

Early Detection of Aquatic Invasive Species Using eDNA Technology: How MiCorps Volunteers can Help!

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What is environmental DNA?

DNA released into the environment by an organism:

- Scraped-off tissue cells
- Feces or excrements
- Fish slime
- Reproduction: Eggs, veligers, juveniles, larva, etc.
- Cells released after organism death/decay
- Free-floating DNA released from any cell lysis



Why eDNA for detecting invaders?

- 1. Sensitivity**
- 2. Cost**

eDNA can be used for:

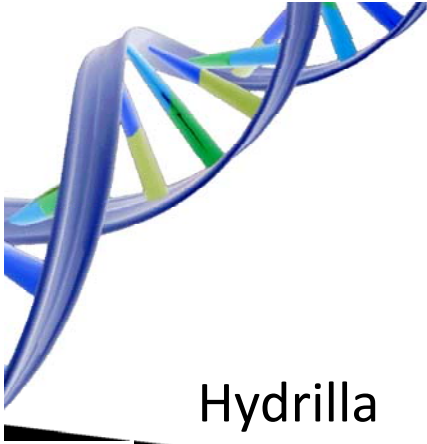
- Determining the presence or absence of an organism in an area
- Creating distribution maps to determine how wide-spread the invasion is
- Confirming results obtained via sightings



Project Overview

- eDNA-based monitoring
- Community-based sampling
- Smart phone-based reporting





Target Species

Hydrilla



[www.sms.si.edu]

Northern Snakehead



[shopboblake.blogspot.com]

Golden Mussel



[<http://biolo.bg.fcen.uba.ar/primerapagina.htm>]

Fishhook Water Flea



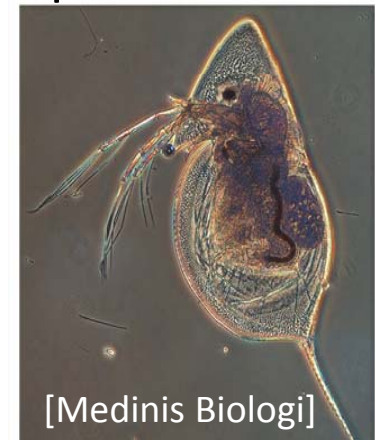
[natureofnature.tumblr.com]

Killer Shrimp



[[Michael Grabowski](#)]

Daphnia cristata



[[Medinis Biologi](#)]



Gene-Z™ for detecting eDNA



Decentralized
detection of gene
targets in a field
setting!



Gene-Z Application for
iPhone or Android

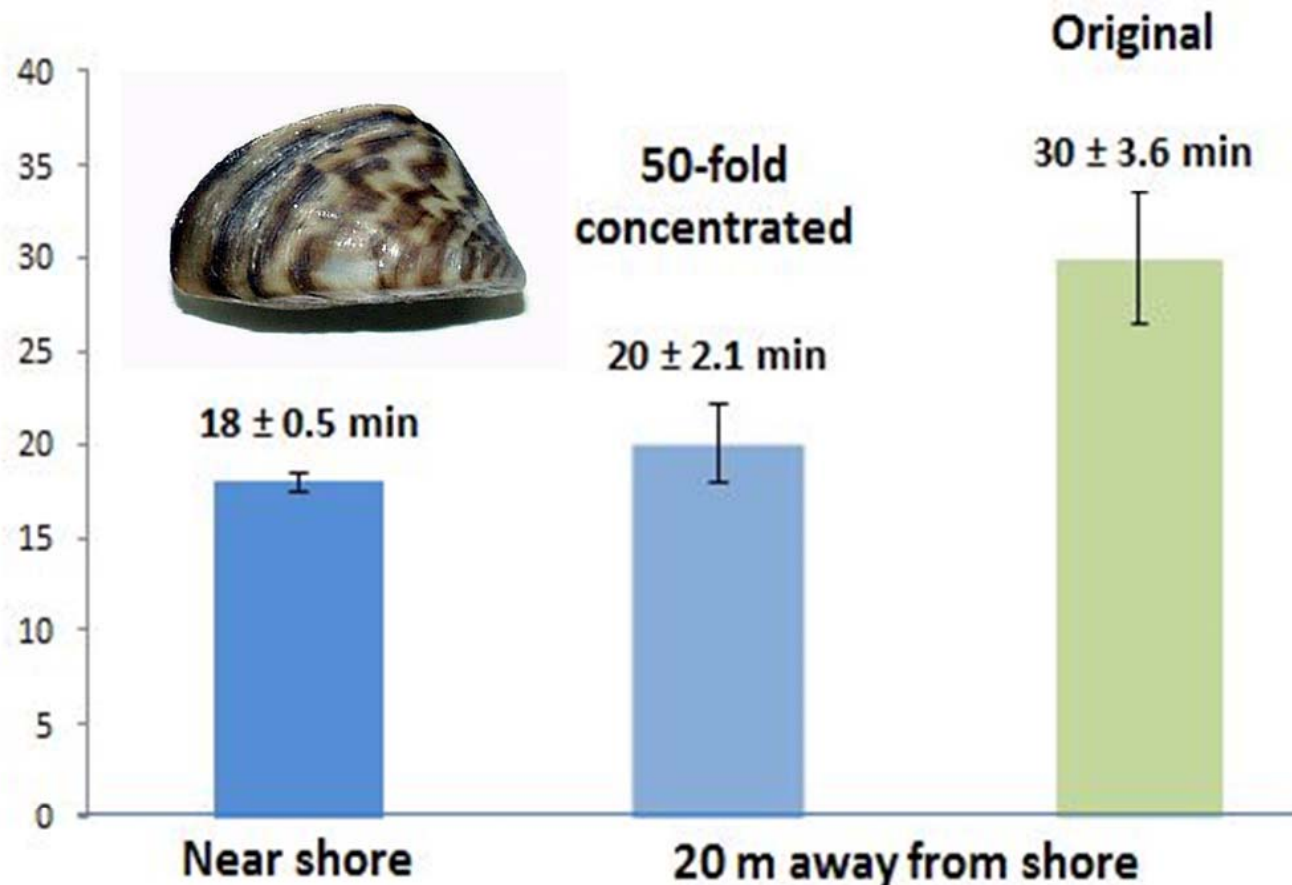


Gene-Z uses
microfluidic chips
that allow easy
dispensing of
samples into
reaction wells.

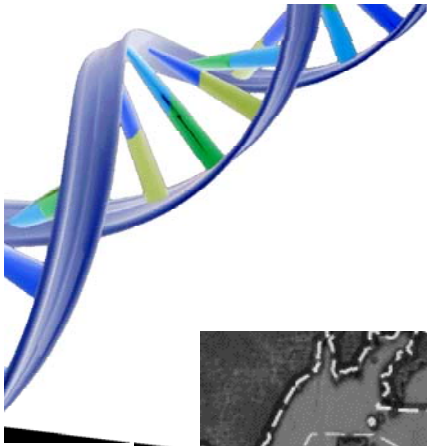


Preliminary eDNA results

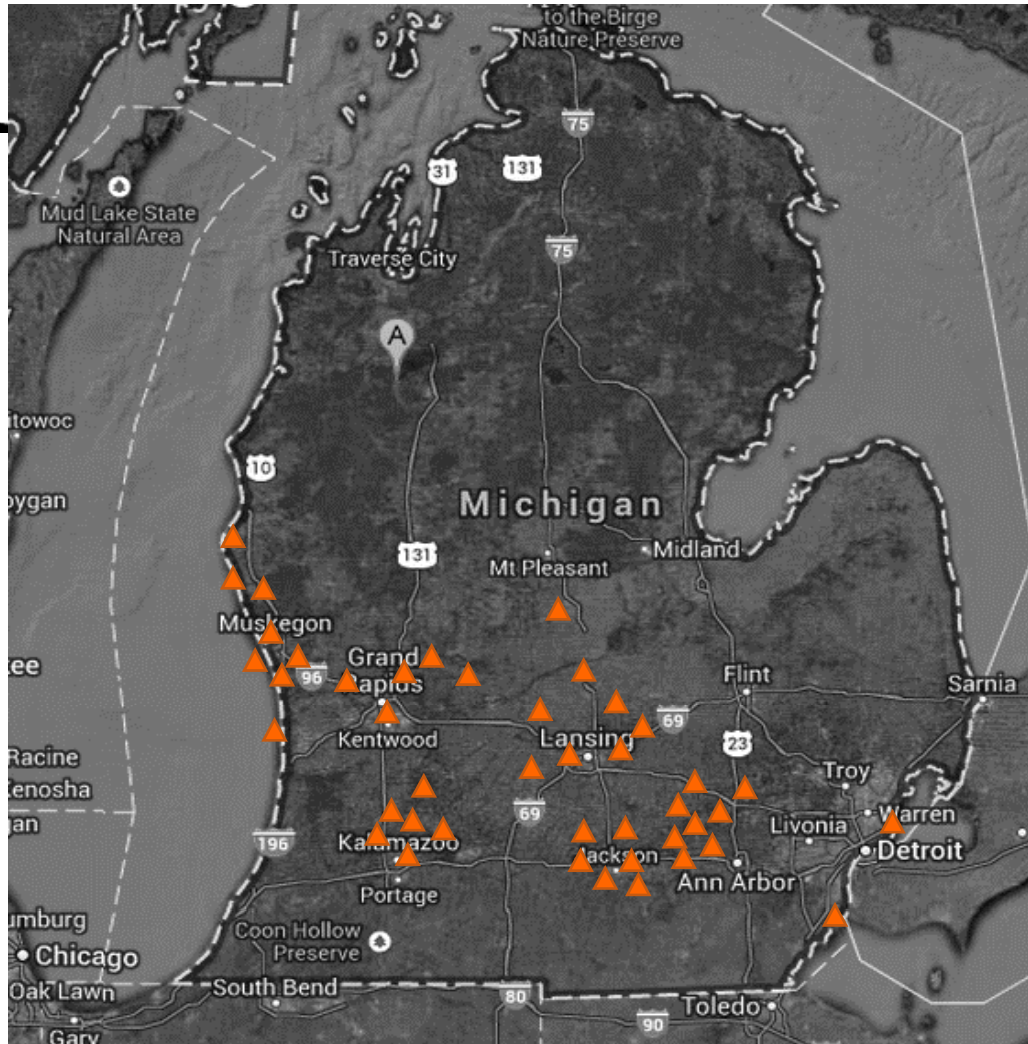
Zebra Mussel primer sets in 1 μ l lake water samples



Minimal/ no sample processing is required at high abundances!



Sampled locations



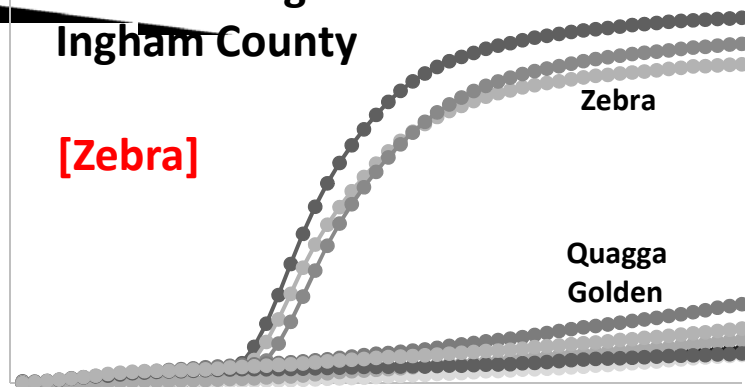
Unfortunately, we are limited in sample collection personnel and have only collected samples from the southern half of Michigan's Lower Peninsula.



Some results for invasive mussels

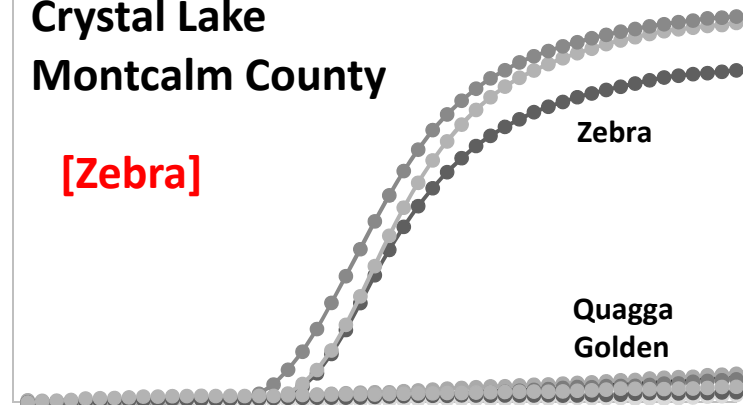
Lake Lansing
Ingham County

[Zebra]



Crystal Lake
Montcalm County

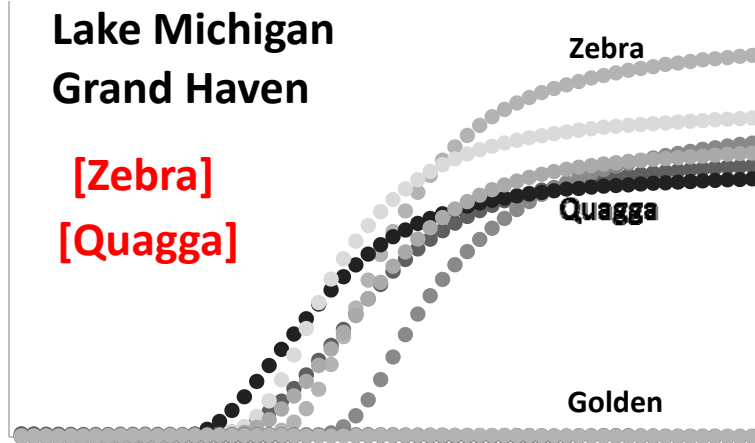
[Zebra]



Lake Michigan
Grand Haven

[Zebra]

[Quagga]



Round Lake
Clinton County

[None!]





How can MiCorps volunteers help?

We need help collecting samples!



Two Types of Samples are collected:

1. Collect 2 Liters of lake water samples
2. Filter 20 Liters of water through a filter funnel



The Sampling Kit

- One 1 Liter Filtration Bottle
- Two 1 Liter water sample bottles
- One Sampling Information Sheet
- One Sampling Protocol Sheet
- One 50 mL Tube
- One Shipping Box with Prepaid Postage and Mailing Address



Just place samples in freezer overnight, then ship back the next day!



Samples will be tested for:

Potential Invasive Species

- Golden Mussel
- Northern Snakehead
- Hydrilla
- Daphnia cristata
- Killer Shrimp

**We can also add species if
there is a particular one
you are interested in!**

**If resources/time are available*

Present Invasive Species

- Spiny Waterflea
- Fishhook Waterflea
- Sea Lamprey
- Round Goby
- Zebra Mussel
- Quagga Mussel
- Rusty Crayfish



Cornell University



Emailed results within one month!

General Information	
Sample Submitted By:	John Smith
Lake Name:	Lake Michigan
Sample Collected at:	Muskegon State Park Beach North Muskegon, MI
Sampling Date:	10/1/2013
Sample Types Submitted:	2 Bottles of Pure Lake Water 1 50 mL tube with Filtrate
Sample Analyzed by:	Maggie Kronlein
Analysis Date:	10/3/13



Emailed results within one month!

Invasive Species Results		
<u>Common Name</u>	<u>Scientific Name</u>	<u>Present/Absent</u>
Golden Mussel	<i>Limnoperna fortunei</i>	Not Detected
Northern Snakehead	<i>Channa argus</i>	Not Detected
Hydrilla	<i>Hydrilla verticillata</i>	Not Detected
Daphnia	<i>Daphnia cristata</i>	Not Detected
Killer Shrimp	<i>Dikerogammarus villosus</i>	Not Detected
Zebra Mussel	<i>Dreissena polymorpha</i>	Detected
Quagga Mussel	<i>Dreissena bugensis</i>	Detected
Fishhook Waterflea	<i>Cercopagis pengoi</i>	Detected
Spiny Waterflea	<i>Bythotrephes longimanus</i>	Detected
Sea Lamprey	<i>Petromyzon marinus</i>	Detected
Round Goby	<i>Neogobius melanostomas</i>	Detected
Rusty Crayfish	<i>Orconectes rusticus</i>	Not Detected



iSAW for results and reporting



Invasive Species Appearance Warning

iSAW software is made possible by support from the United States Environmental Protection Agency, Great Lakes Restoration Initiative, under Assistance Agreement No. GL-00E01127-0



Report a High-Risk
Invasive Species



Check eDNA Results
from your Sample



Ask an Expert



Connect with
Stakeholders



Prevention and
Control Projects



In the News



Invasive Species
Information



Lake Locations



Channel for Invasive
Species



Connect with Other
Programs



FAQs



Comments?
1 minute survey!

Coming Soon!



What comes after a positive test?

- Input eDNA results into the iSAW database for public access
- Results can assist in management / screening
 - Should we be on the lookout for invaders in the first place?
- Allow for the validation of field sampling studies
- Help determine a level of infestation (Low, Moderate, High)
- Determine the distribution of invaders in an area
- Gene-Z™ devices will be distributed to individual in MiCorps!

Early detection is crucial to successful eradication!



Acknowledgements



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Michael Stevens.