

Dreissenid Mussel Control Demonstration Project

Invasive Mussel Collaborative



Mission

 Advance scientifically sound technology for invasive dreissenid mussel control to produce measurable ecological and economic benefits.

Goal

 Develop and guide the implementation of a longterm adaptive strategy that establishes and prioritizes an agenda for developing effective dreissenid mussel control methods that can be applied at a variety of spatial scales and environments to suppress or eradicate dreissenid mussels and support the restoration of biodiversity, and ecosystem functions and services



Strategy to Advance Management of Invasive Zebra and Quagga Mussels (2018)

- drive investments in policy and research that lead to reducing invasive mussels and their impacts
- inform, coordinate and prioritize ongoing research and management
- allow flexibility in developing approaches to implementation







Strategy Management Goals

- Respond to new detections of ZQM to slow spread and/or protect assets
- Protect and restore critical habitats with broad ecological value, focusing on Great Lakes coastal areas
- Protect/restore native unionid mussel populations and habitat
- Restore balanced productivity in impacted lake systems
- Restore socioeconomic benefits in impacted systems





Dreissenid Mussel Control Demonstration Project

- Application of species-specific molluscicide (Zequanox^{® 1}) underneath a containment barrier placed on top of a small area of coastal reef in Lake Michigan
- Conduct monitoring to assess the effectiveness of the treatment and ecological effects.
- Project site is Good Harbor Bay near Sleeping Bear Dunes National Lakeshore





¹Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Dreissenid Mussel Control Demonstration: Good Harbor Reef

Invasive Mussel Collaborative Webinar: Outcomes and Lessons Learned from Recent ZQM Control Studies August 27, 2020

Doug Bradley, Sr. Project Scientist



Demonstration Project Goals

1) Evaluate the feasibility and effectiveness of invasive mussel control methods in a Great Lakes coastal environment

2) Response of the benthic community to treatment



\mathbf{O}

Study Area

- Off Sleeping Bear Dunes National Lakeshore
- SW of Leland
- ~ 1.25 off shore



Good Harbor Reef

- Rocky reef
- ~30 ft deep
- Dense mussel coverage
- (D. rostriformis bugensis)





Selected Method: Zequanox ®

Can this product be effectively applied to an offshore location using a controlled and contained approach?

- Derived from naturally occurring soil bacteria (*Pseudomonas fluorescens*)
 - Contains dead bacterial cells
 - Mussels ingest product; destroys digestive system
 - Mortality 3-21 days
- Loses potency within hours
- Target specific to zebra and quagga mussels
- Approved by EPA for open water use (Reg. No. 84059-15)
- Low risk to human health and the environment; low toxicity to fish, native mussels, insects, plants, etc.
- Safely used in lakes in Michigan (Round Lake and Lake Erie), Illinois (Deep Quarry Lake) and Minnesota (Christmas Lake, Lake Minnetonka)
- Applied by certified aquatic pesticide applicator

Regulatory Requirements

- National Pollutant Discharge Elimination System (NPDES) permit
 EGLE
 - Nuisance animal control
 - Monitoring and reporting requirements
 - Pesticide discharge management plan
- EGLE Great Lakes Submerged Lands Permit
 - Placement of structures on bottom
 - Disposal of sandbag contents
- Army Corps of Engineers Permit
 - Great Lakes bottomlands
 - Endangered species
 - State historic preservation
- Public Notice and Comment
- Public Meeting*

*Not required but included

Plot Layout

- 3 treatment plots (10m x 10 m)
- 12 quadrates (5mx5m)
- Control site (UWM)

Ref. Pt		Ref. Pt	Ref. Pt			
1	Treatment Plot A		Treatment Plot B		Treatment Plot C	
Day 1	A1	A2	B1	B2	C1	C2
Day 2	Center					
Day 3		>)
	A3	A 4	B3	B4	C3	C4



Containment Design

- Enclosures (x4)
 - 1¹/2" PVC
 - 3 ft tall
 - 15x18 ft
- Barriers (x4)
 - Clear Poly
 - String reinforced
 - 30x3oft
- Seal (x 135)Sandbags 30lb





Application Design

- Portable design for boat
- Effective on-site mixing
- Effective pump at distance and depth
- Effective delivery/spread into containment plots









Monitoring

- Pre-treatment
- During treatment
- Post-treatment
 - 1 day
 - 1 week
 - 2 weeks
 - 5 weeks

- Water quality
 - Dissolved oxygen
 - Ammonia
 - pH
 - Conductivity
 - Turbidity
 - Total suspended solids
 - CBOD5
 - Total phosphorus



- Caged mussels
- Mussel density and size
- Benthic invertebrates
- Bacterial community
- Visual assessment





Product concentration and volume

Plot	Sonde No	Treatment Date	Treatment Duration (hrs)	Max Turbidity (NTU)	Average Turb (NTU)	Avg Zeq Concentration (mg/L)
A1	1	8/13/2019	20.95	567	95	177
A2	1	8/7/2019	7.75	183	89	166
A3	1	8/12/2019	6.00	330	56	103
A4	3	8/13/2019	20.43	472	110	205

*Concentrations are calculated using turbidity measured at a single point within the structure. Single point measurements may not be representative of the entire treatment area.

Mixed 6kg into 100 liters lake water Mixed ~60 gmp, little oxygen mixing, delivered at ~7 gpm to divers

August 2019

Target

- Permits in hand
- Calm lake, < current
- No fish spawning activity
- >10C for Zequanox effectiveness
- 8hr exposure
- Staged treatment (3 days, planned)

Actual

- Permits in hand
- Not calm and caused delays
- Only goby observed
- 20 C entire time
- 6 to 20 hr exposure (weather)
- Staged over two weeks



Summary

- Layout effective
- Divers needed and setup worked
- Mixing and pumping worked







Summary

- Containment worked and held
- Delivery system worked
- Met turbidity targets
- Many ideas on improvements
- Very happy with outcome!

Next Steps

Project Goals

- Evaluate the feasibility and effectiveness of invasive mussel control methods in a Great Lakes coastal environment
- 2) Assess response of the benthic community to treatment

Mixing process worked Great delivery to wand Nice distribution into area Hit turbidity target No leakage Exposure period generally met

09:54:28

Can this product be effectively applied to an offshore location using a controlled and contained approach?



Thanks for the opportunity and support -

Project Team plus the following,

GL Commission – Erika Jensen, Jill Estrada, Cecilia Weibert

UCC Divers – John Jabas, Jeff Bursey, Adam Roskowski, Matt Welch, Paul Nelson, Melanie Lyman

USGS – Jim Luoma

EGLE – Darrin McCullough, Robyn Schmidt, Sylvia Heaton

ACOE – Katie Otanez

Leeland Marina Staff

LimnoTech – Kathy Hall, Carrie Turner, Brandon Ellefson

Doug Bradley: <u>dbradley@limno.com</u>

🔍 www.limno.com

Notice: Invasive Quagga Mussel Treatment Underway



This week you may see increased activity at and around Leland Marina and Good Harbor Bay

The Invasive Mussel Collaborative is working with a team of experts and certified divers to treat invasive guagga mussels on a reef in Good Harbor Bay. This work is part of a project to evaluate control methods for zebra and quagga mussels in a Great Lakes coastal environment, and to assess potential benefits to native fish and the surrounding aguatic community

and their divers be

he project team will be

while on a real state suffect little over the same

Long Variation (Labor 1997) contrately final wodes for

the steep is set of the

artical of will have

have sell be an mean on th

ato ereriting in the area or the solety of the clime



Why any investve manages being treated here? off is stud countage mainwith any fore assumbly andres adolesced and an entropy damage to the Deed must hadness between the page of the restore a statute the traderal after spacial and divergence for acquire free wath Later eth changing montable and redeatch shows that Galegon man

contribute to an example algoring contribution and total interface like of this cloud algaet take liked to conditions that produce the briefour states which is taken to by reasonic and introduced into the local well, leading to the death of heb and water tanks roladed threatened and endargened species. This plut propert that will have emign) the diffectiveness of the location's centred and the infected her Internet in Addressing the state of the stat

Creat Labors, and Diverge, and the U.S. Arrow Carpor of Regimeers to replayment the property

this sums. Nully approxime renarized and approach for propert work play and constant for pro-

for public review provids final approval. The pervets both to evolve that the propert will

premiers' Datasi Lakers manter receivers and sufficient on reputive torgets on threadened in

has proper pertitioning and estate place in place in other to perdict the period and

other boatent are asked to be and Medanian () as at least \$50 method as an Store the area of and the board is worked. he will also minimum americal disruptions to the work

What will the team and their divers be doing?

of them, diserts will be assertiling a series of analyzers (large rote a const area of the seel. The team call they agong the con-ground Zequarreath through a bone and enter-work the target Zergamonii to a LUC 194 register presidently, designed to best full years and a segar rescale. It is proceed for one in star laises and has been safely used in several lates. The endored terms will been Englanceable on the work only advance is in people it, preventing 207112 relial party of the work



What permits are required for this project?

endergared samples, or honord and colluted seen

the perpetit team second required permits have the Maringan







Next Steps

Good Harbor Reef Project



Invasive Mussel Collaborative

- Work Groups
 - Research coordination and prioritization
 - Coastal site identification



Acknowledgements

- IMC Members & Agencies
- Great Lakes Restoration Initiative
- U.S. Geological Survey
- NOAA
- Great Lakes Fishery Commission

www.invasivemusselcollaborative.net invasivemussels@great-lakes.net

This material is based upon work supported by the U.S. Geological Survey under Grant/Cooperative Agreement No. **G18AC00279**. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Geological Survey. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Geological Survey.



Invasive Mussel Collaborative