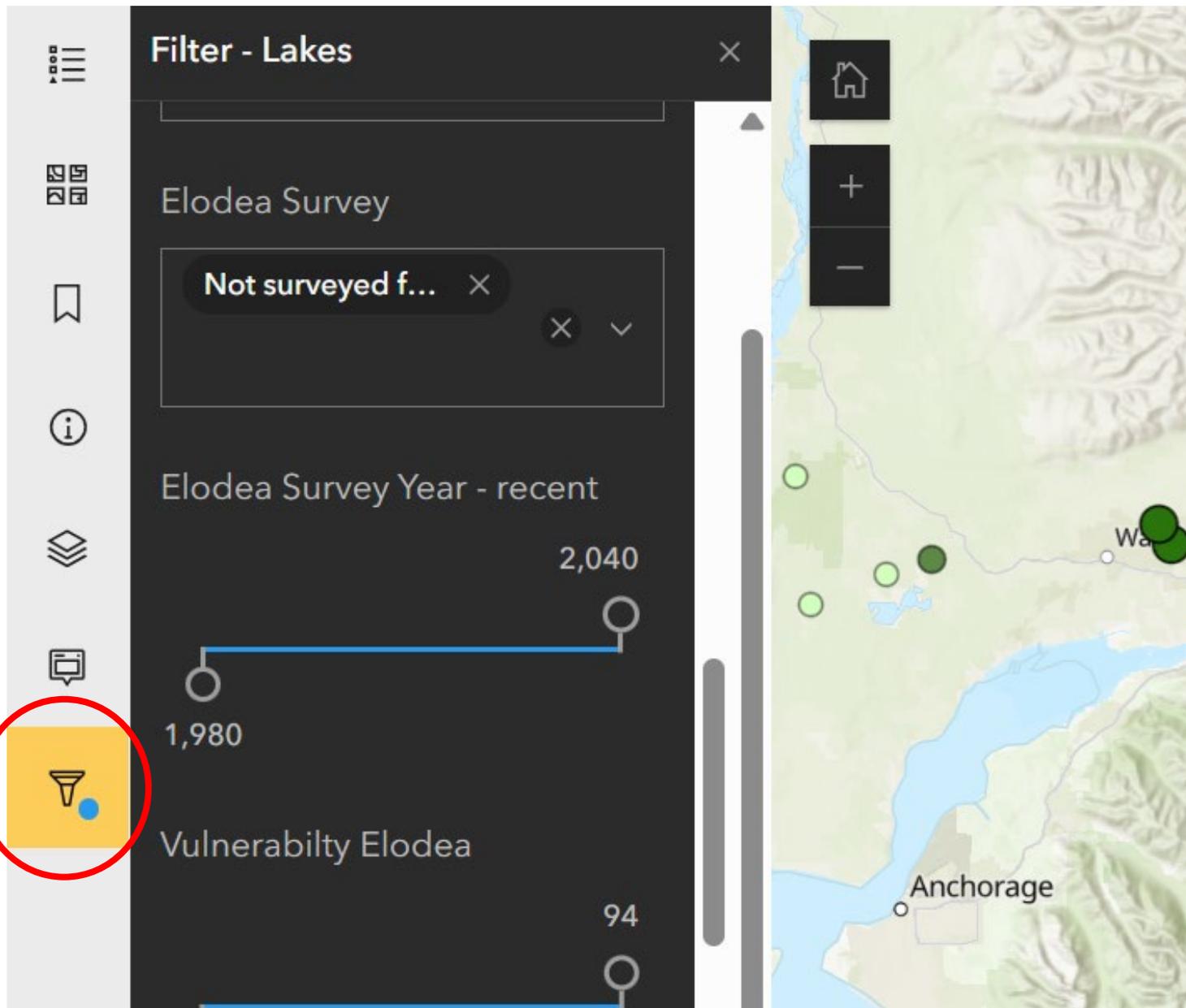
Talkeetna

Washita

nik ANVSA

Filter Example:

- High / Medium Sampling Priority
- AWC
- No Pike



Filter Example:

- High / Medium Monitoring Priority
- Mat-Su Borough
- AWC
- No Elodea Survey



Filter - Lakes

0.24

Export list to CSV file

Pike Status

Pike Status

search by Lake Name

Open tab(s): 1

Prioritized Lakes: Mussel Monitoring and Calcium Sampling

Prioritized Lakes: Mussel Monitoring and Calcium Sampling (Total: 8 | Selection: 0)

	Name	Area SqKm	Acres	
<input type="checkbox"/>	Big Lake	12.421	3069.28	
<input type="checkbox"/>	Big Beaver Lake	0.62	153.09	
<input type="checkbox"/>	Flat Lake	1.258	310.78	Private

Refresh data

Export to CSV

User Guide: Dreissenid Mussel Monitoring and Sampling Web Mapping Application

OVERVIEW: This web mapping site provides the user with an ability to view Alaskan lakes and ponds' vulnerabilities to multiple aquatic invasive species. The tool focuses on dreissenid mussels (quagga and zebra) although it also includes information on other species such as plant elodea, and northern pike outside their native range. The tool combines datasets from multiple sources related to waterbodies, monitoring, and sampling as well as ongoing monitoring and sampling activities.

With all of this information consolidated by waterbody, and sampling prioritizations to plan summer field seasons, managers can designate critical lakes for

START UP: You will see a map of Alaska with green circles represent lakes and ponds that have been prioritized for sampling to assess habitat suitability. As you zoom in, more details will become visible on the web map.

BASIC TOOLS: You will see six icons along the map's left



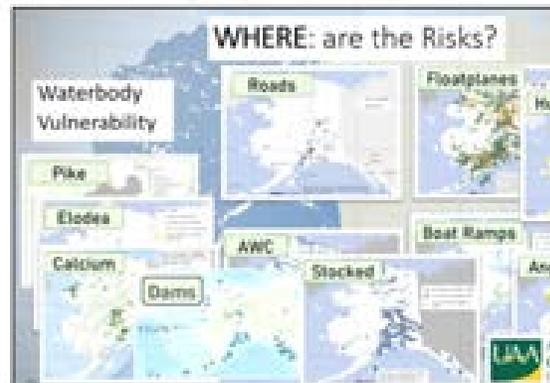
How we prioritized Alaska's 1 million Lakes and Ponds for Aquatic Invasive Species Monitoring?

1) We started with a base layer of 878,000 lakes and ponds from the US Geological Survey's (USGS) National Hydrographic Dataset (NHD) for Alaska. This is a geographic information system (GIS) dataset of polygons tracing the perimeters of Alaska's non-flowing, freshwater.



2) We intersected these polygons of lakes and ponds with a range of other data layers that can be grouped into categories such as:

- Base:** layers that convey context (land manager, Borough, watershed, etc.)
- Infection Threat:** layers that are risk factors for an invasive species that has been introduced and successfully established in a waterbody (boat to roads)
- Monitoring:** information related to waterbody monitoring (e.g. calcium sampling, calcium modeled concentration, plankton data)
- Spread Threat:** layers that are risk factors for an invasive species upon its connection or proximity to infested waterbodies (hydroelectric, presence of elodea or pike in the watershed, floatplanes)
- Values:** layers that represent ecosystems, economic, and social values (hydroelectric lakes, drinking water sources, anadromous water bodies stocked by AK Dept. of Fish and Game)



- User Guide
- Methods “How we Prioritized..”
- Field Sampling SOP



— BUREAU OF —
RECLAMATION

Standard Operating Procedure: Field Sampling Methods for Invasive Mussel Early Detection

Field Sampling Standard Operating Procedure (SOP)
Version 8 (Date Revised: 2024)
Document No. Ecolab-F-036-8-2024-06

Bureau of Reclamation
Ecological Research Laboratory



HOW: You can help?

Sampling - Collect Water for Calcium Analysis

- Use Map to determine greatest needs
- Confirm with Dreissenid working group: Tammy Davis – ADF&G, Kim Holzer - USFWS, Marcus Geist - UAA
- Obtain Sampling Kit Contact Deanna Strohm , UAF
- ddstrohm@alaska.edu



HOW: You can help?

Monitoring - Survey 123 app

- Shoreline (wrack line) walks for adult mussels
- Existing substrate (docks, pilings, etc.) for adult mussels
- Aquatic plant shake-down for adult mussels
- Plankton tow for larval mussels (veligers)
- Settlement plates or submerged bricks for adult mussels
- Ponar dredge (sediment grab sample) for adult mussels
- <https://arcg.is/19H8SG2>





Acknowledgements

- Funding: AK Dept. of Fish & Game & US Fish and Wildlife Service

Project Team:

- Tammy Davis, Krissy Dunker, Parker Bradley, Eric Wood – ADF&G
- Kim Holzer, Lisa Dlugolecki, Ben Wishnek - US Fish and Wildlife Service
- Toby Schwoerer, Erik Schoen, Deanna Strohm, Andy Baltensperger, and Dana Brown, UAF, International Arctic Research Center



<https://accs.uaa.alaska.edu/invasive-species/>

Marcus Geist
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Alaska Center for
Conservation Science
UNIVERSITY of ALASKA ANCHORAGE



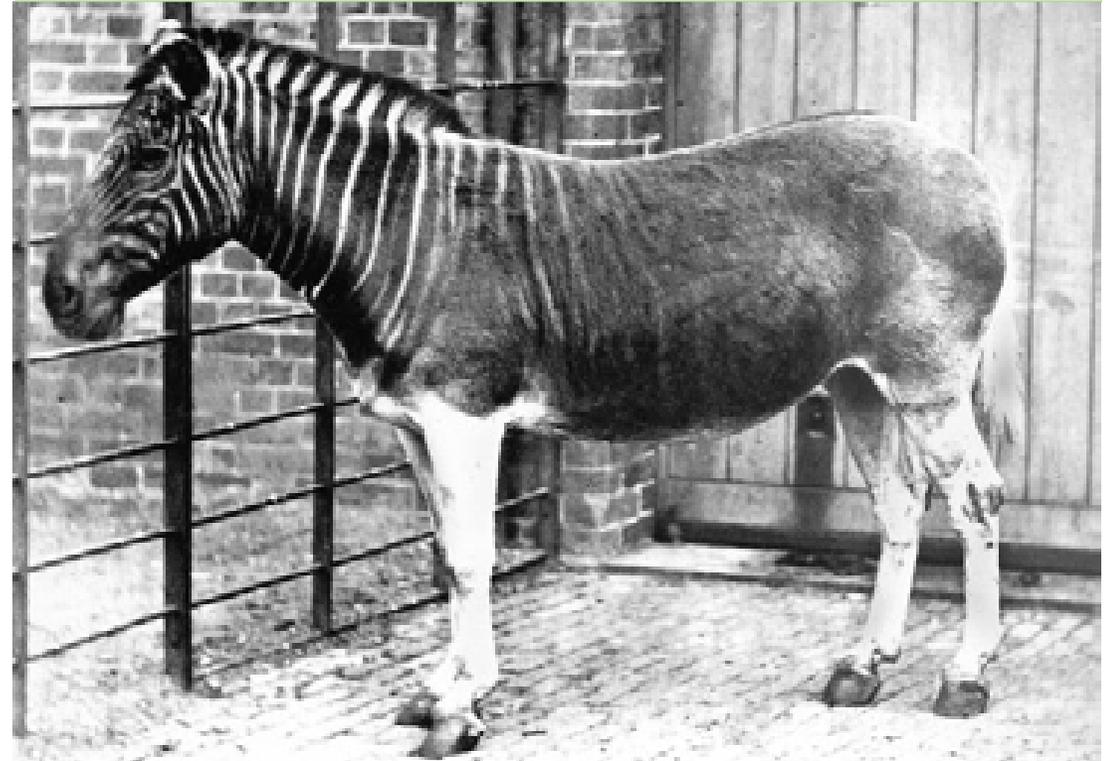
Prioritizing Invasive Dreissenid Mussel Monitoring

Zebra



By Yathin S Krishnappa - Own work, CC BY-SA 3.0,
<https://commons.wikimedia.org/w/index.php?curid=31862629>

Quagga



By Frederick York (d. 1903) - This file comes from the Biodiversity Heritage Library, and is available online at [biodiversitylibrary.org/page/28201475/.](https://commons.wikimedia.org/w/index.php?curid=108413), Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=108413>

WHEN/WHERE: can we see results?



ArcGIS
Survey
123

Standardized
data fields

Uploads to web
map

Includes site
photos

The screenshot shows the ArcGIS Survey 123 interface. On the left is a vertical toolbar with icons for home, zoom, layers, and other map functions. The main area is a satellite map of Lake Lucille, with a green overlay indicating the lake's boundary. Two red circular markers are placed on the lake. A 'Feature Pop-up information' window is open, displaying details for a feature named 'Lake Lucille'. The window includes a 'Zoom to' button, a table of 'Sample Location' and 'Survey Methods', and a 'Waterbody Name' field. At the bottom of the pop-up is a photo of a person in a life vest handling a white bag. A scale bar at the bottom of the map indicates 2,000 feet. The map labels include 'Burchell High School', 'W Parks Hwy', 'W Foggy Dr', 'W Lucille Dr', 'W Salina Ln', 'B Eckerwort St', 'Glenwood Ave', and 'Lake Lucille Park'.

Sample Location	Survey Methods
Campground	Plankton_Tow_
Dock	for_Veligers,Se
	ttlement_Plate
	_(artificial_su

Dreissenid Impacts (why you should care!)

- Infrastructure damage
 - Reproduce fast & often
 - Attach with glue-like byssal threads
 - & take up space – a lot of it!
- Outcompeting other species
 - Reduce phytoplankton biomass
- Eradication very difficult and expensive
 - Can prompt recreational closures
 - Lake quarantine can reduce property values



Dreissenid Impacts

- Alter energy pathways, nutrient availability
- Redirect biomass
 - water column → benthos
- Store a TON of carbon and nutrients
 - Reduce primary productivity
 - Potential “boom & bust” due to die-off events
 - May promote cyanobacteria blooms



(photo by: Jiyang Li)