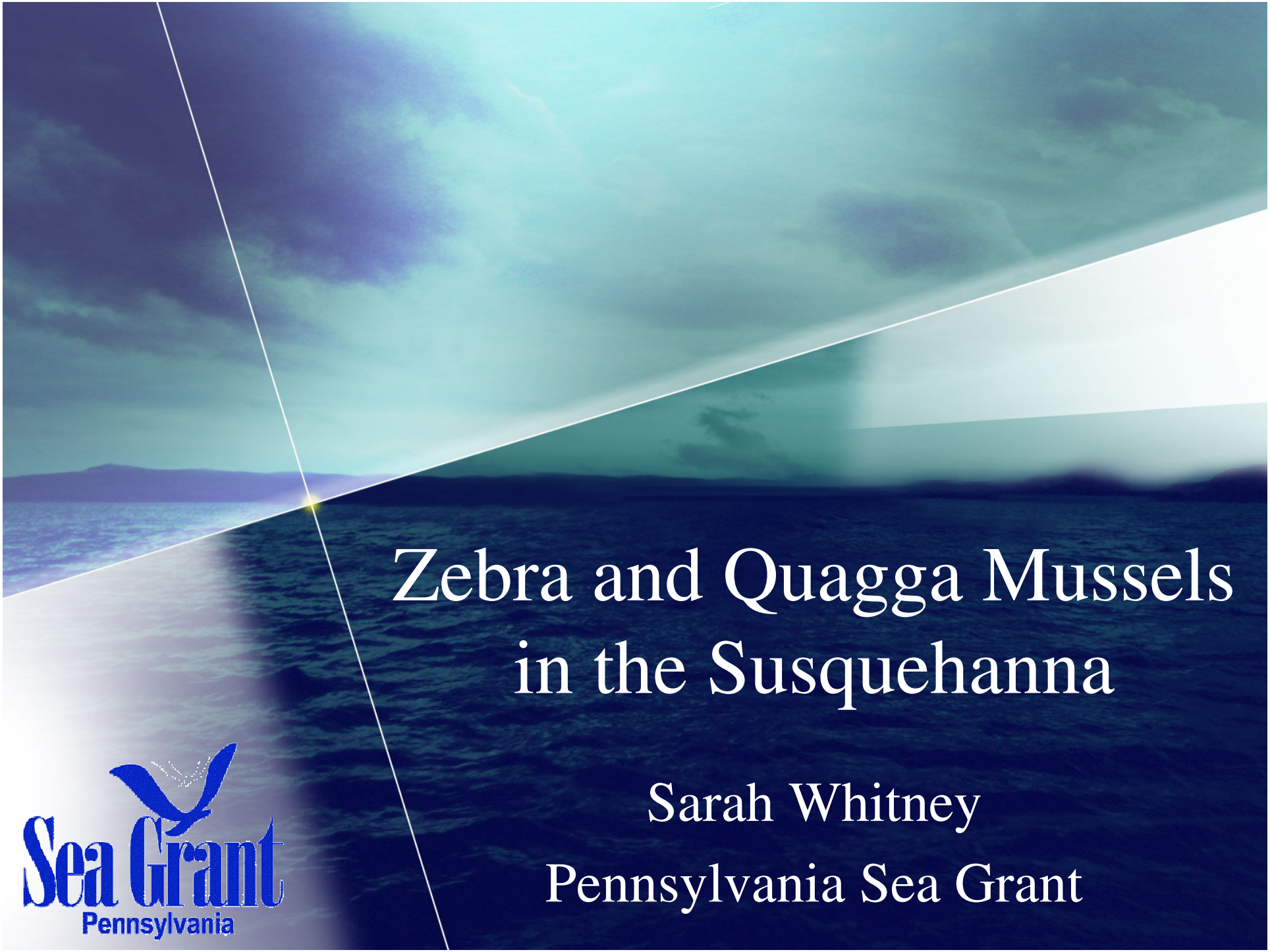


Zebra and Quagga Mussels in the Susquehanna

Sarah Whitney
Pennsylvania Sea Grant

Sea Grant
Pennsylvania

Credits

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

Invasive Species

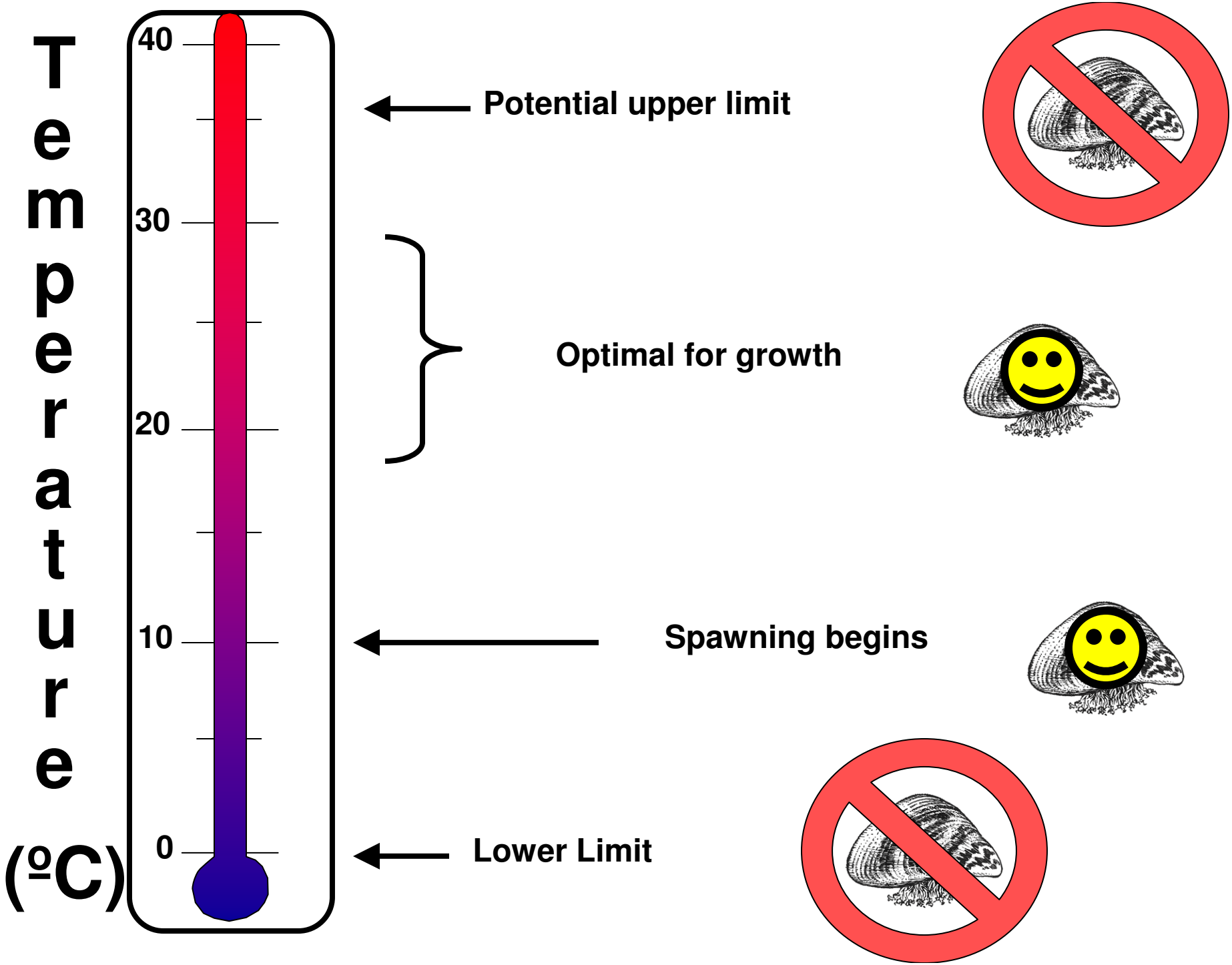
- Invasive species are the greatest threat to freshwater biodiversity worldwide
  (Sala et al. 2000, Lodge 2001)

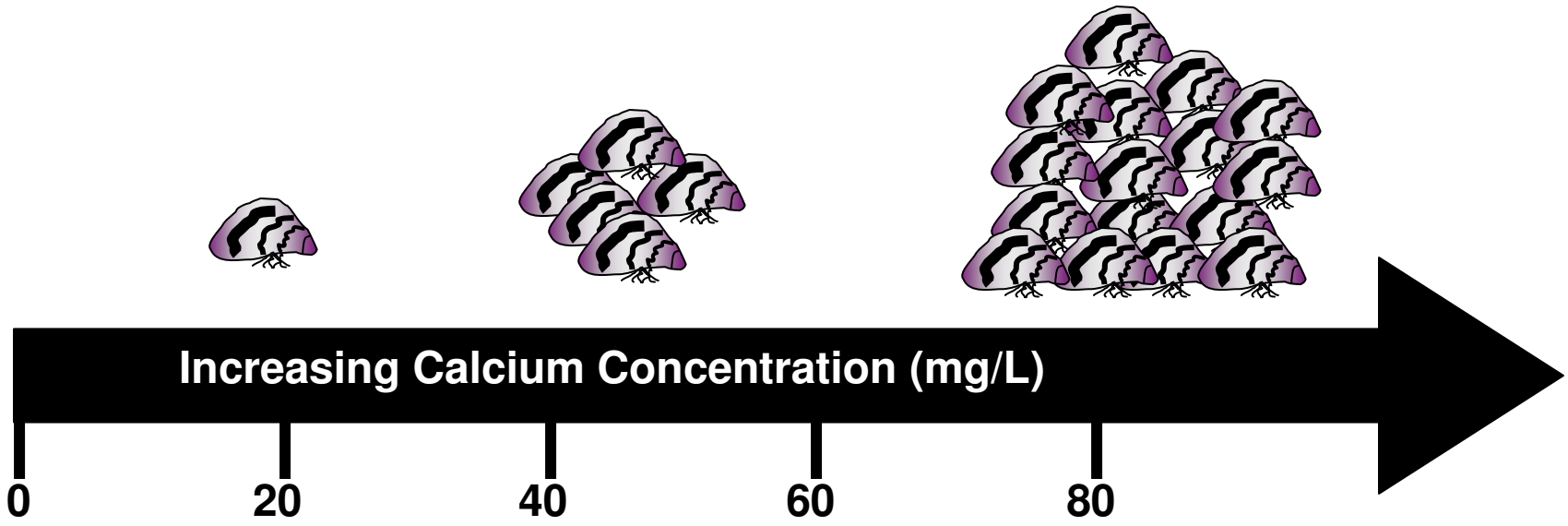
- Over 180 invasive species have been introduced into the Great Lakes since the 1800s

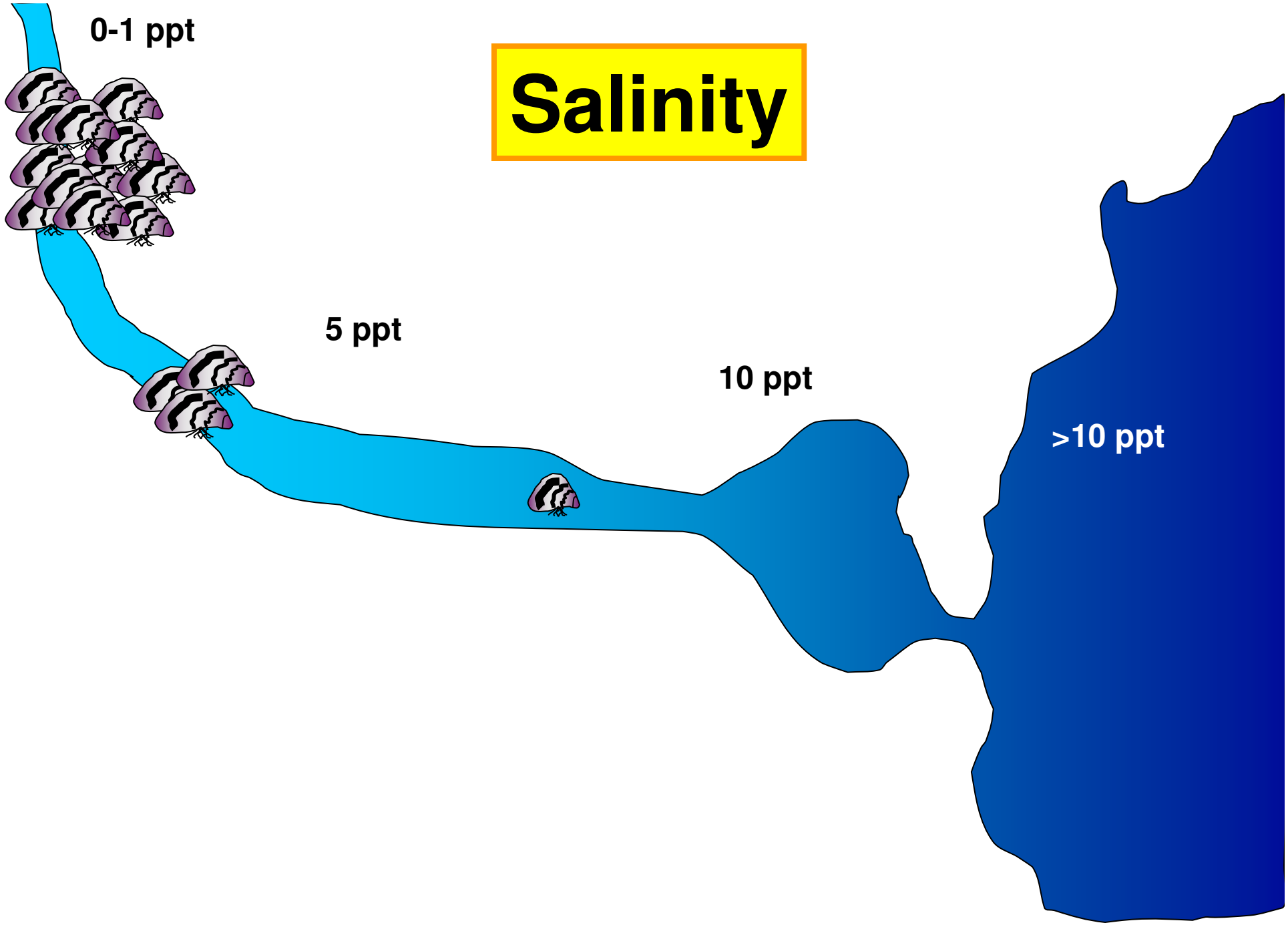
Dreissenid Mussels

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

Dreissena polymorpha
Zebra mussel


Temperature (ºC)
40
30
20
10
0
Potential upper limit
Optimal for growth
Spawning begins
Lower Limit


Increasing Calcium Concentration (mg/L)
0
20
40
60
80


Salinity
0-1 ppt
5 ppt
10 ppt
>10 ppt

Impacts

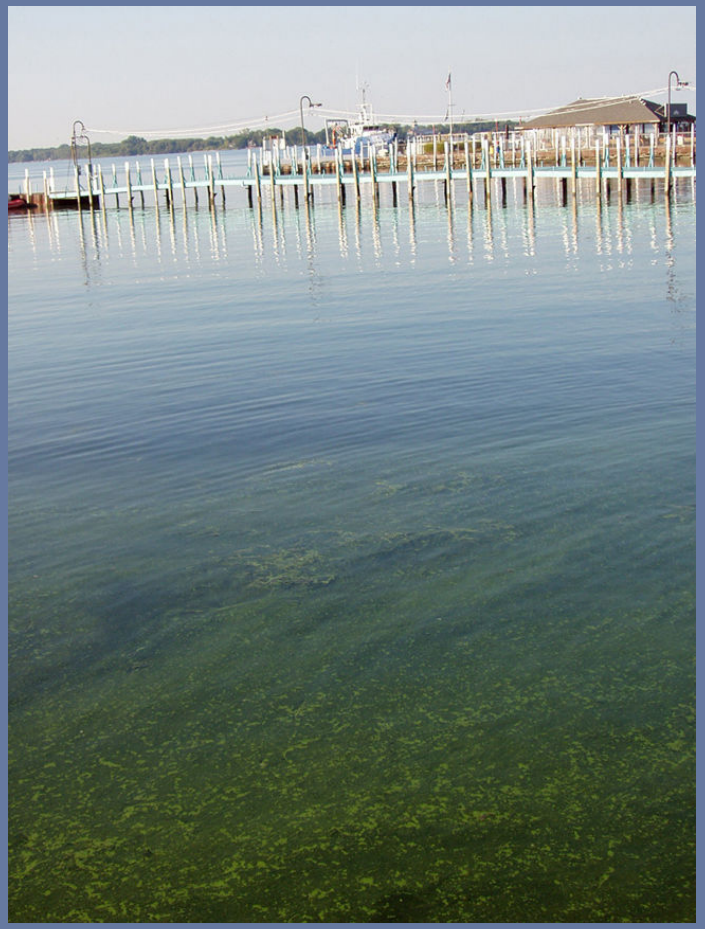
For 1989 – 2004, over $1 billion was estimated spent on zebra mussel prevention and control by electric generation and water treatment facilities alone (NYSG estimate)

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

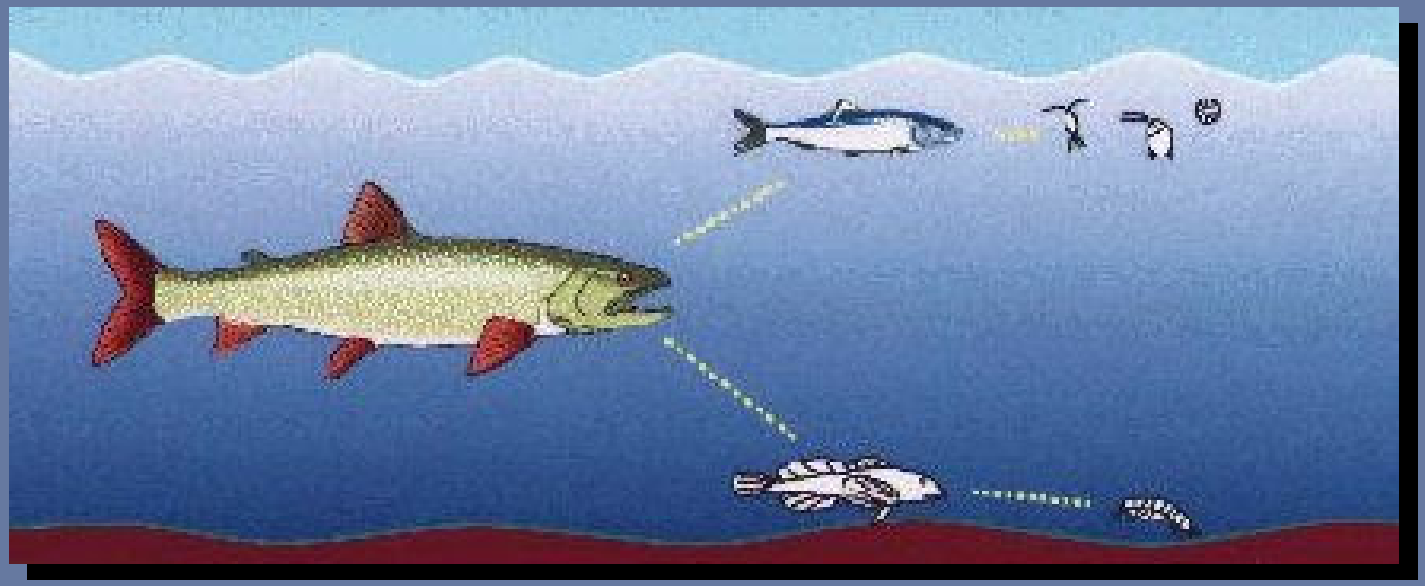
(Leach 1993; Karatayev et al. 1997)

Impacts



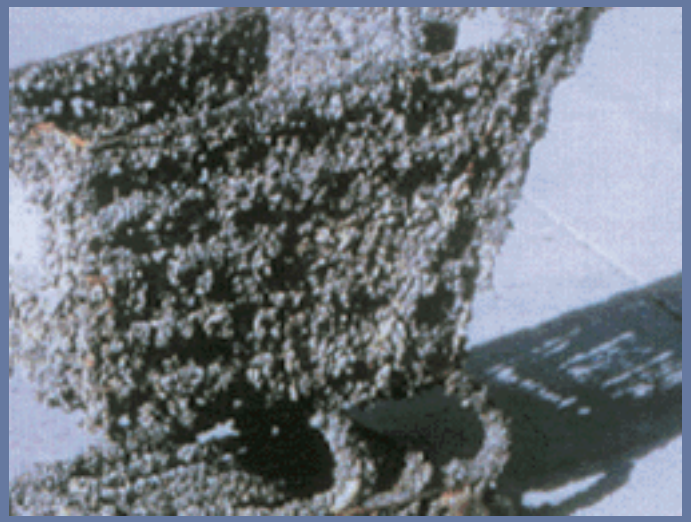
- Removal of plankton, bacteria and suspended sediments from water can lead to excessive plant growth and harmful algal blooms

Impacts



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

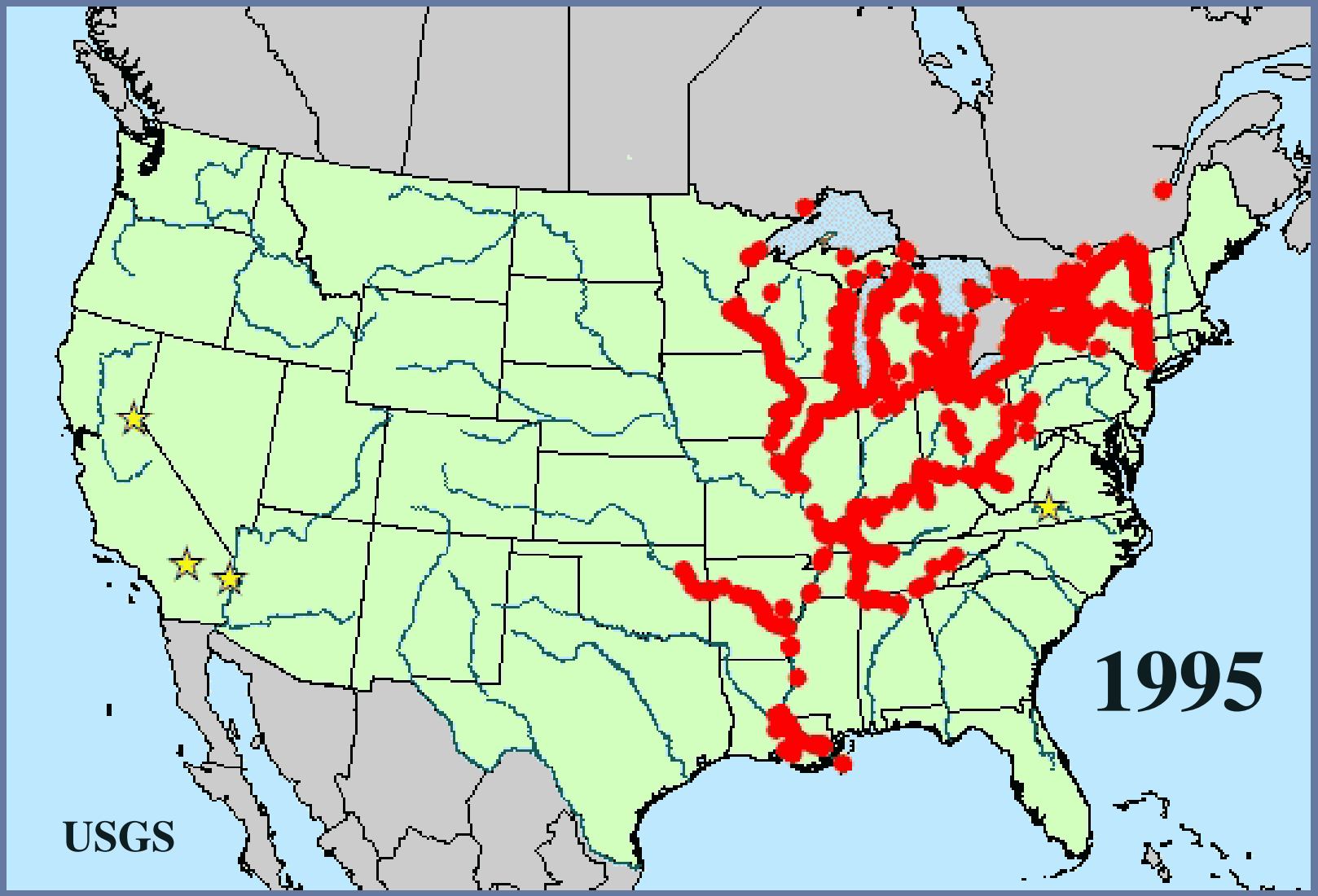
Impacts



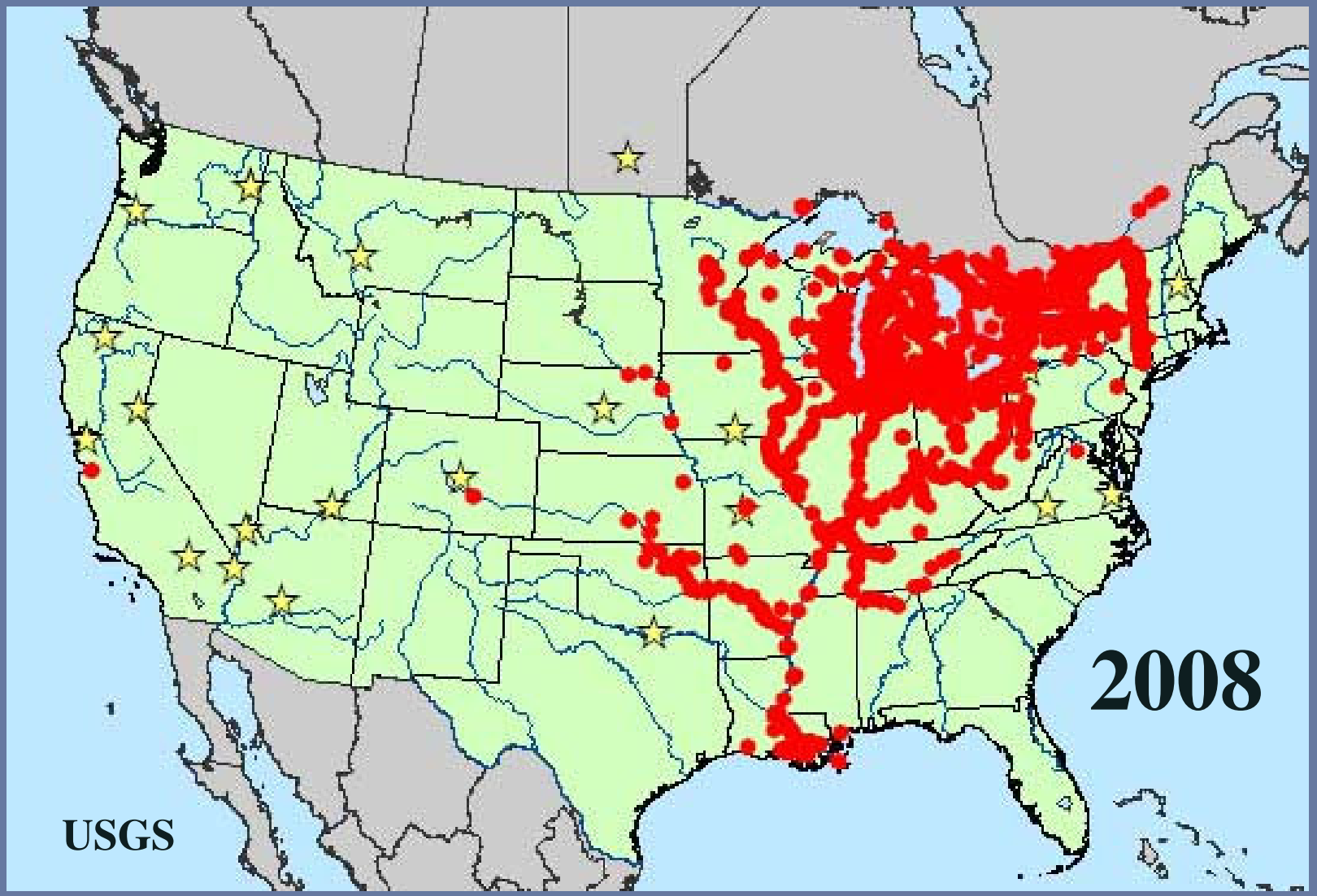
Colonization – densities up to 400,000/m^2

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:

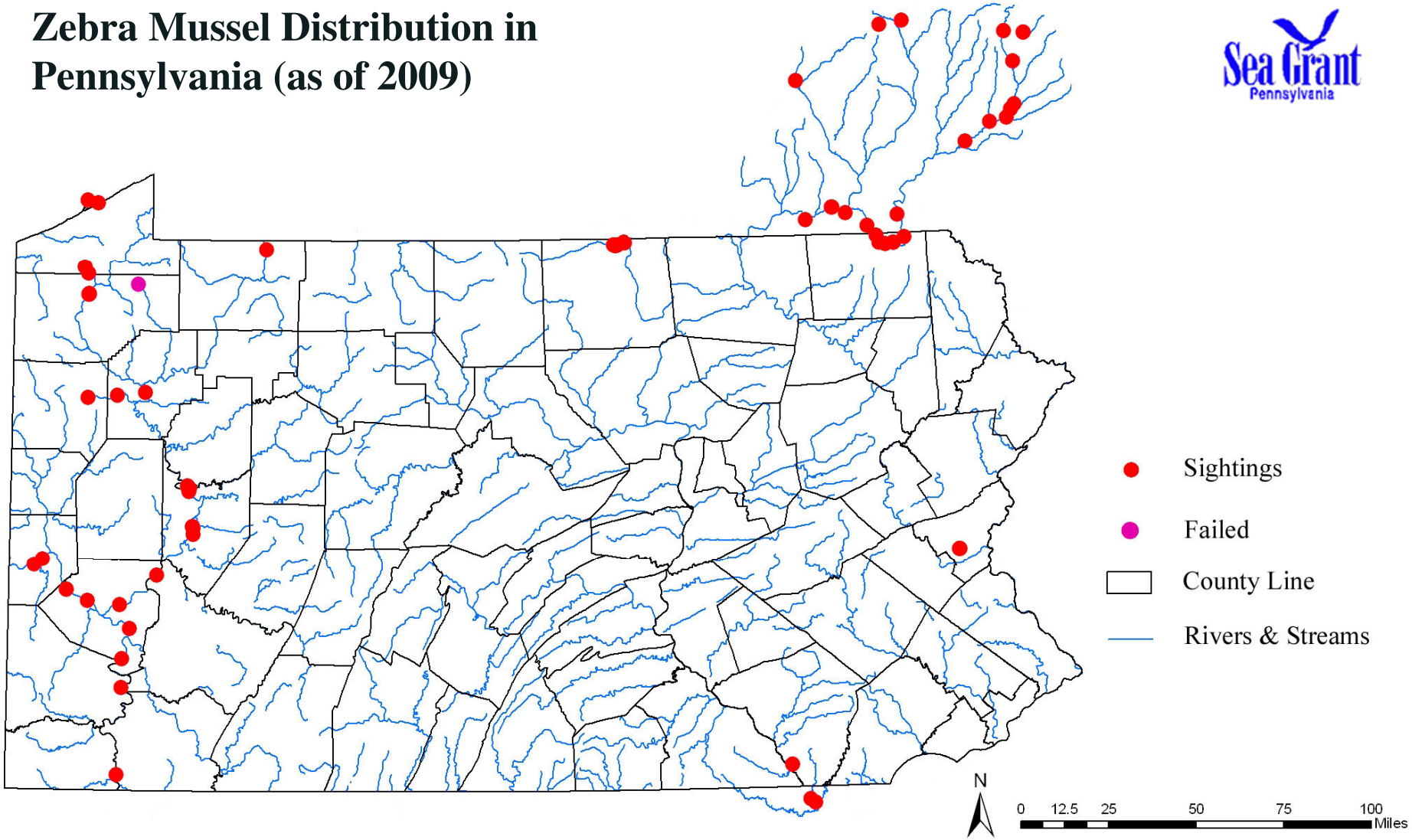
First name:				Last name:				
E-mail:		Affiliation						
Area code and telephone:	(Work)			(Cell)				
Street address:								
City:		State:		Zip:		- (extension)		

SURVEY DATA:

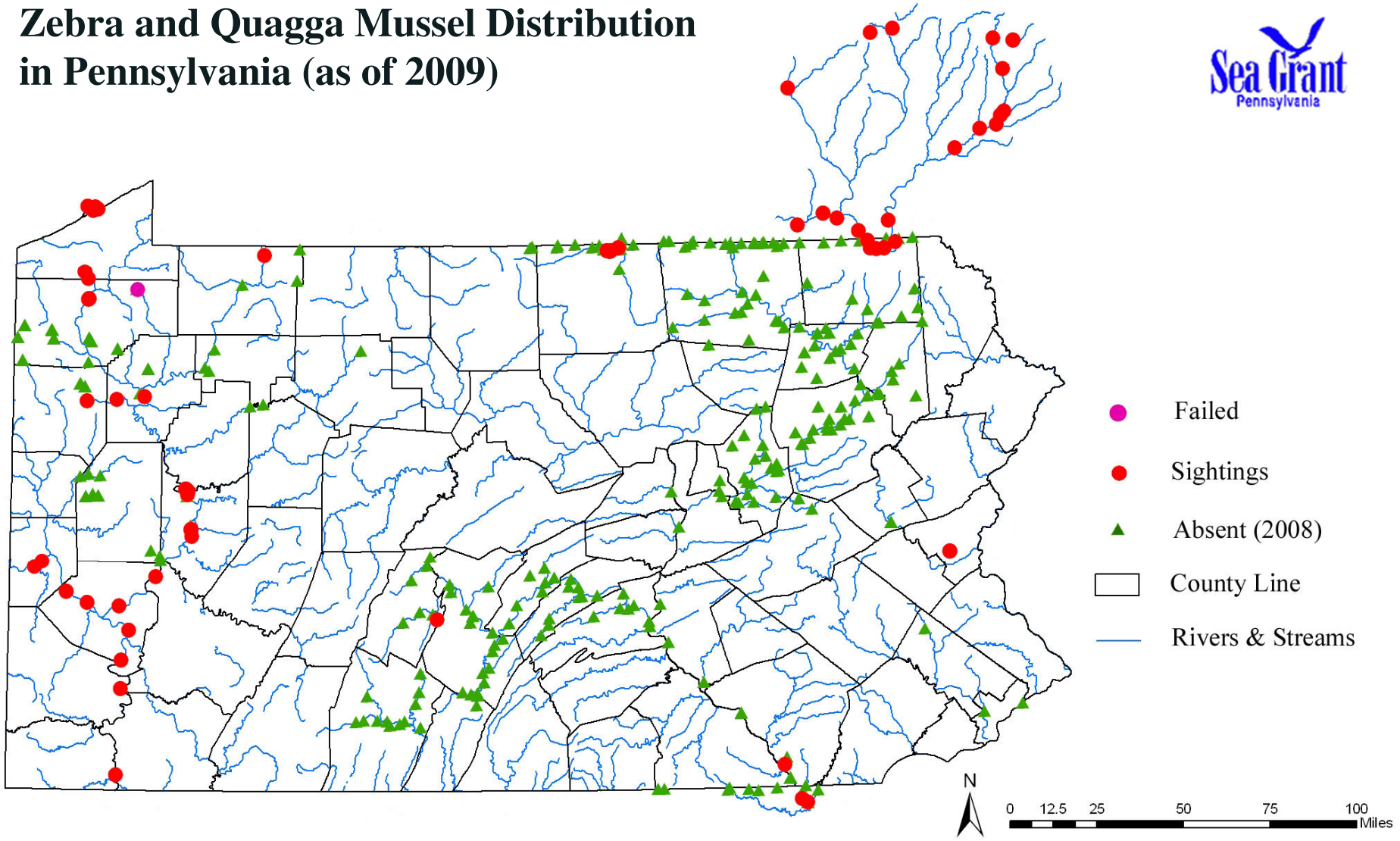
Date of survey:		Time:		Station Name:			
Name of waterbody:				County:		State:	
If new location, nearest town and direction:							
If new location, road crossing, route or street name:							
Location: **Either** decimal degrees	Latitude				Longitude		
OR degrees-minutes-seconds	Latitude		(degrees)		(minutes)		(seconds) N
	Longitude		(degrees)		(minutes)		(seconds) W
Method of survey: (check)	Scuba		Snorkel		Swim/wade		Dock Search
Other:							
Approximate water visibility		(meters)	Approximate depth range surveyed				(meters)
How much time did you spend searching this location?					(minutes)		
Description of location and substrates examined							
Were any zebra or quagga mussels found? (Yes / No)							

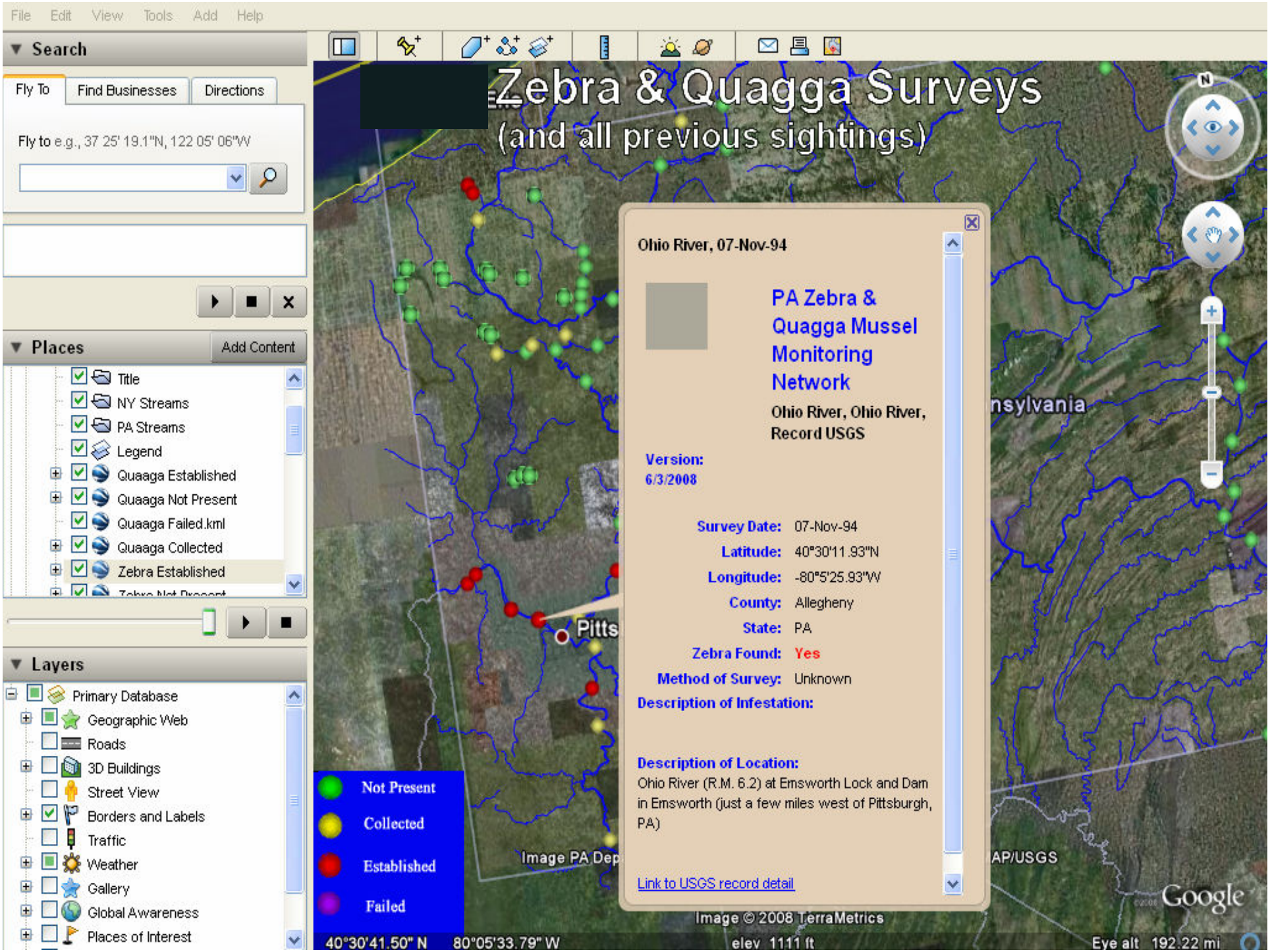
Identification and Verification

Zebra Mussel Distribution in Pennsylvania (as of 2009)

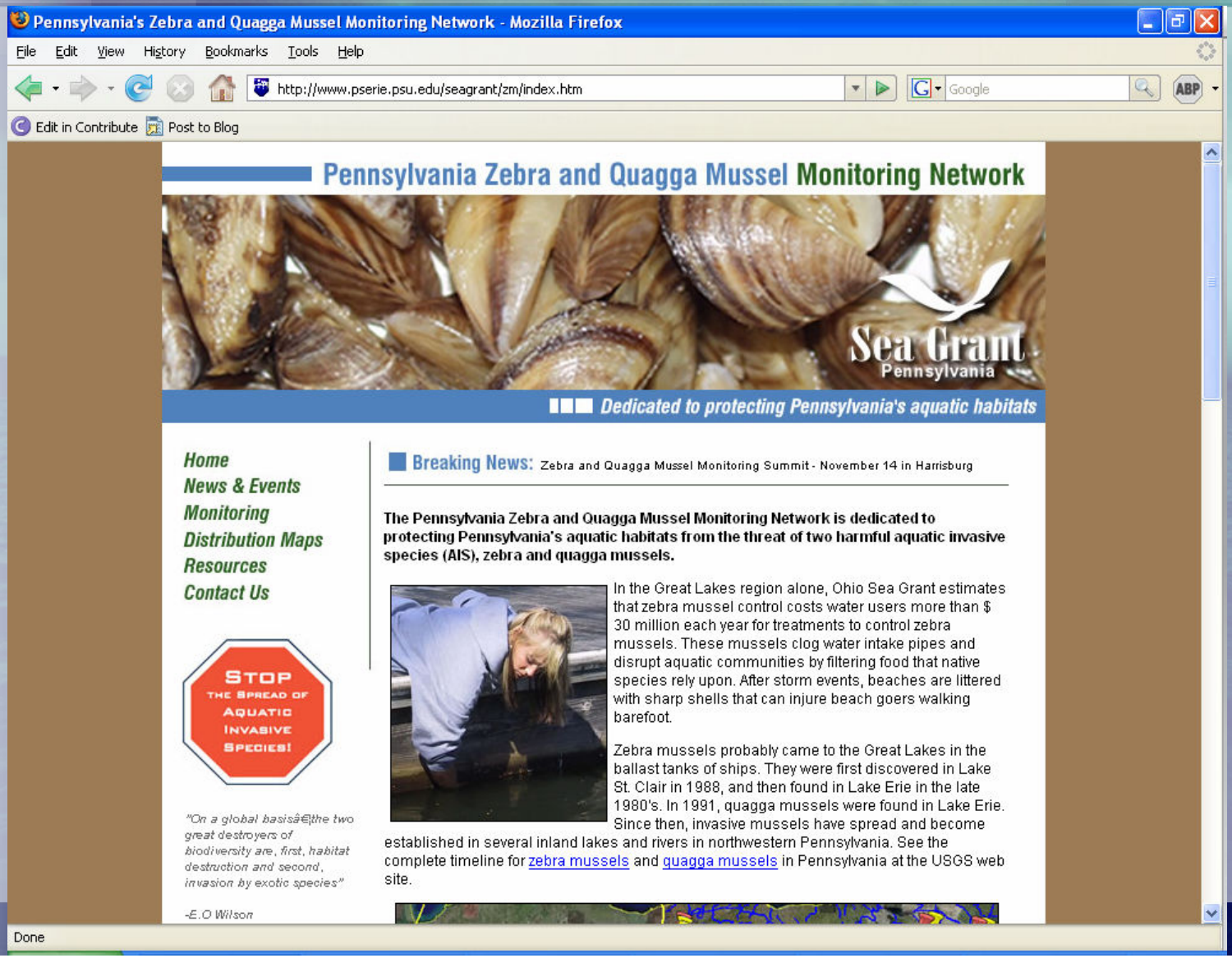


Zebra and Quagga Mussel Distribution in Pennsylvania (as of 2009)




File Edit View Tools Add Help
Search
Fly To
Find Businesses
Directions
Fly to e.g., 37 25' 19.1"N, 122 05' 06"W
Places
Add Content
Title
NY Streams
PA Streams
Legend
Quaaga Established
Quaaga Not Present
Quaaga Failed.kml
Quaaga Collected
Zebra Established
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
Image © 2008 TerraMetrics
40°30'41.50" N 80°05'33.79" W
elev 1111 ft
Eye alt 192.22 mi
Google

http://seagrant.psu.edu/zm



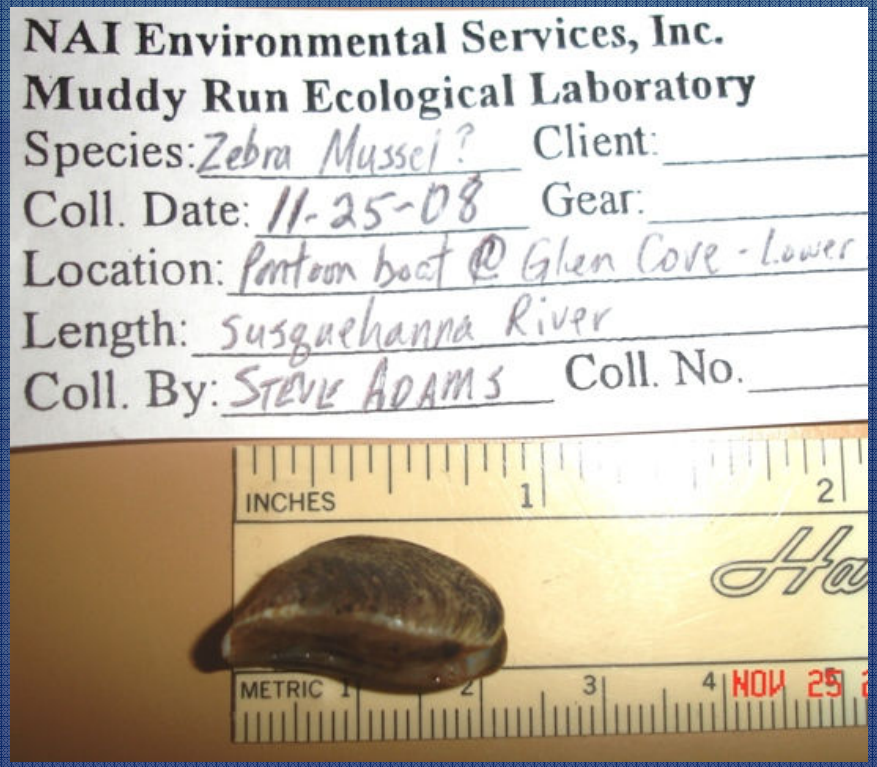
2008 Discoveries

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.

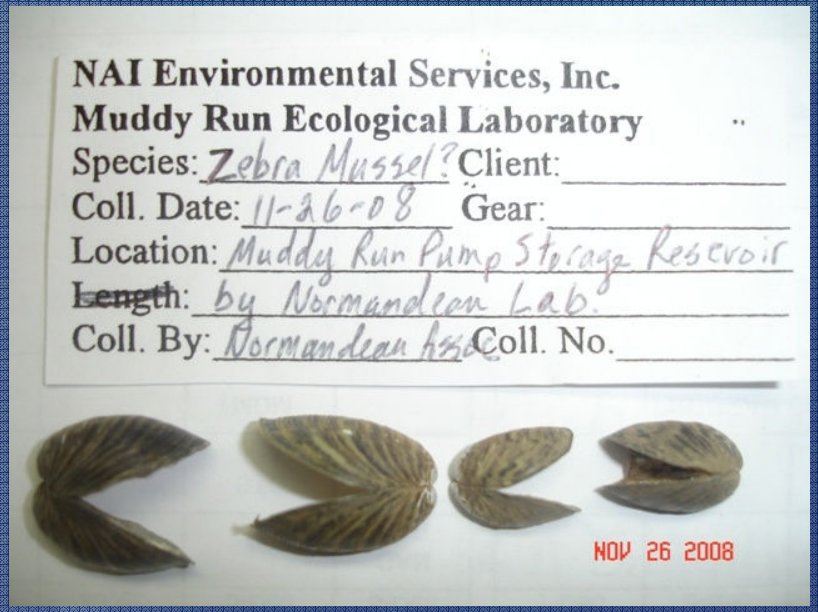
2008 Discoveries

- 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.



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?

Sarah Whitney
Pennsylvania Sea Grant
swhitney@psu.edu
610-304-8753