

Zebra and Quagga Mussels in the Susquehanna

Sarah Whitney

Pennsylvania Sea Grant



Credits

- Sara Gris , Pennsylvania Sea Grant
- Tom Horvath, SUNY College at Oneonta
- Chuck O'Neill, New York Sea Grant
- Jim Grazio, Pennsylvania DEP

Invasive Species

- Invasive species are the greatest threat to freshwater biodiversity worldwide
(Sala et al. 2000, Lodge 2001)
- Over 180 invasive species have been introduced into the Great Lakes since the 1800s



Dreissenid Mussels



Dreissena bugensis
(Actual size is 13 mm)



Photo by Bill Tate



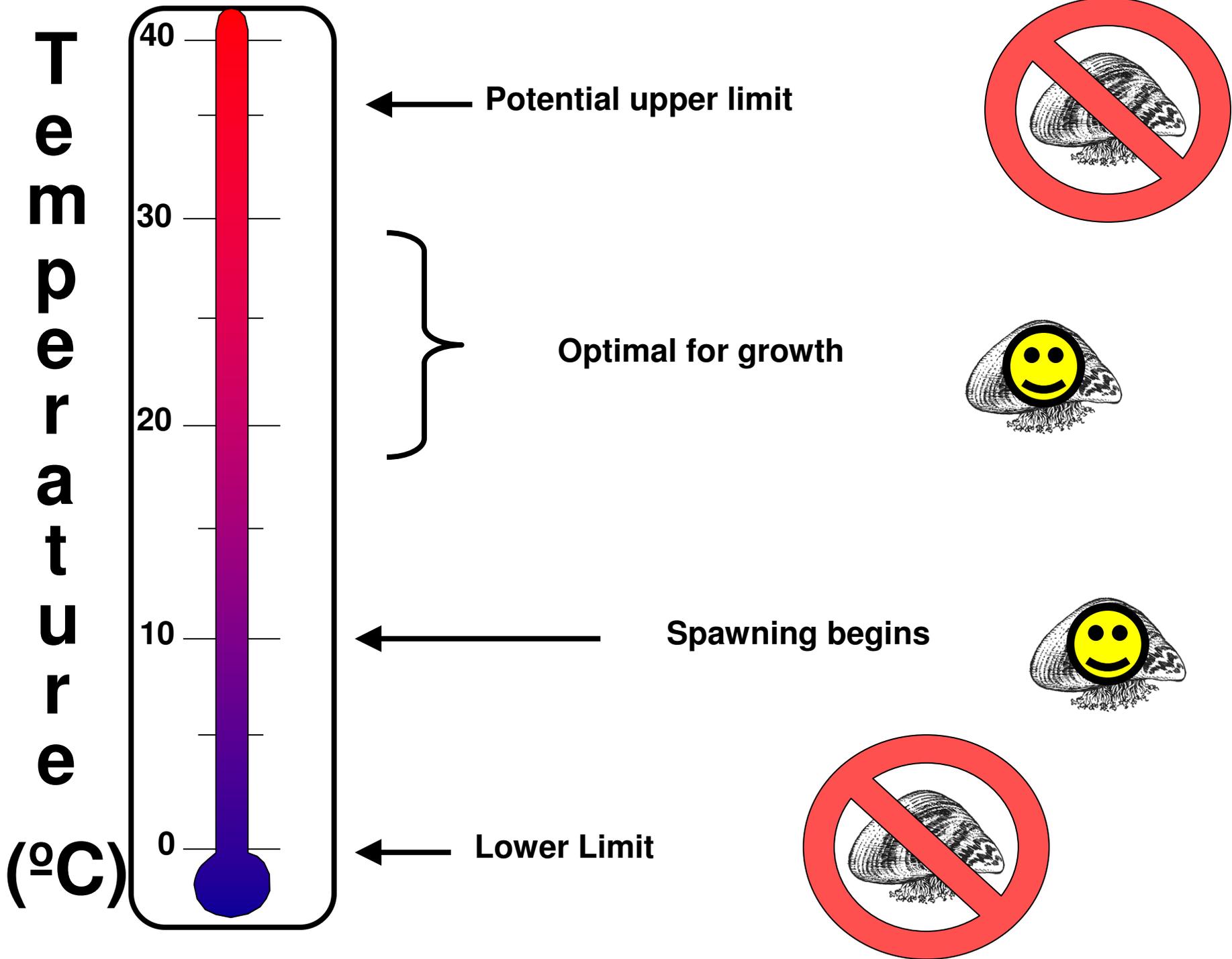
Ohio Sea Grant

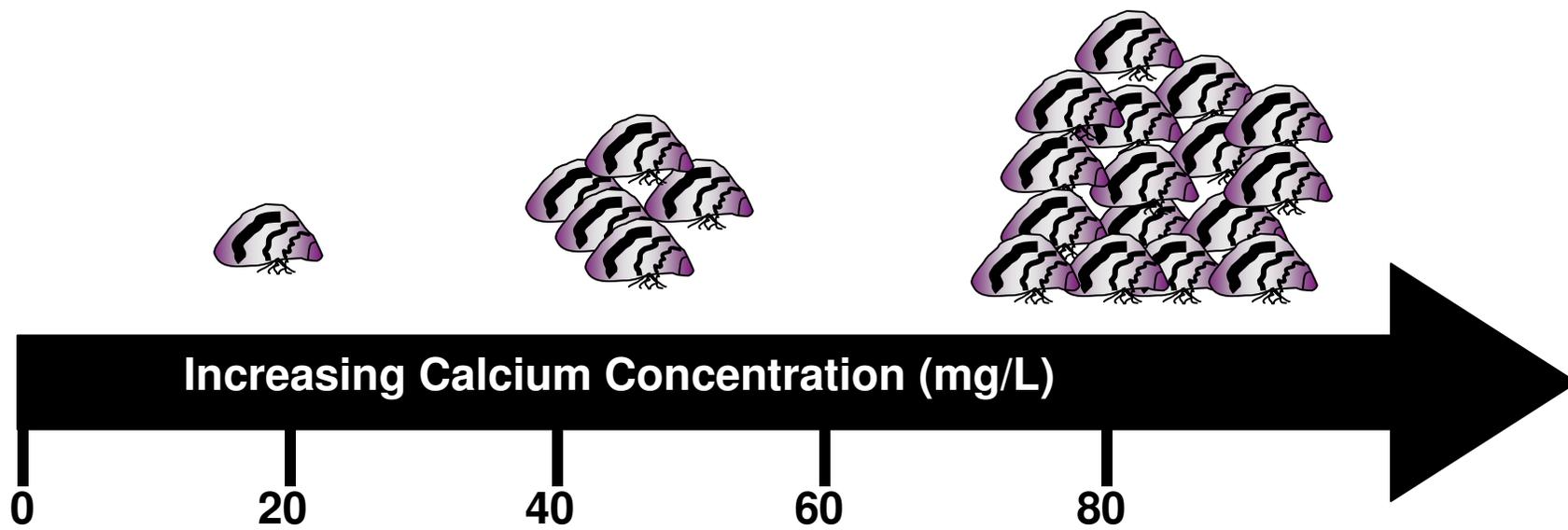


Dreissena bugensis
Quagga Mussel (larger,
tolerate colder and deeper
waters)

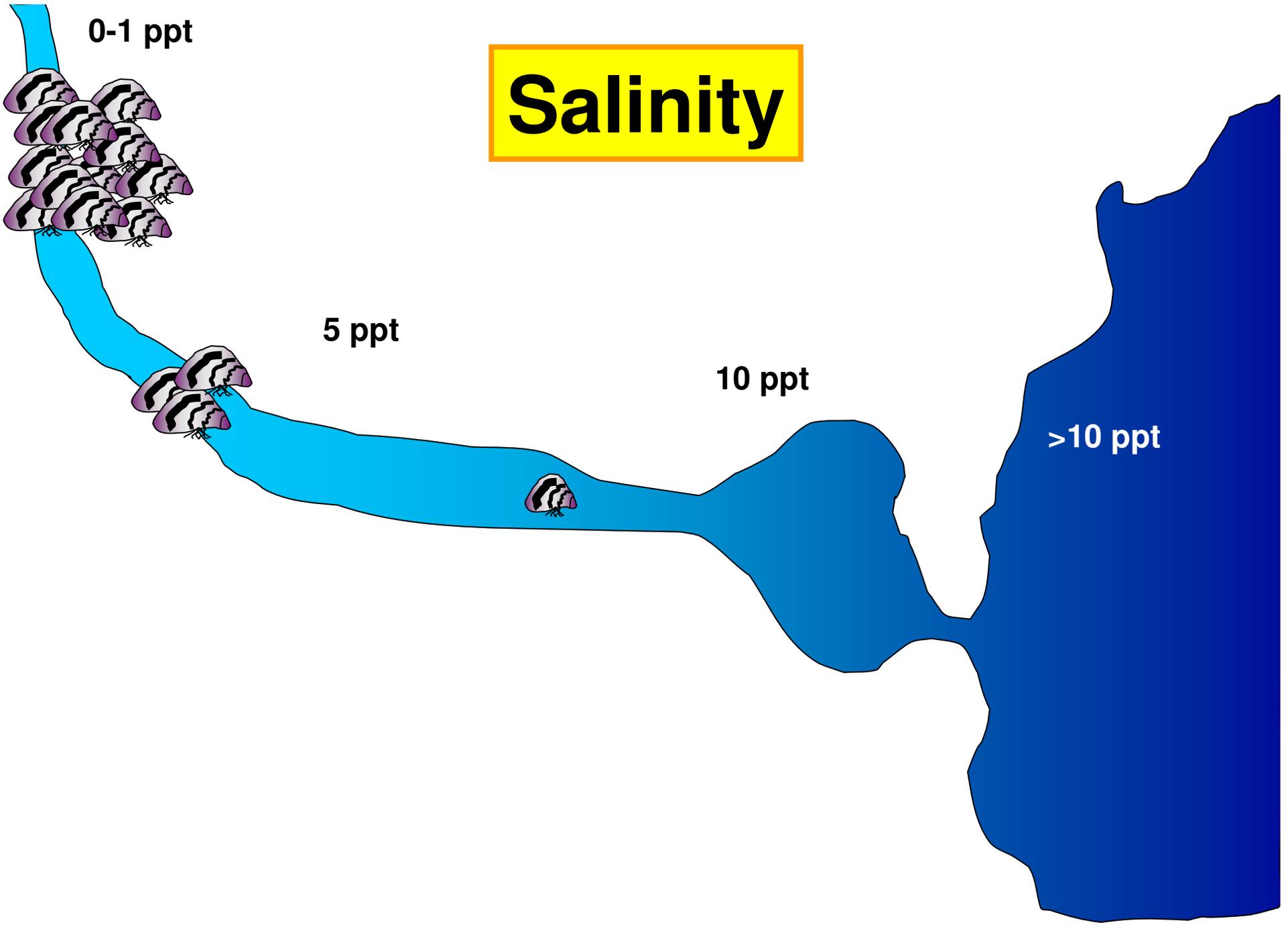


Dreissena polymorpha
Zebra mussel





Salinity



Impacts



For 1989 – 2004, over \$1 billion was estimated spent on zebra mussel prevention and control by electric generation and water treatment facilities alone (NYSG estimate)

Impacts

- Filter up to 1 liter of water per day
- Remove important components of aquatic food webs
- Reduced phytoplankton in Lake Erie by 60 percent

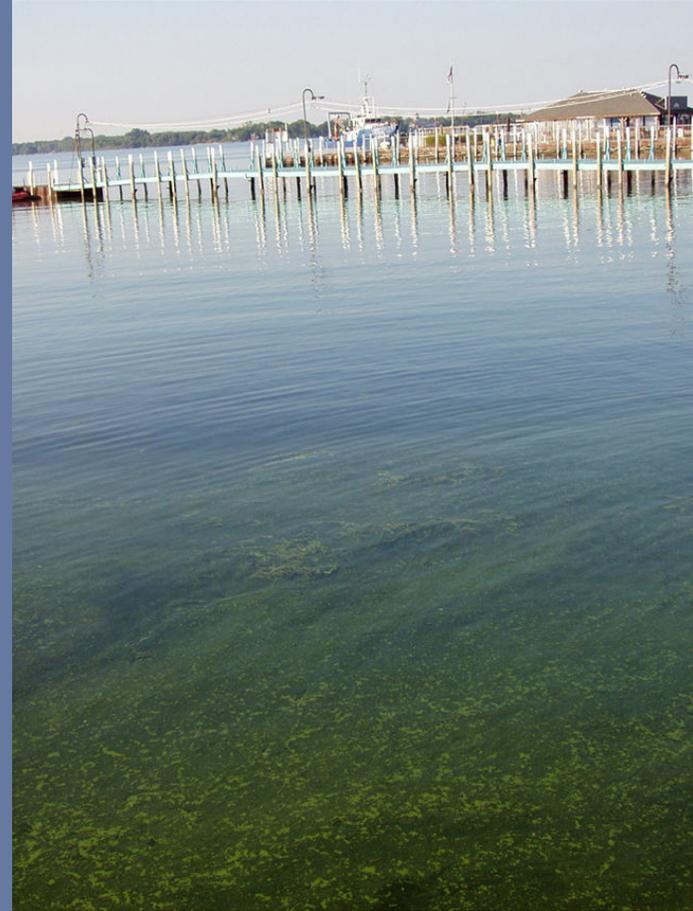


(Leach 1993; Karatayev et al. 1997)

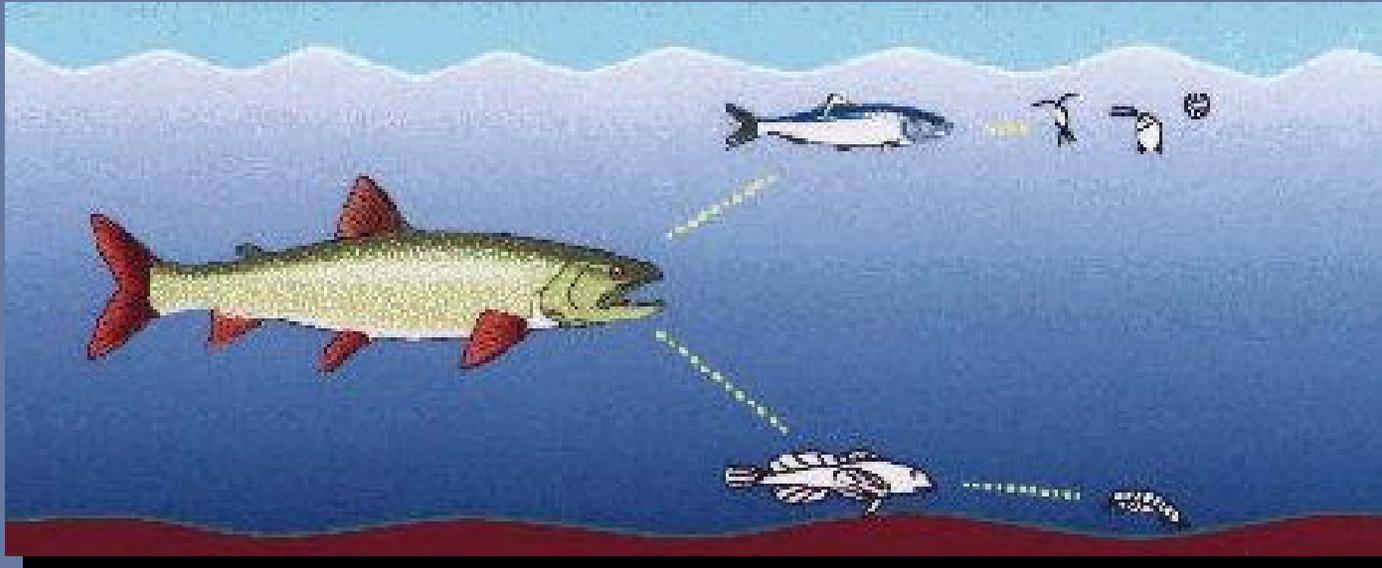
Impacts



- Removal of plankton, bacteria and suspended sediments from water can lead to excessive plant growth and harmful algal blooms

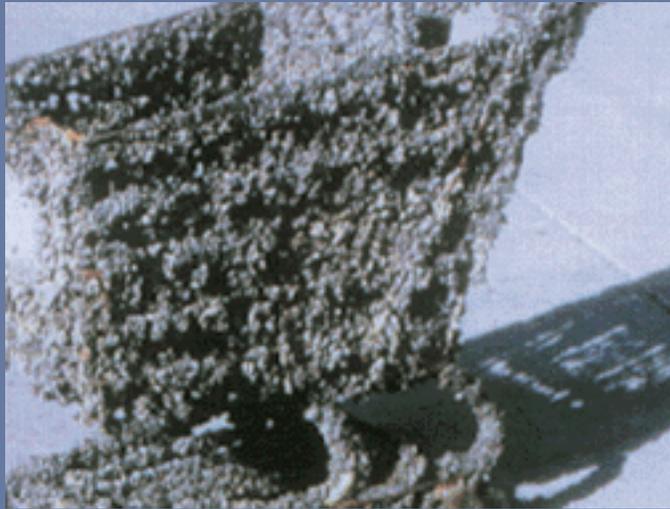


Impacts



Can increase bioaccumulation of contaminants like PCBs, PAHs, and metals in fish and ducks

Impacts



Colonization – densities up to 400,000/m²

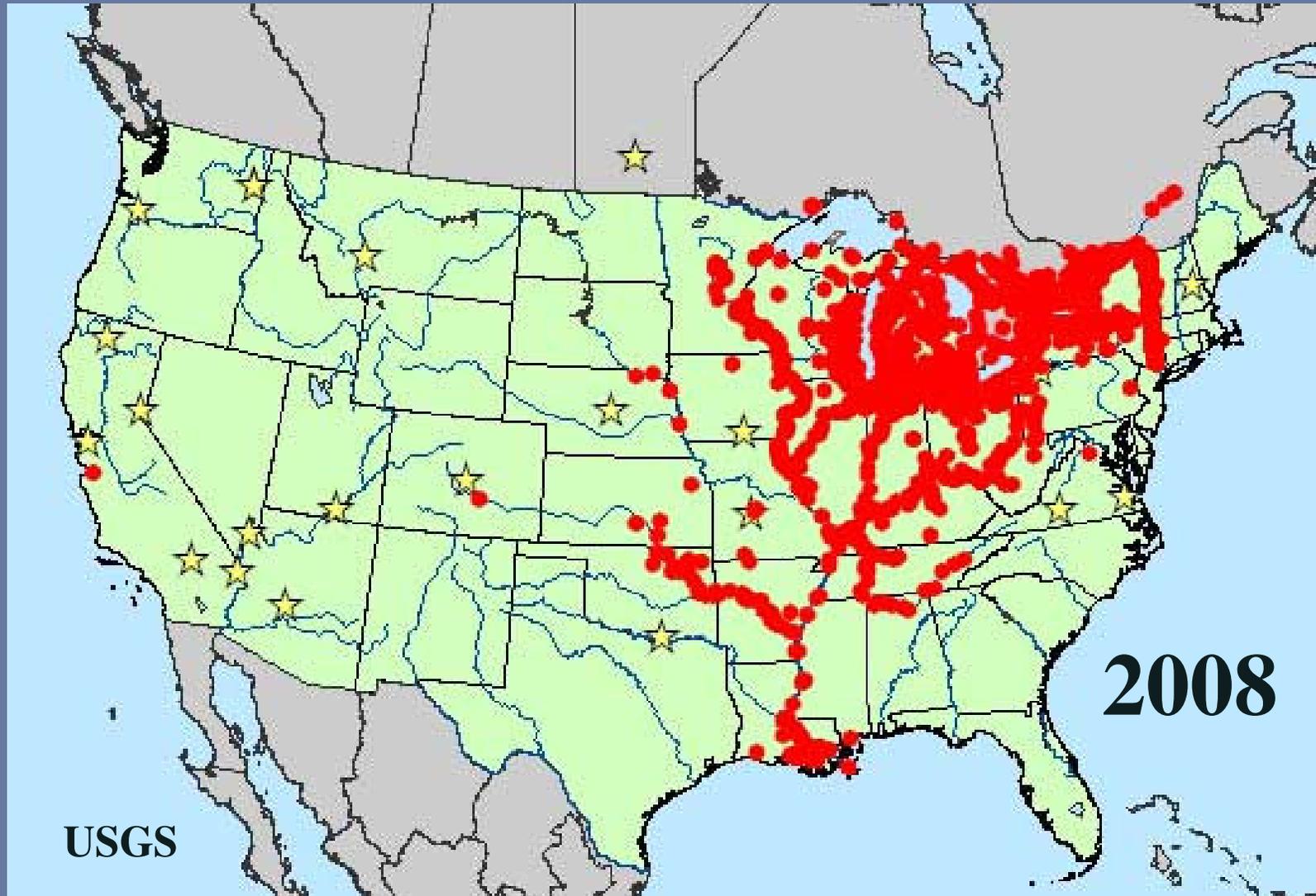
Zebra Mussel Spread



Zebra Mussel Spread



Zebra Mussel Spread



Pennsylvania Zebra & Quagga Mussel Monitoring Program



The Network

- Pennsylvania DEP started zebra mussel monitoring in 1991
- Pennsylvania Sea Grant began helping DEP coordinate the network in 2007



Primary Objectives

1. Detect and track the spread of zebra and quagga mussels in Pennsylvania waters

- Mapping and tracking
- Identification and verification
- Communicate findings

2. Alert local water users and develop outreach programs

- Curriculum and training materials
- Provide training workshops and opportunities
- Develop and distribute timely information via reporting systems
- Maintain network website

Why Monitor?

- To detect invasive species before they become established
- To find existing populations, so that lake and river users can be alerted to help prevent their spread
- To develop control and monitoring plans for infested waters



Monitoring



Monitoring

ZEBRA & QUAGGA MUSSEL SURVEY FORM

Please complete this form in pencil or indelible pen using one form for each survey date and location.

Please take a new GPS reading even if you've sampled from this location before. You can easily tab to the next cell.

SURVEYOR INFORMATION:

5	First name:		Last name:	
6	E-mail:		Affiliation	
7	Area code and telephone:	(Work) <input type="text"/>	(Cell) <input type="text"/>	
8	Street address:	<input type="text"/>		
9	City:	<input type="text"/>	State:	<input type="text"/>
			Zip:	<input type="text"/> - (extension) <input type="text"/>

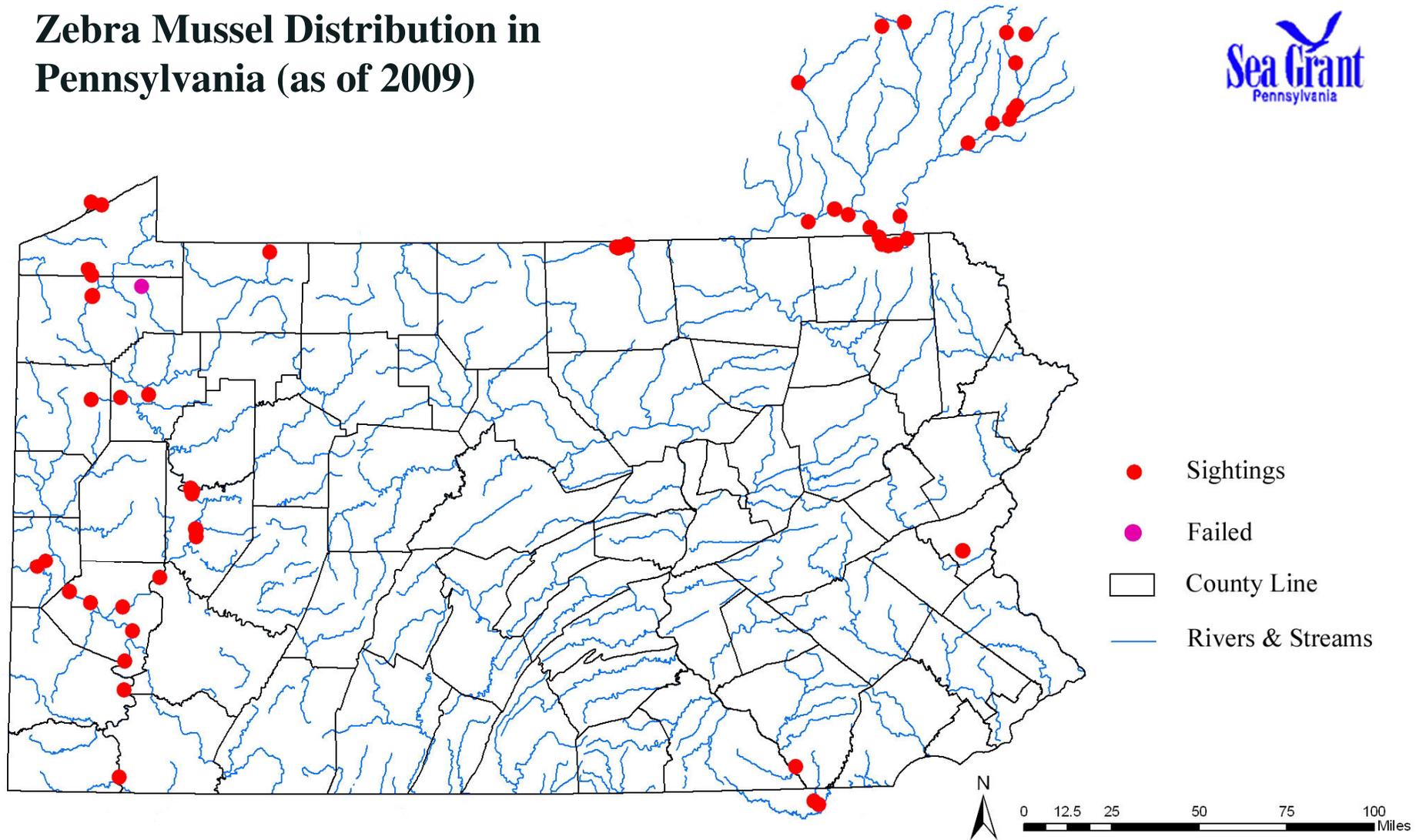
SURVEY DATA:

11	Date of survey:	<input type="text"/>	Time:	<input type="text"/>	Station Name:	<input type="text"/>
12	Name of waterbody:	<input type="text"/>		County:	<input type="text"/>	State:
13	If new location, nearest town and direction:	<input type="text"/>				
14	If new location, road crossing, route or street name:	<input type="text"/>				
15	Location: Either decimal degrees	Latitude	<input type="text"/>	Longitude	<input type="text"/>	
16	OR degrees-minutes-seconds	Latitude	<input type="text"/> (degrees)	<input type="text"/> (minutes)	<input type="text"/> (seconds) N	
17		Longitude	<input type="text"/> (degrees)	<input type="text"/> (minutes)	<input type="text"/> (seconds) W	
18	Method of survey: (check)	Scuba <input type="checkbox"/>	Snorkel <input type="checkbox"/>	Swim/wade <input type="checkbox"/>	Dock Search <input type="checkbox"/>	
19	Other:	<input type="text"/>				
20	Approximate water visibility	<input type="text"/> (meters)	Approximate depth range surveyed	<input type="text"/> (meters)		
21	How much time did you spend searching this location?	<input type="text"/> (minutes)				
22	Description of location and substrates examined	<input type="text"/>				
23		<input type="text"/>				
24		<input type="text"/>				
25		<input type="text"/>				
26	Were any zebra or quagga mussels found? (Yes / No)	<input type="text"/>				

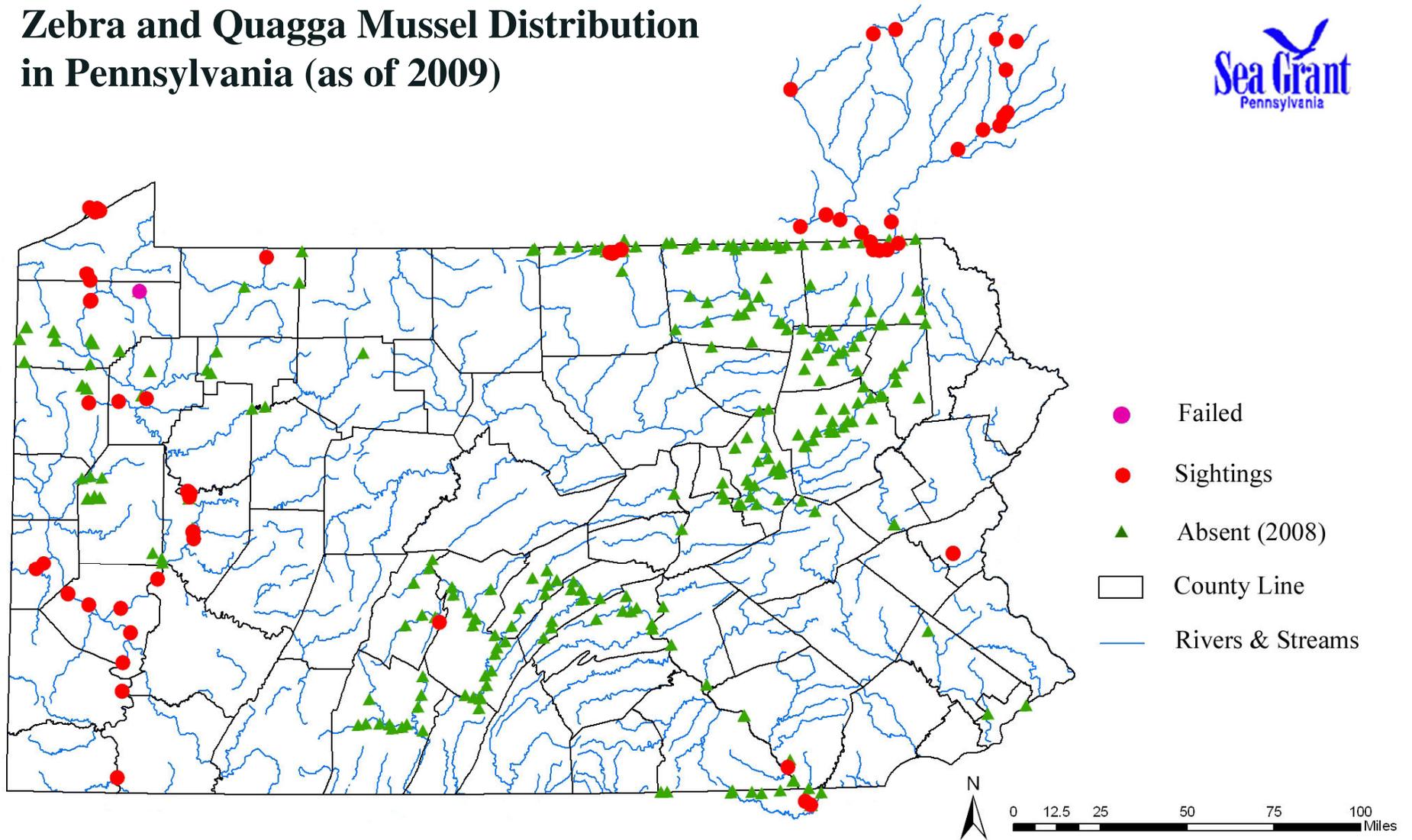
Identification and Verification



Zebra Mussel Distribution in Pennsylvania (as of 2009)



Zebra and Quagga Mussel Distribution in Pennsylvania (as of 2009)



Search

Fly To Find Businesses Directions

Fly to e.g., 37 25' 19.1"N, 122 05' 06"W

Search input field with a magnifying glass icon.

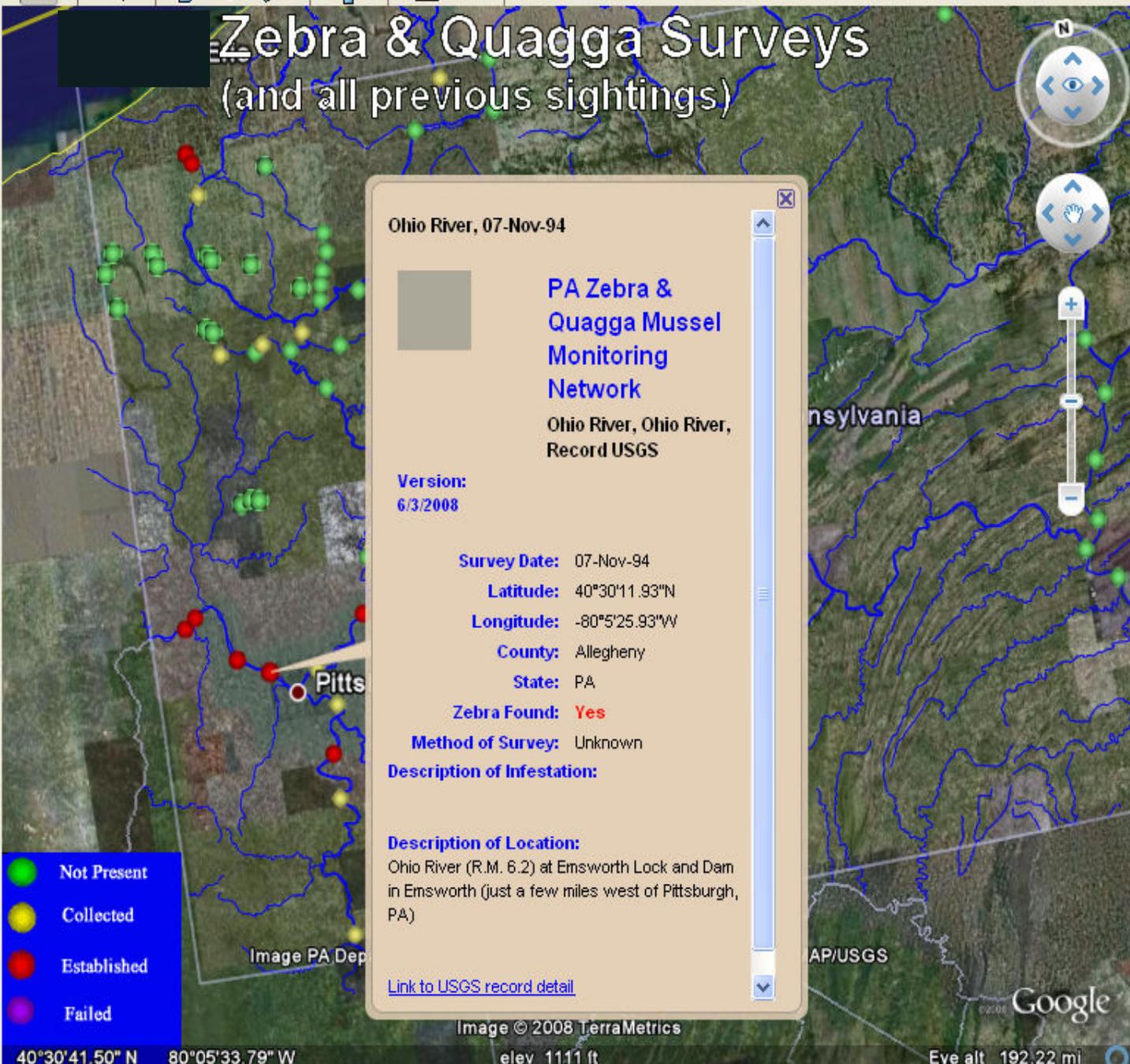
Places

Add Content

- Title
- NY Streams
- PA Streams
- Legend
- Quaaga Established
- Quaaga Not Present
- Quaaga Failed.kml
- Quaaga Collected
- Zebra Established
- Zebra Not Present

Layers

- Primary Database
- Geographic Web
- Roads
- 3D Buildings
- Street View
- Borders and Labels
- Traffic
- Weather
- Gallery
- Global Awareness
- Places of Interest



Zebra & Quagga Surveys (and all previous sightings)

Ohio River, 07-Nov-94



PA Zebra & Quagga Mussel Monitoring Network

Ohio River, Ohio River, Record USGS

Version: 6/3/2008

Survey Date: 07-Nov-94
Latitude: 40°30'11.93"N
Longitude: -80°5'25.93"W
County: Allegheny
State: PA

Zebra Found: Yes

Method of Survey: Unknown

Description of Infestation:

Description of Location:

Ohio River (R.M. 6.2) at Emsworth Lock and Dam in Emsworth (just a few miles west of Pittsburgh, PA)

[Link to USGS record detail](#)

- Not Present
- Collected
- Established
- Failed

http://seagrant.psu.edu/zm

■ ■ ■ **Dedicated to protecting Pennsylvania's aquatic habitats**

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STOP
THE SPREAD OF
AQUATIC
INVASIVE
SPECIES!

"On a global basis, the two great destroyers of biodiversity are, first, habitat destruction and second, invasion by exotic species"

-E. O. Wilson

Breaking News: Zebra and Quagga Mussel Monitoring Summit - November 14 in Harrisburg

The Pennsylvania Zebra and Quagga Mussel Monitoring Network is dedicated to protecting Pennsylvania's aquatic habitats from the threat of two harmful aquatic invasive species (AIS), zebra and quagga mussels.



In the Great Lakes region alone, Ohio Sea Grant estimates that zebra mussel control costs water users more than \$ 30 million each year for treatments to control zebra mussels. These mussels clog water intake pipes and disrupt aquatic communities by filtering food that native species rely upon. After storm events, beaches are littered with sharp shells that can injure beach goers walking barefoot.

Zebra mussels probably came to the Great Lakes in the ballast tanks of ships. They were first discovered in Lake St. Clair in 1988, and then found in Lake Erie in the late 1980's. In 1991, quagga mussels were found in Lake Erie. Since then, invasive mussels have spread and become established in several inland lakes and rivers in northwestern Pennsylvania. See the complete timeline for [zebra mussels](#) and [quagga mussels](#) in Pennsylvania at the USGS web site.

Done

2008 Discoveries

 Muddy Run Reservoir (PA)

 Glen Cove Marina (MD)

 Conowingo Dam (MD)

Image © 2009 TerraMetrics
Image PA Department of Conservation and Natural Resources-PAMAP/USGS
© 2008 Tele Atlas
Image © 2009 DigitalGlobe

Google

39°44'28.03" N 76°13'14.30" W

elev. 248 ft

Eye alt 20.83 mi

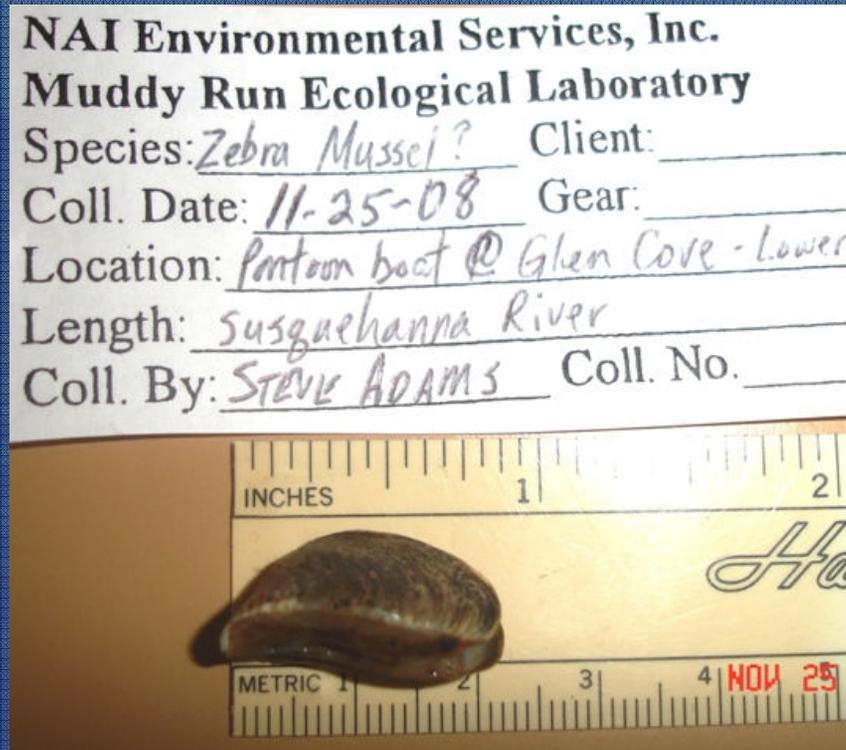
2008 Discoveries

- Conowingo Dam:
 - October 30, 2008; one zebra mussel found by Normandeau Associates in a strainer sample (Unit #5) during a routine examination of strainer samples for out migrating juvenile American shad.
 - The specimen appeared to be an early adult and probably 9+ months old. The mussel was ~0.5 inch (12-15 mm) long, and was alive at the time collected; no other mussels were observed.



2008 Discoveries

- Glen Cove Marina (MD):
 - November 25, 2008; - one zebra mussel found on a pontoon boat that had just been hauled out of the water. The boat was at the marina all year.



2008 Discoveries

- Muddy Run Pump Storage Reservoir (PA):
 - November 26, 2008; Four zebra mussels were found. Looked along shoreline at waters edge. Substrate was rocks and boulders.

NAI Environmental Services, Inc.
Muddy Run Ecological Laboratory
Species: Zebra Mussel? Client: _____
Coll. Date: 11-26-08 Gear: _____
Location: Muddy Run Pump Storage Reservoir
Length: by Normandeau Lab.
Coll. By: Normandeau Assoc. Coll. No. _____



Biological Control - Bacteria

- Dr. Dan Molloy, NY State Museum
- *Pseudomonas fluorescens*
 - Pf-CL145A
- Soil bacteria
- Both live and dead bacterial cells are equally toxic to *Dreissena*
- Has entered into partnership with Marrone Organic Innovations to produce the bacteria commercially. Patents pending in US and Canada



Impacts on Susquehanna?

In Hudson River:

- May 1991 – Zebra mussels first appear
- September 1992 – dominant in freshwater tidal portion
- Phytoplankton biomass fell by 80% (Caraco et al. 1997)
- Zooplankton numbers fell by 70% (Pace et al. 1998).

Impacts on Susquehanna?

In Hudson River:

Fish that live in the open water (shad and herring) and whose young feed on zooplankton for a long time will become less abundant, grow slower, and/or shift downriver.

(Strayer et al 2004)

Impacts on Susquehanna?

In Hudson River:

Fish that live in the vegetated shallows (sunfish) and whose young feed chiefly on benthos will become more abundant, grow faster, and/or shift upriver.

(Strayer et al 2004)

Questions?

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