



# NAAG Invasive Species Panel

## Issues Overview

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## Overview

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### Introduction to Invasive Species

- Risks and pathways of invasion
- Economic, environmental costs, & harm to human health
- A shared problem – the need for coordinated action
- Importance of prevention - most cost effective strategy
- Legislative solutions



## Invasive Species are:

- Not native to the ecosystem under consideration
- Whose introduction does or is likely to do harm to human health, the economy, or the environment

[Executive Order 13112]



Source: <http://naturalplane.blogspot.com/2011/06/floridas-nile-monitor-lizard-invasion.html>



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## Invasive Species include:

### Plants, **Animals** and Microorganisms





## Pathways to Introduction

### Intentional Introductions

- Pet trade
  - ❑ Lionfish, Burmese python, Etc.
- Live food and bait
  - ❑ Snakehead
- Ornamental plants
  - ❑ English Ivy, Kudzu, Purple loosestrife, Etc.
- Aquaculture
  - ❑ Asian carps

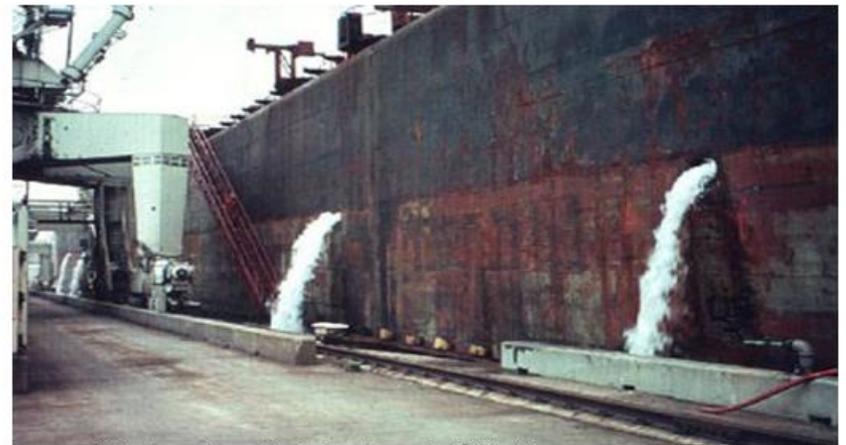




## Pathways to Introduction

### Unintentional Introductions

- Cargo & shipping crates
- Ballast water movement
- Hull Fouling



source: <http://massbay.mit.edu/exoticspecies/ballast/>



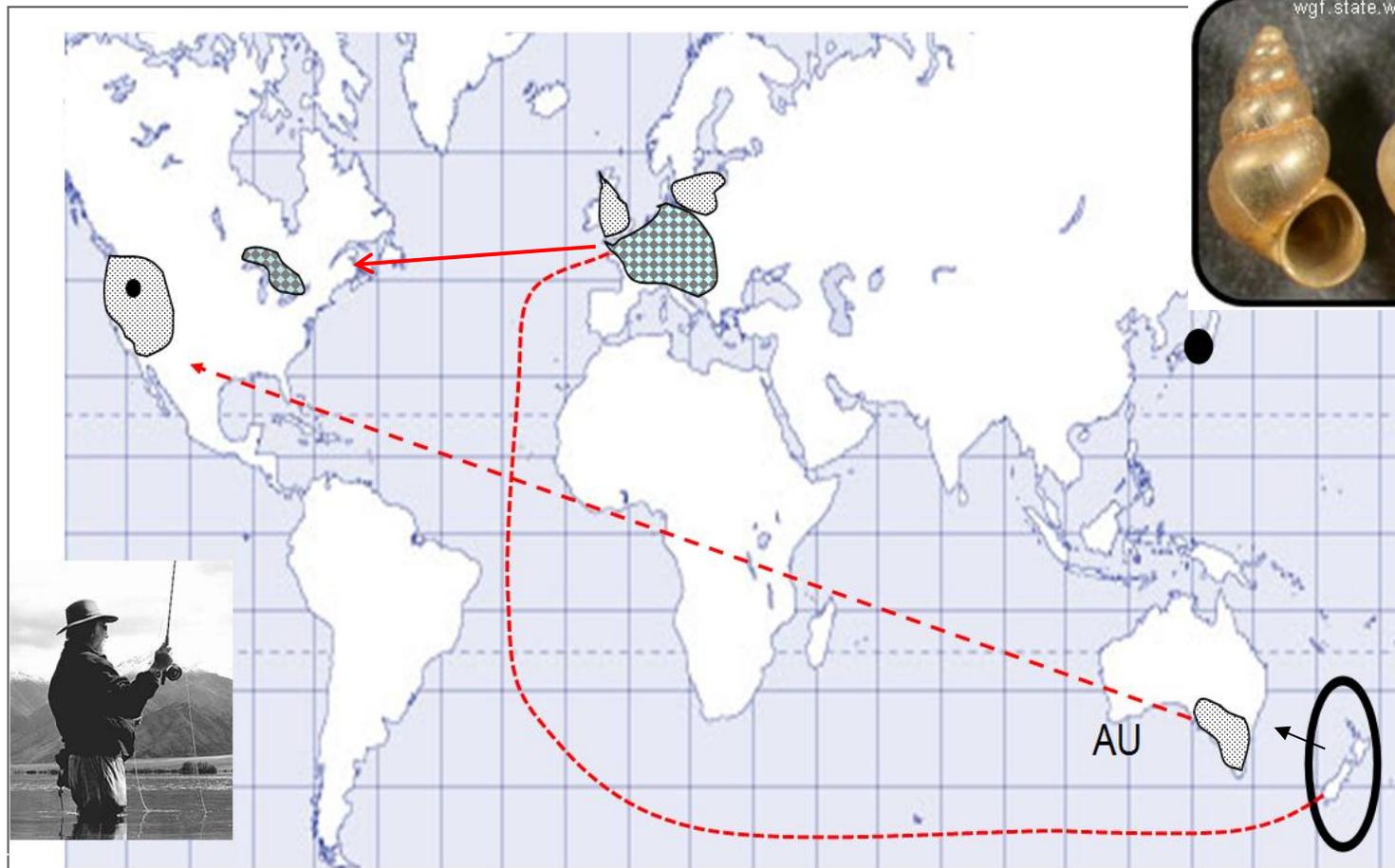
Tamara Freyman



Tamara Freyman



## New Zealand mud snail - multiple U.S. invasions





## Environmental Impacts of Invasive Species

- Degradation of natural areas such as military lands, national parks, forests, & wildlife refuges
- Altered ecosystem function (e.g., seasonal shifts in nutrient availability, reduced dissolved oxygen in water)
- Altered predator-prey relationships, competition for space, risk of hybridization and disease spread
- Displacement of endangered species (e.g., predation, habitat loss)
- Increased rate and severity of wildfires (e.g., fine fuels)



# Impacts on Ecosystem Services

## Provisioning Services

*Products obtained from ecosystems*

- Crops
- Marine food resources
- Timber
- Genetic resources



## Regulating Services

*Benefits obtained from the regulation of ecosystem processes*

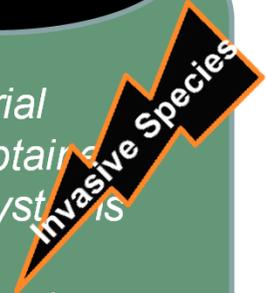
- Erosion control / sediment retention
- Disease mitigation
- Pollination



## Cultural Services

*Non-material benefits obtained from ecosystems*

- Aesthetic value
- Recreation
- Tourism



## Supporting Services

*Services necessary for the production of all other ecosystem services*

- Energy
- Nutrients
- Water
- Climate
- Physical habitat



## Economic Impacts of Invasive Species

- Crop, pasture and forest losses
- Reduced property values
- Restricts movement of goods
- Loss of recreational revenue
- Power failures
- Decreased water supply for human use
- Animal, plant, and human health costs due to disease and injury
- Increased cost of water, power supply operations and maintenance.



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## Crop Losses

Estimated \$4.6 billion in crop losses in the U.S. each year includes:

- Disease
- Insects
- Feral hogs
  - Does not include indirect losses such as application of chemicals for pest control



Damaging effects of *Phakopsora pachyrhizi*, Soybean rust.





## Loss of Recreational Revenue

Boat marinas have been reported closed for extended periods on both U.S. coasts.

Propeller driven boats are hampered by thick mats of hydrilla at the water's surface.

Beach access – fouling by shells and algal blooms





## Power Failures

Estimated \$1-4 million annually in lost productivity in Guam due to brown tree snake shorting power lines



Power plant shut down – blocked intake pipes  
*(What does future hold for Hoover Dam with Quagga mussel invasion of lake Mead?)*





## Increased Cost of Operations and Maintenance

- Affected municipalities and industries, using large volumes of Great Lakes water, have spent about \$360,000 per year for zebra mussel control
- Nuclear power plants averaged \$825,000 per year for zebra mussel control
- Small municipalities averaged \$20,000 per year on control efforts



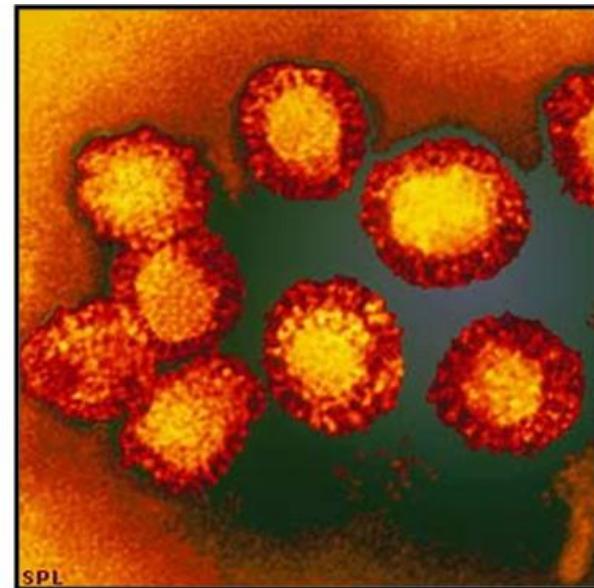
<http://www.nysgextension.org/ans/anspages/Zmussels.html>





## Costs due to disease & injury

Since its discovery in 1999, West Nile Virus has killed more than 1,000 people in the United States.



Asian Tiger Mosquito - <http://cdn.wn.com/o25/ph//2009/03/06/d36cec8d4577c2644f991e52f3abdcfd-grande.jpg>

West Nile Virus - [http://news.bbc.co.uk/2/shared/spl/hi/health/03/travel\\_health/diseases/html/westnile.stm](http://news.bbc.co.uk/2/shared/spl/hi/health/03/travel_health/diseases/html/westnile.stm)



## Estimating the Economic Cost of Invasives

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### What we know...

- Most economic/environmental damage occurs from the small fraction of introduced species that are invasive
- Costs borne by federal, & state governments, businesses, private landowners and consumers
- More species means more money is spent on control
- Rates & risks of introductions have increased



## Emerald ash borer

Emerald ash borer (*Agrilus planipennis*) is an invasive forest insect that has the potential to spread and kill native ash trees (*Fraxinus* sp.) throughout the United States.

Simulations predict an expanding EAB infestation that will likely encompass 25 states and warrant treatment, removal, and replacement of more than 17 million ash trees with mean discounted cost of **\$10.7 billion**.

Kovacs, K.F., et al., Cost of potential emerald ash borer damage in U.S. communities, 2009–2019, *Ecological Economics* (2009), doi:10.1016/j.ecolecon.2009.09.004



Source: <http://imfc.cfl.scf.mcan.gc.ca/insecte-insect-eng.asp?gelD=1000101>



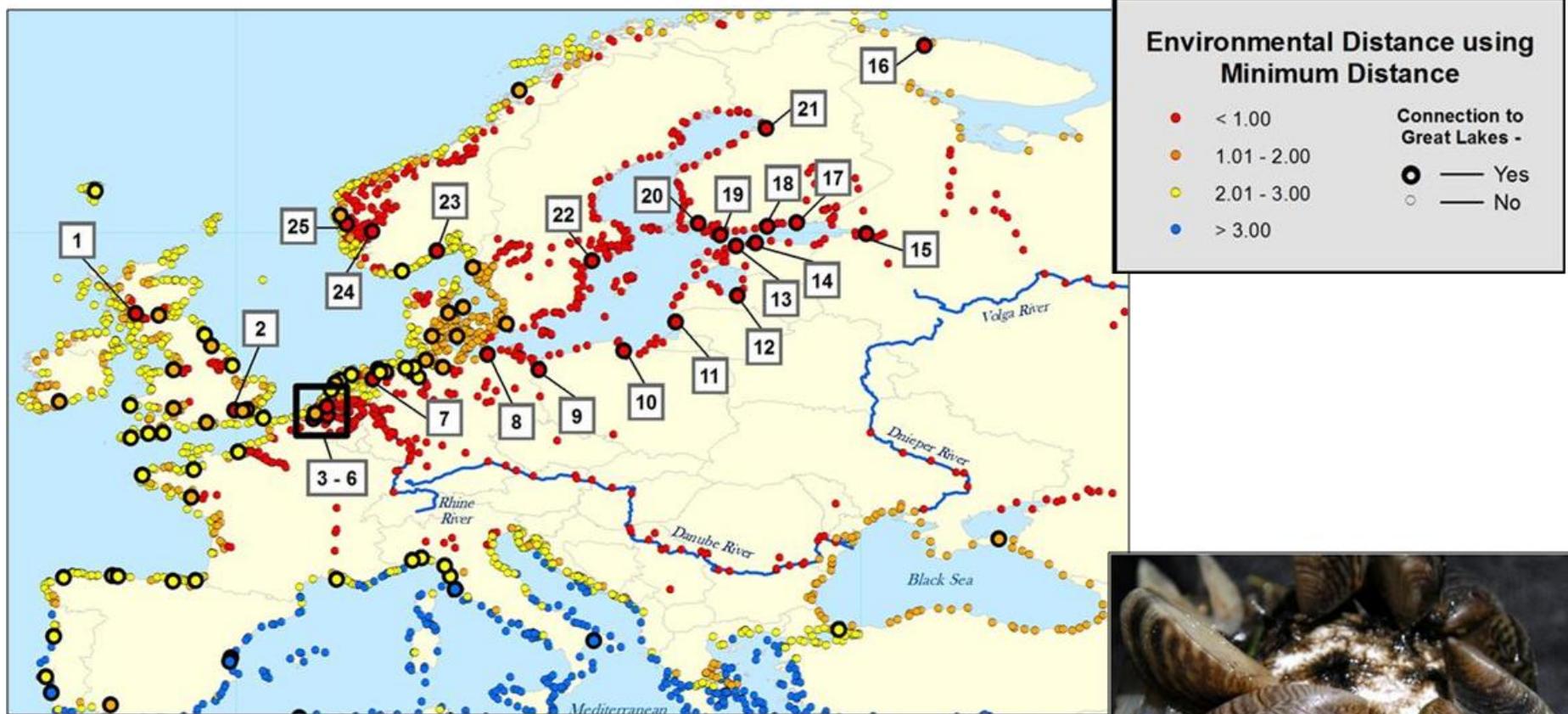
## Invasive Species - a shared problem

1. Don't respect borders
2. Disperse naturally
3. Human spread
  - Cargo transport (e.g. rail, shipping)
  - Trade in living organisms
  - Canals
  - Trailered boats & equipment



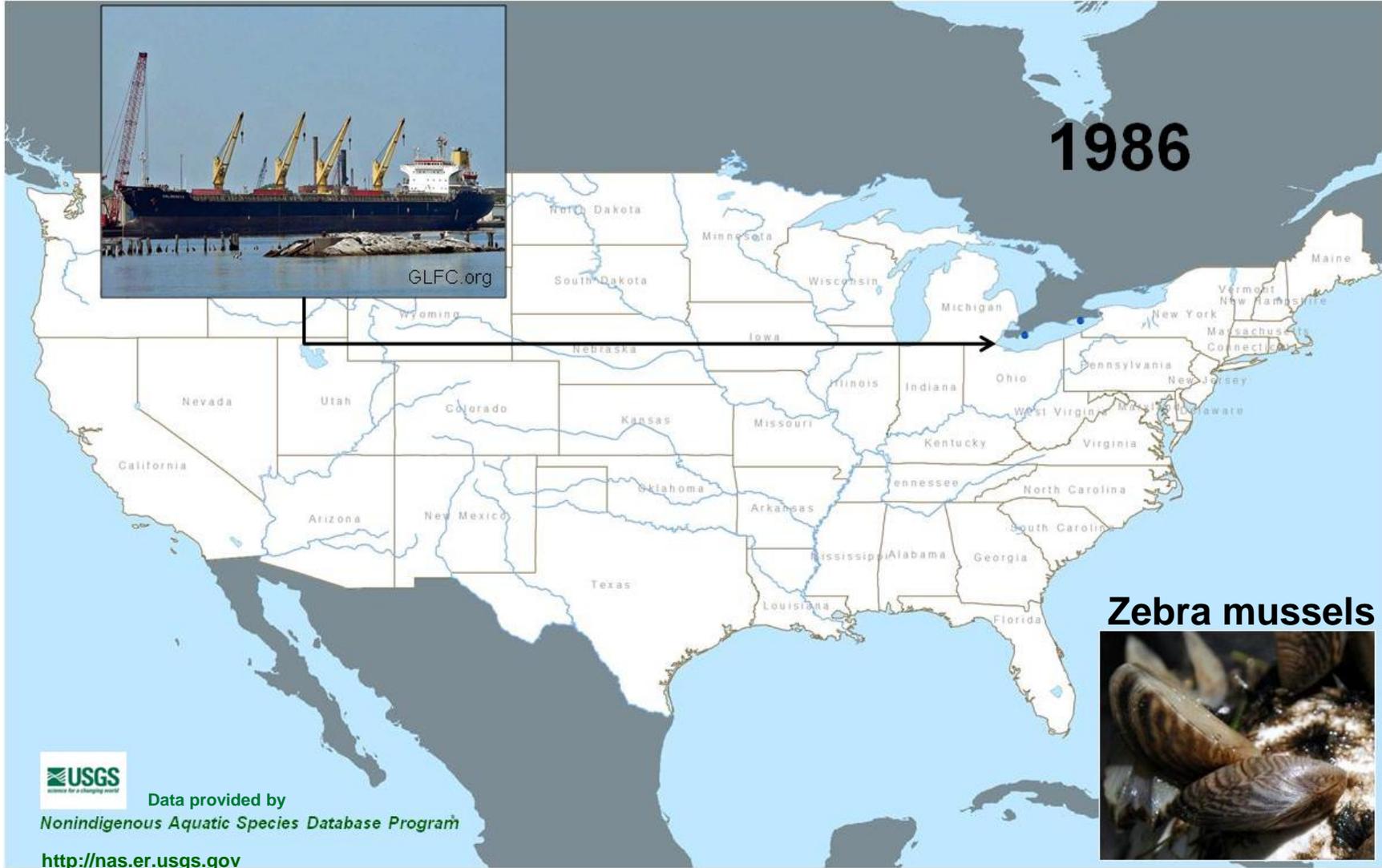


# Zebra and quagga mussels



*Adapted from Keller et al 2010*

# THE NATIONAL INVASIVE SPECIES COUNCIL (NISC)



Meet the Invasive Species Challenge

Know the NISC Plan, Manage the Problem.

PREPARE, PREVENT, PROTECT.

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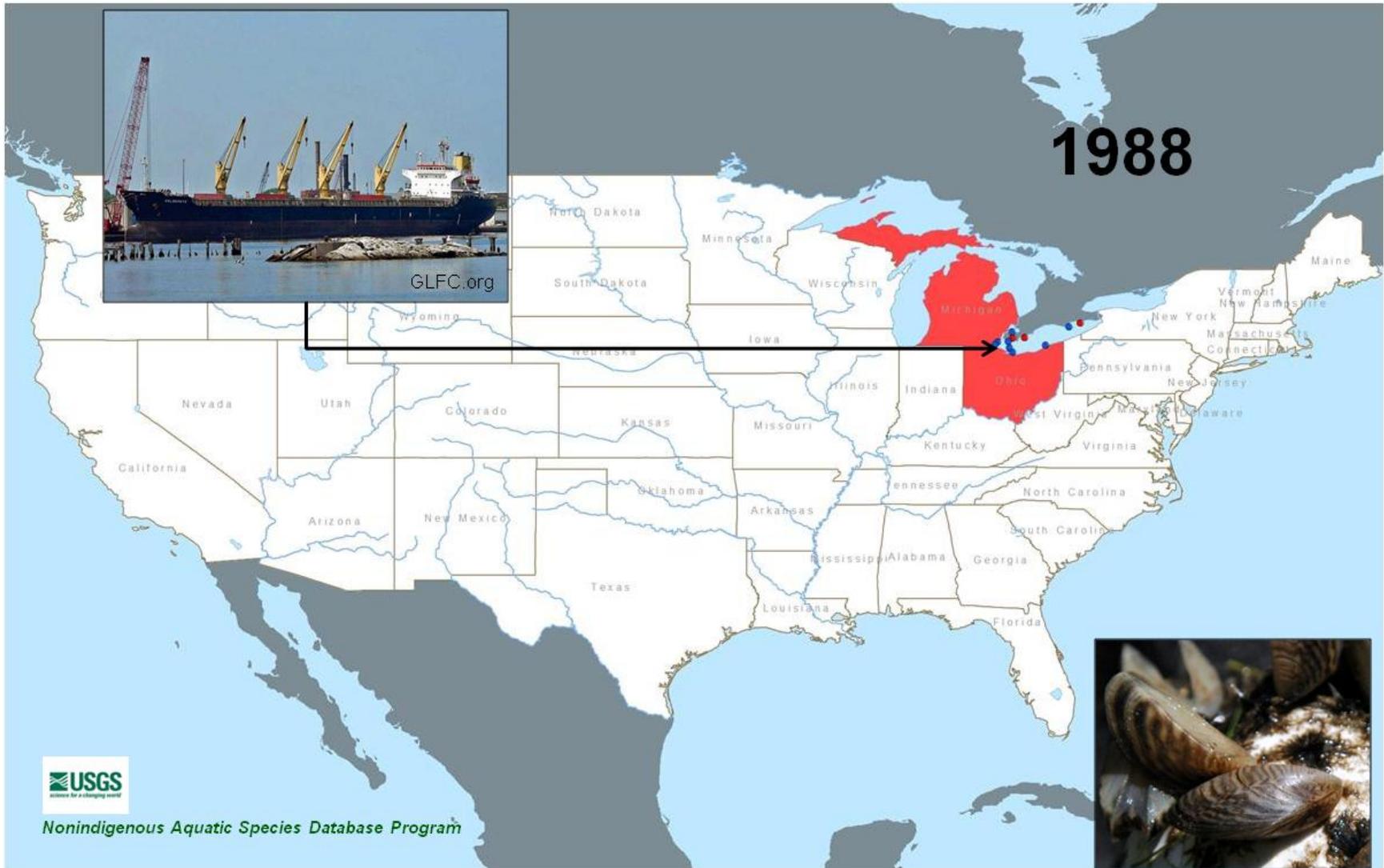


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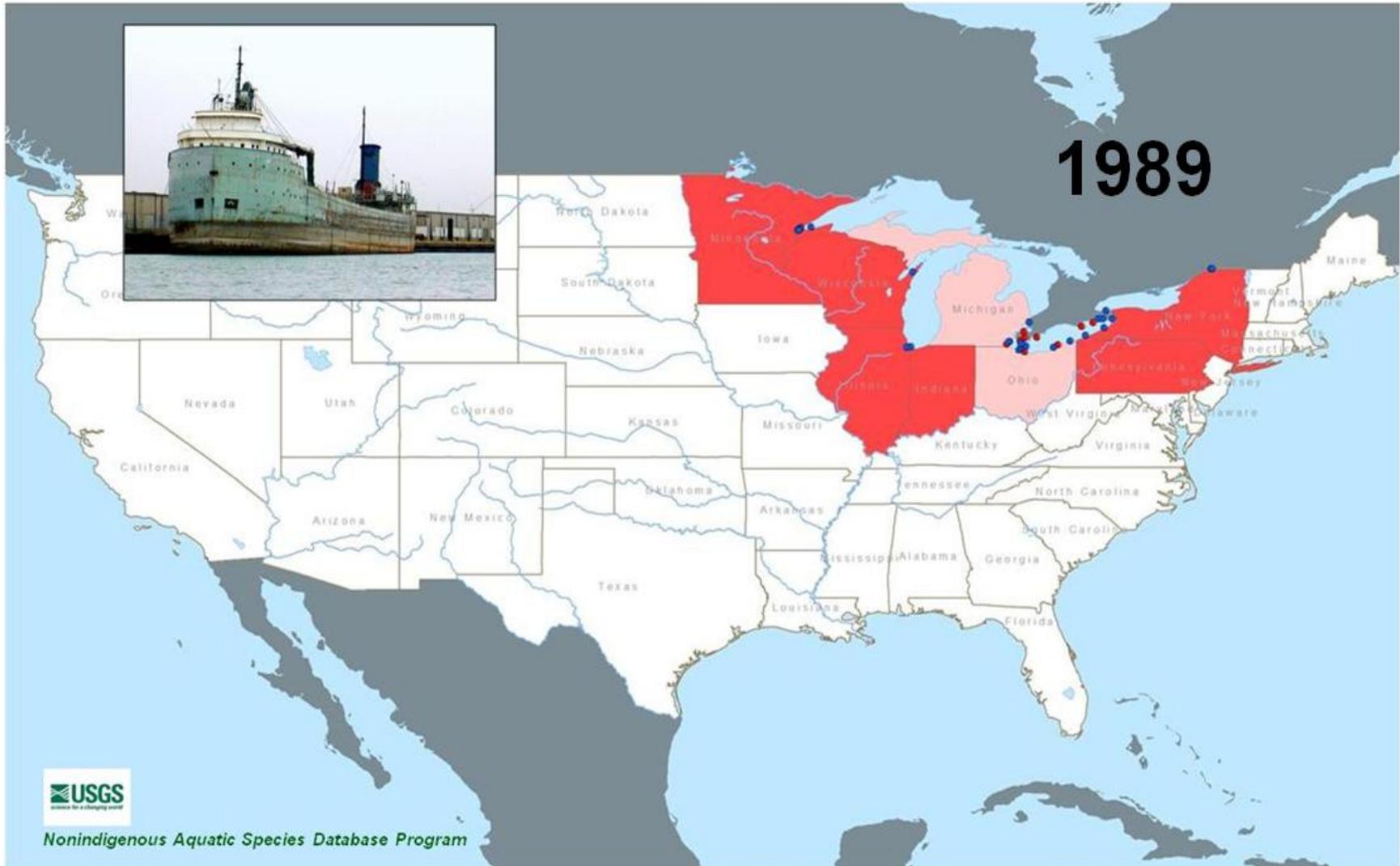


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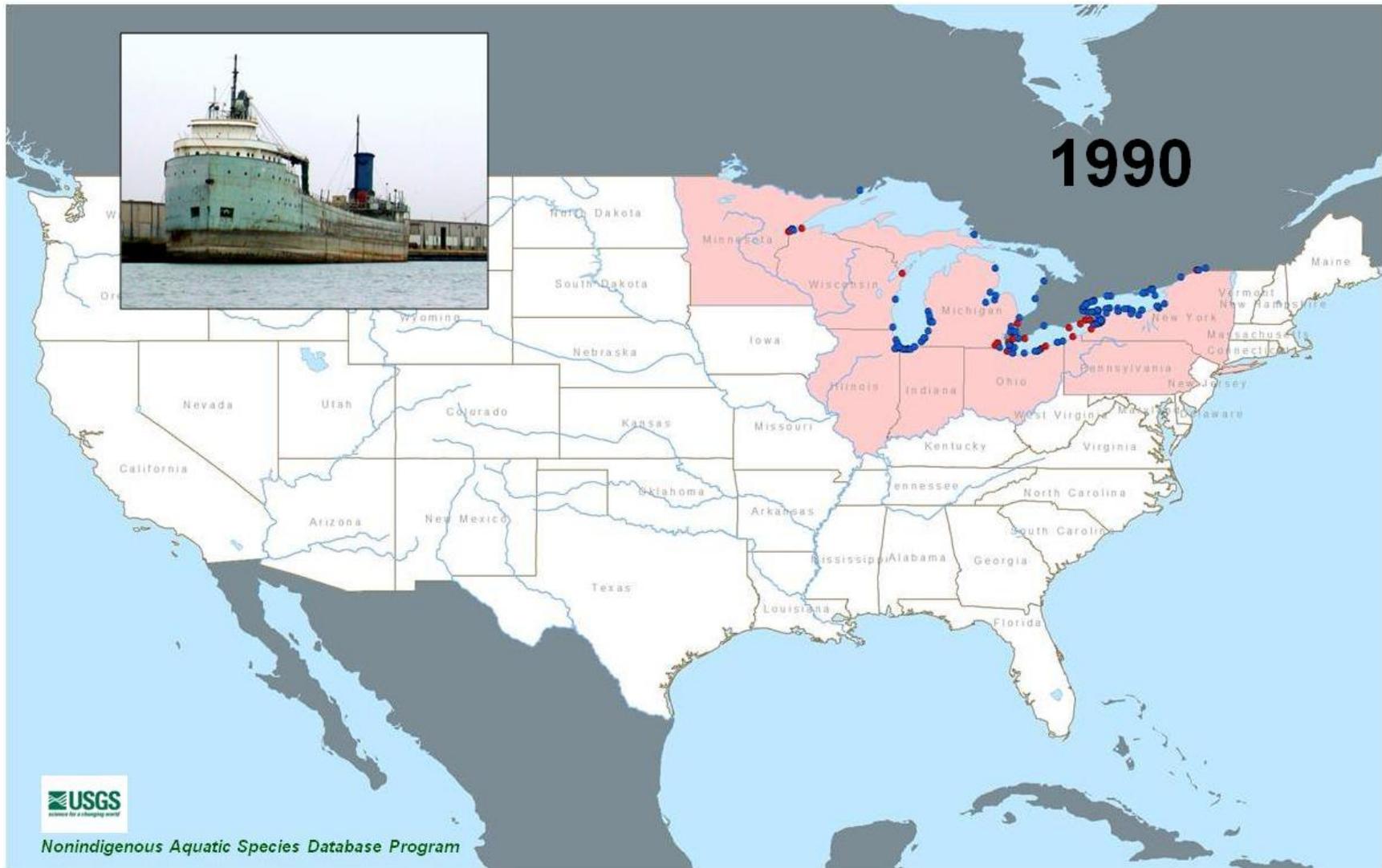


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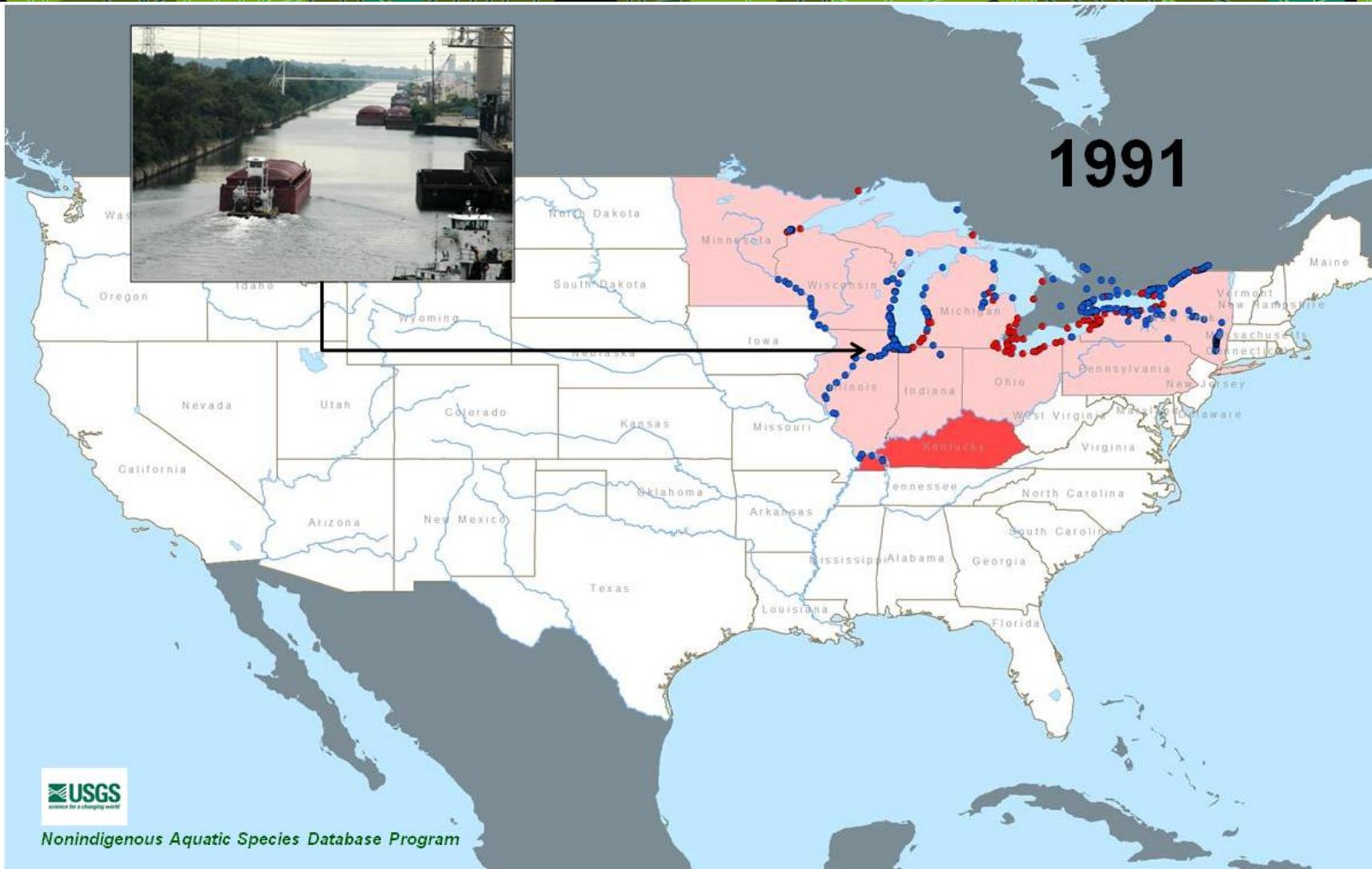


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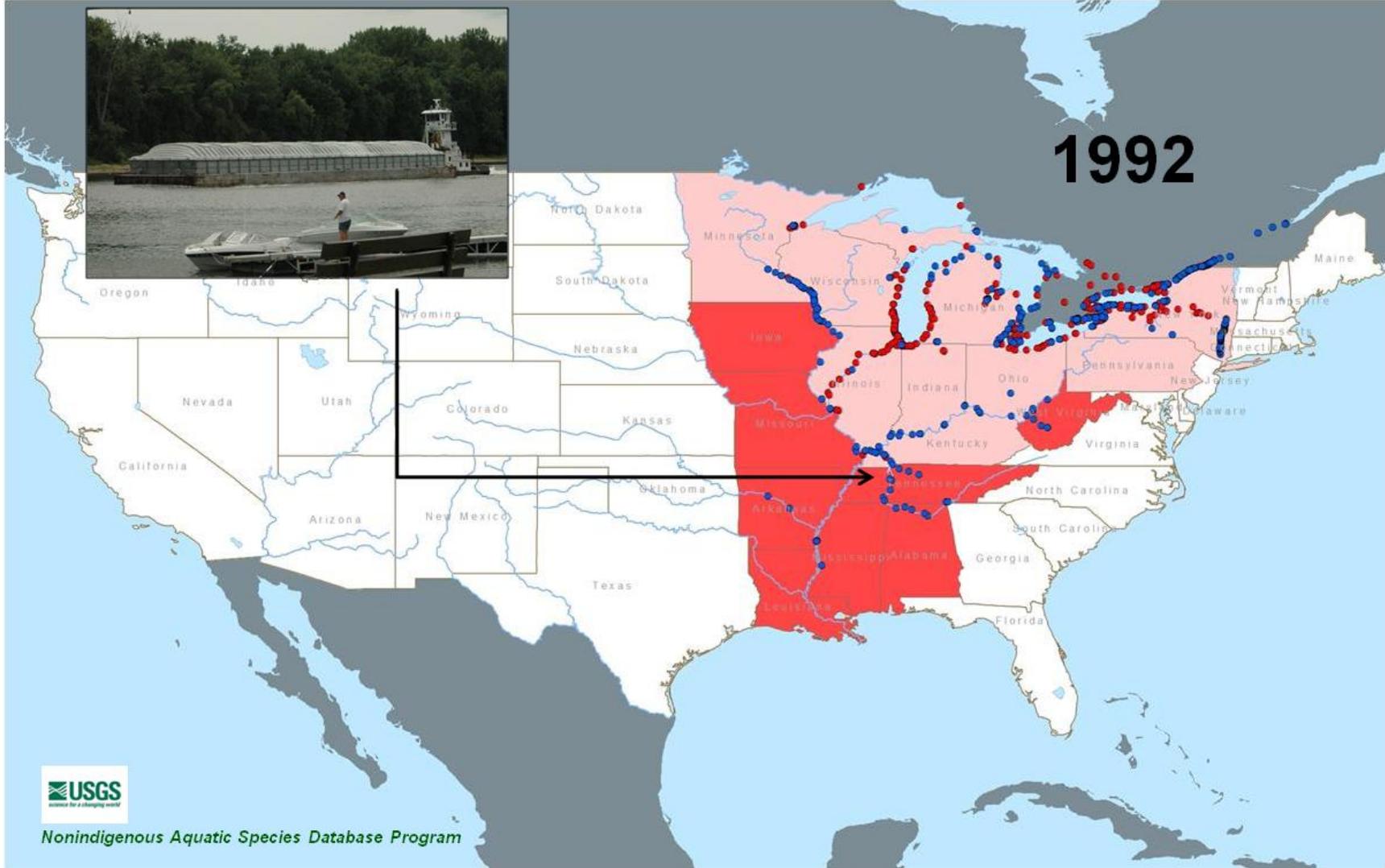


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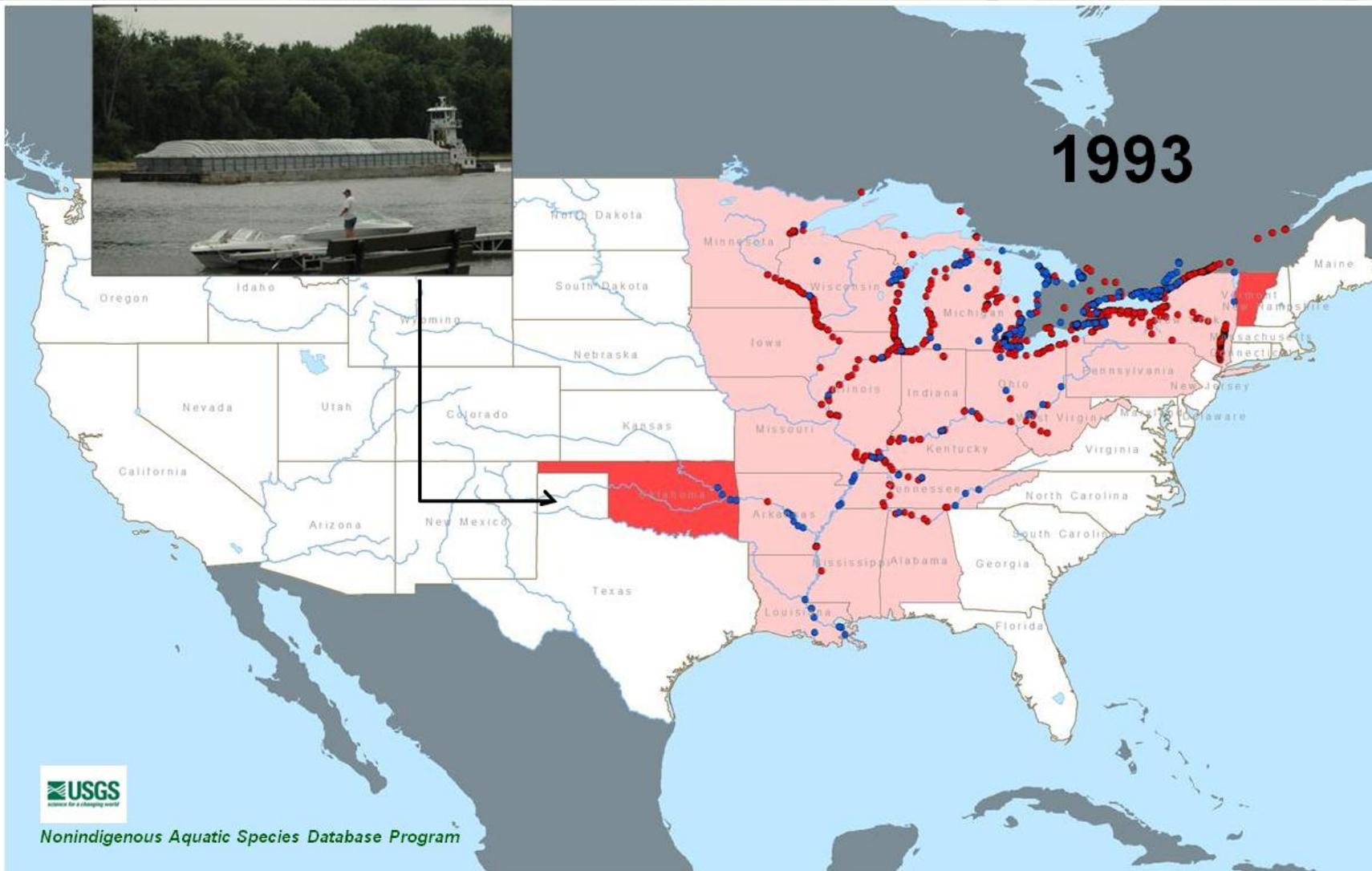


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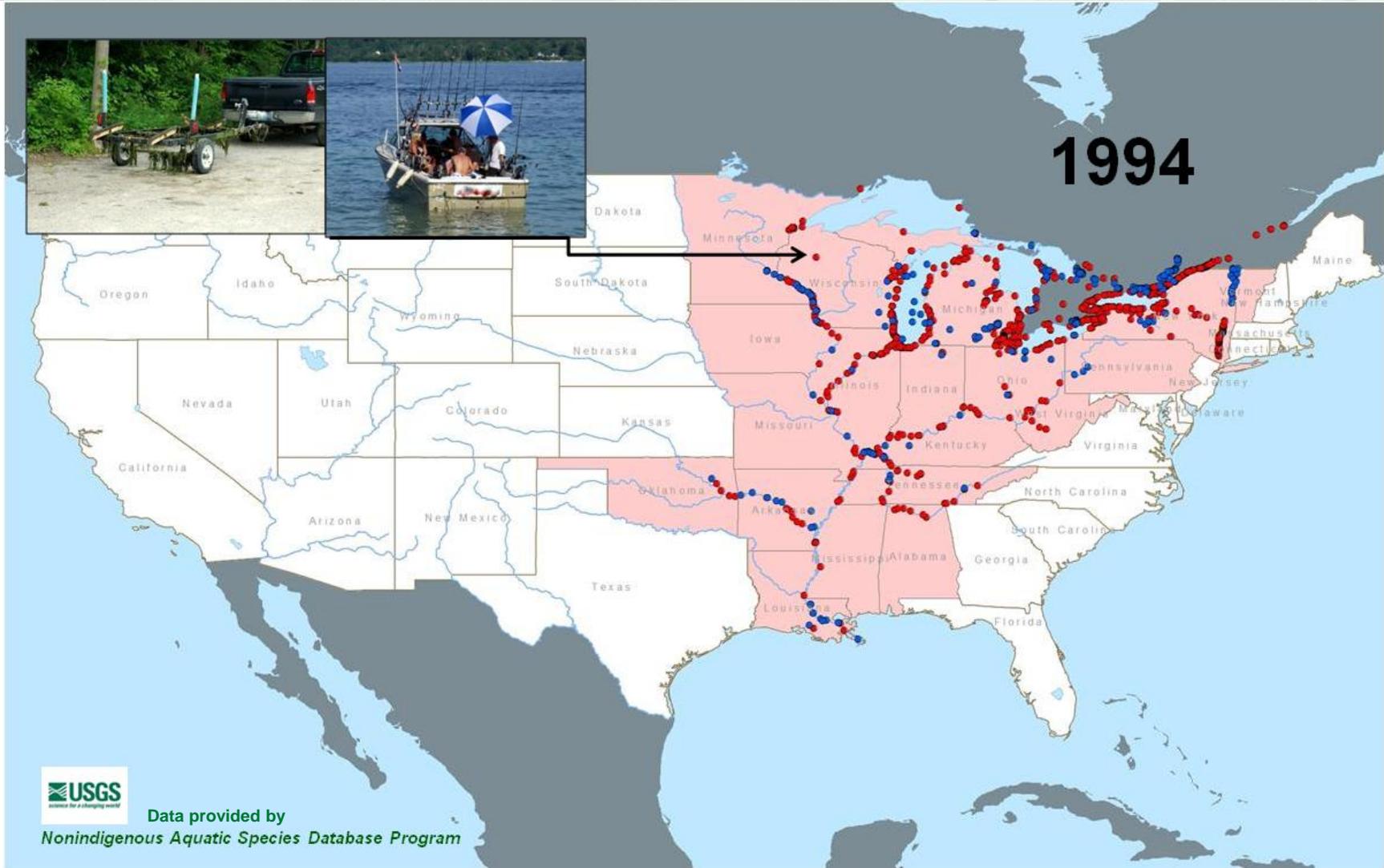


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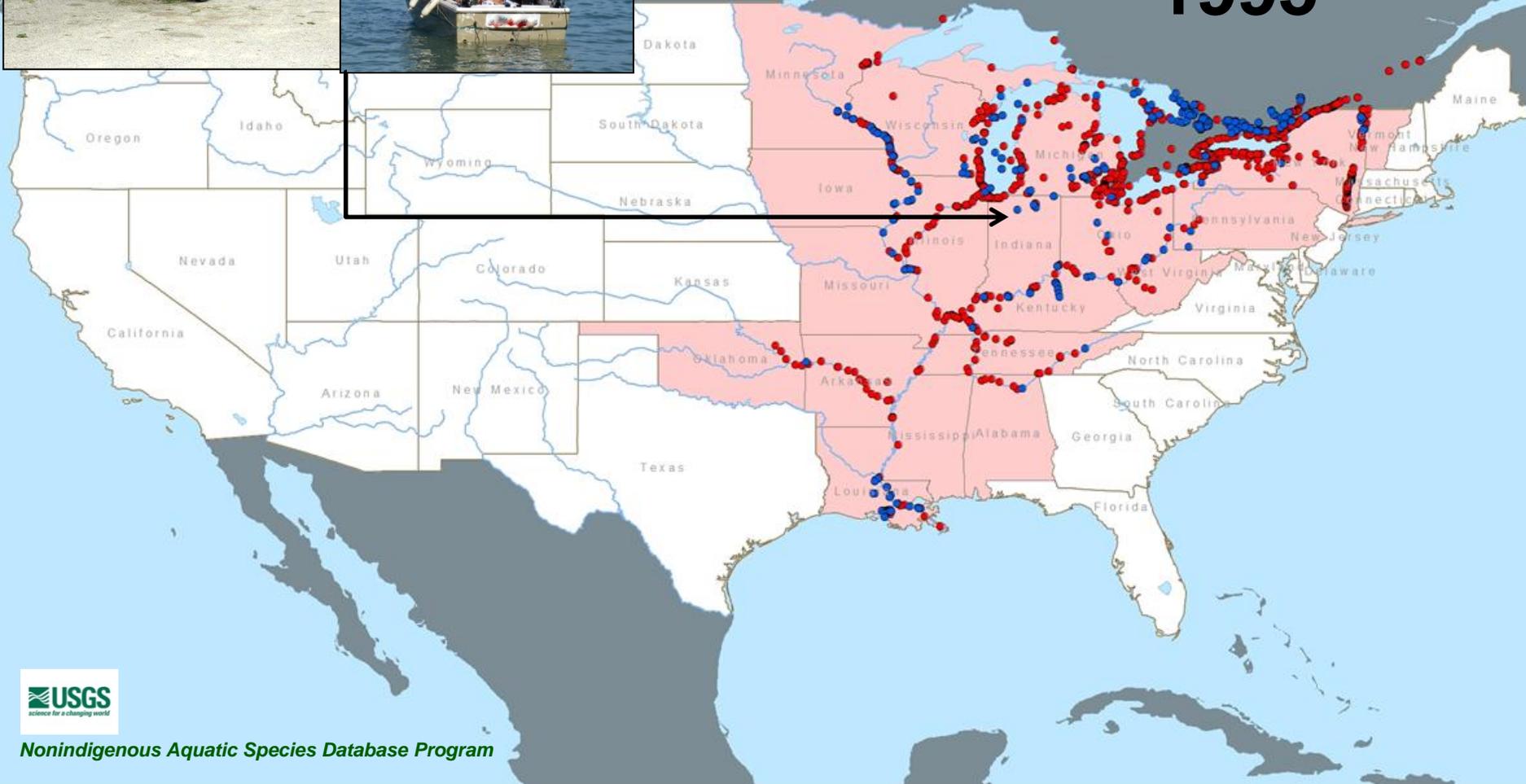
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1995

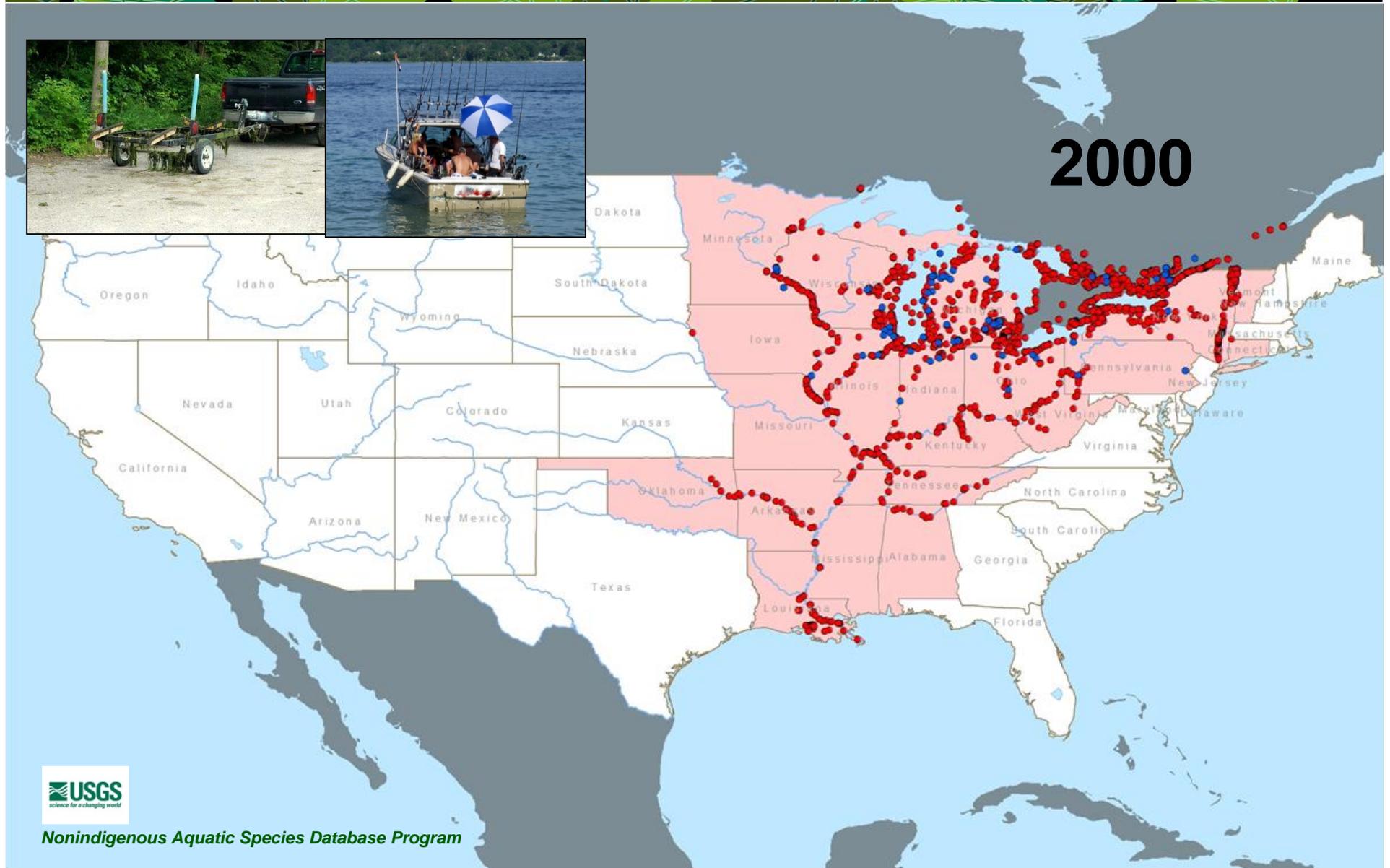


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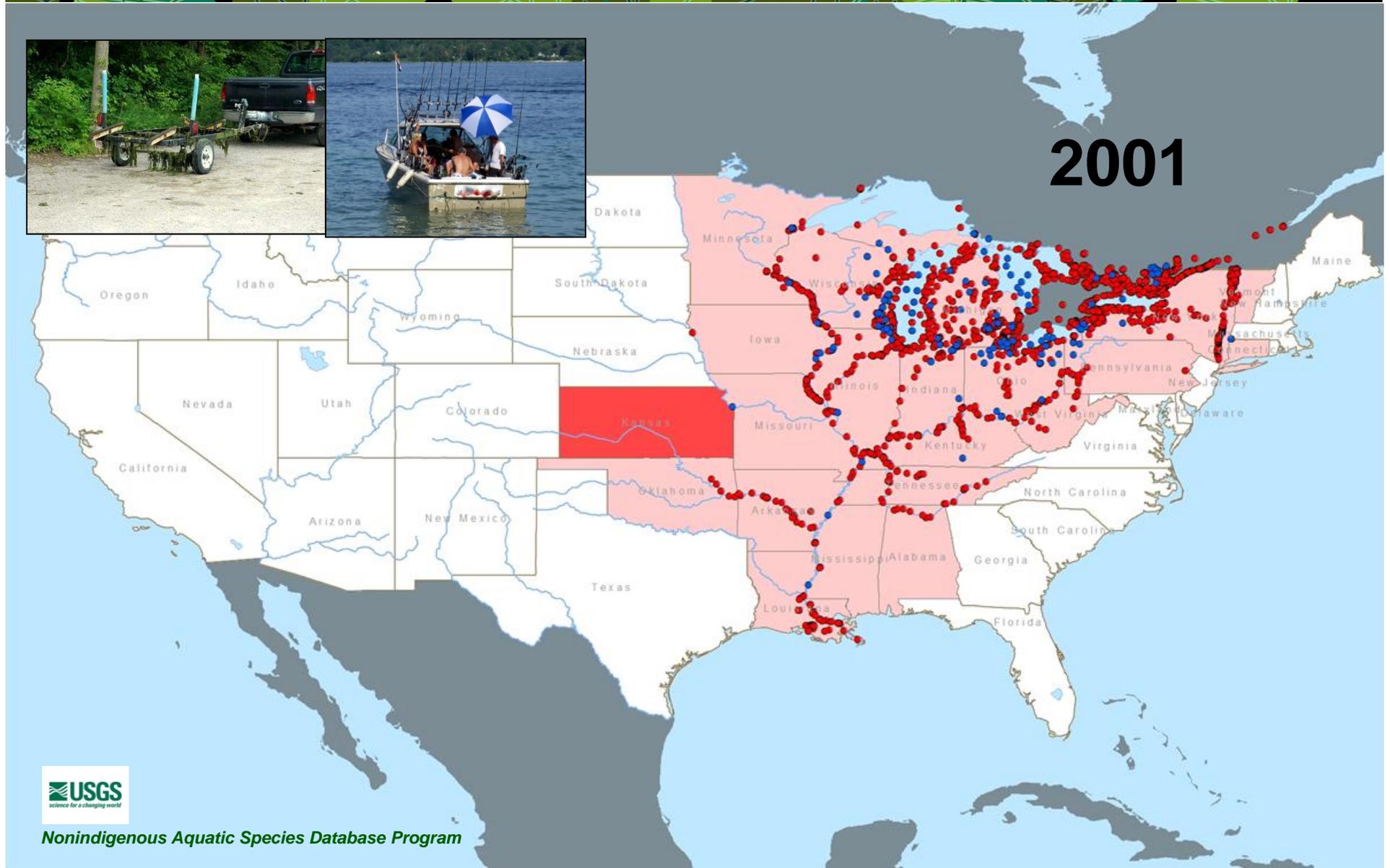


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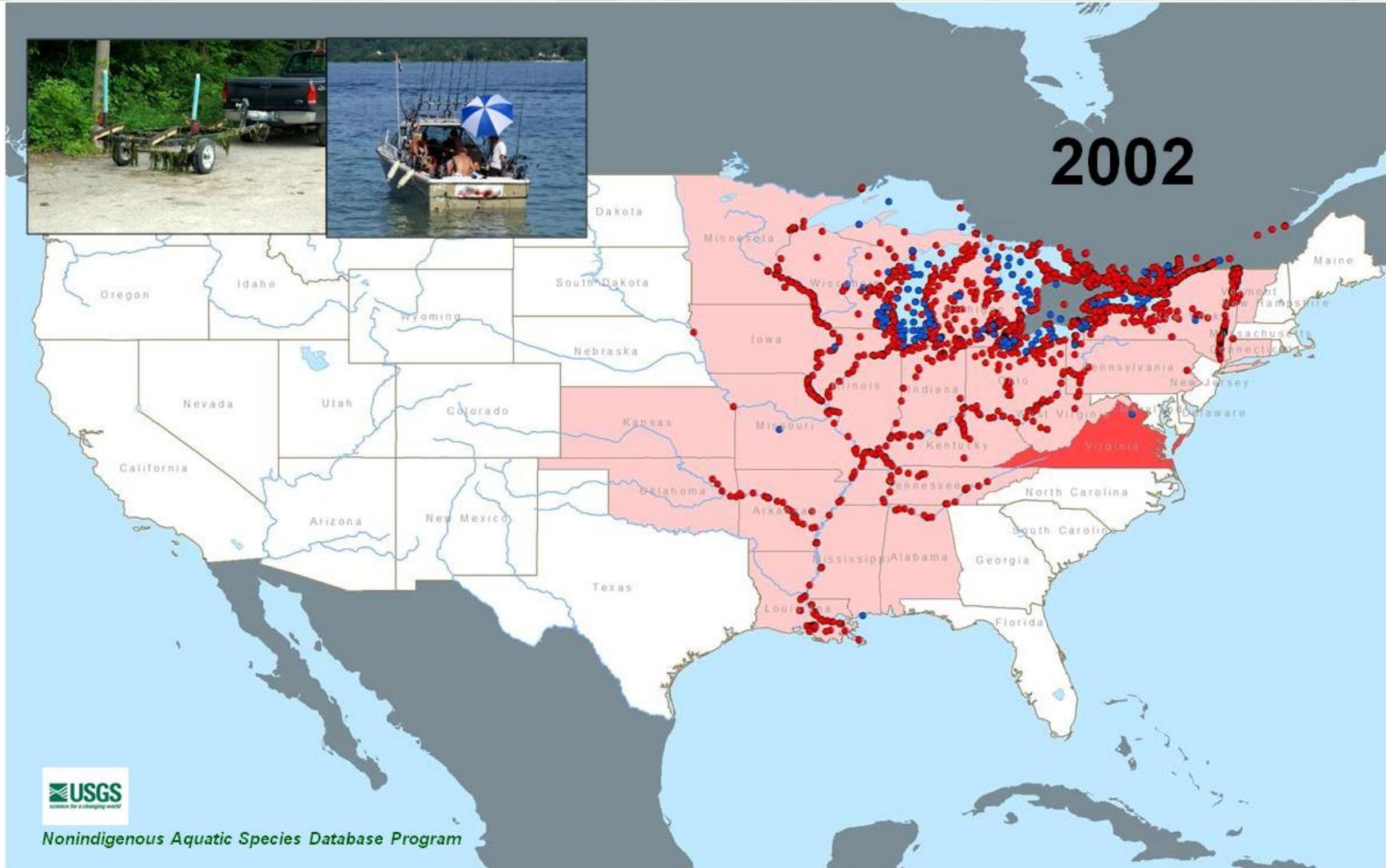


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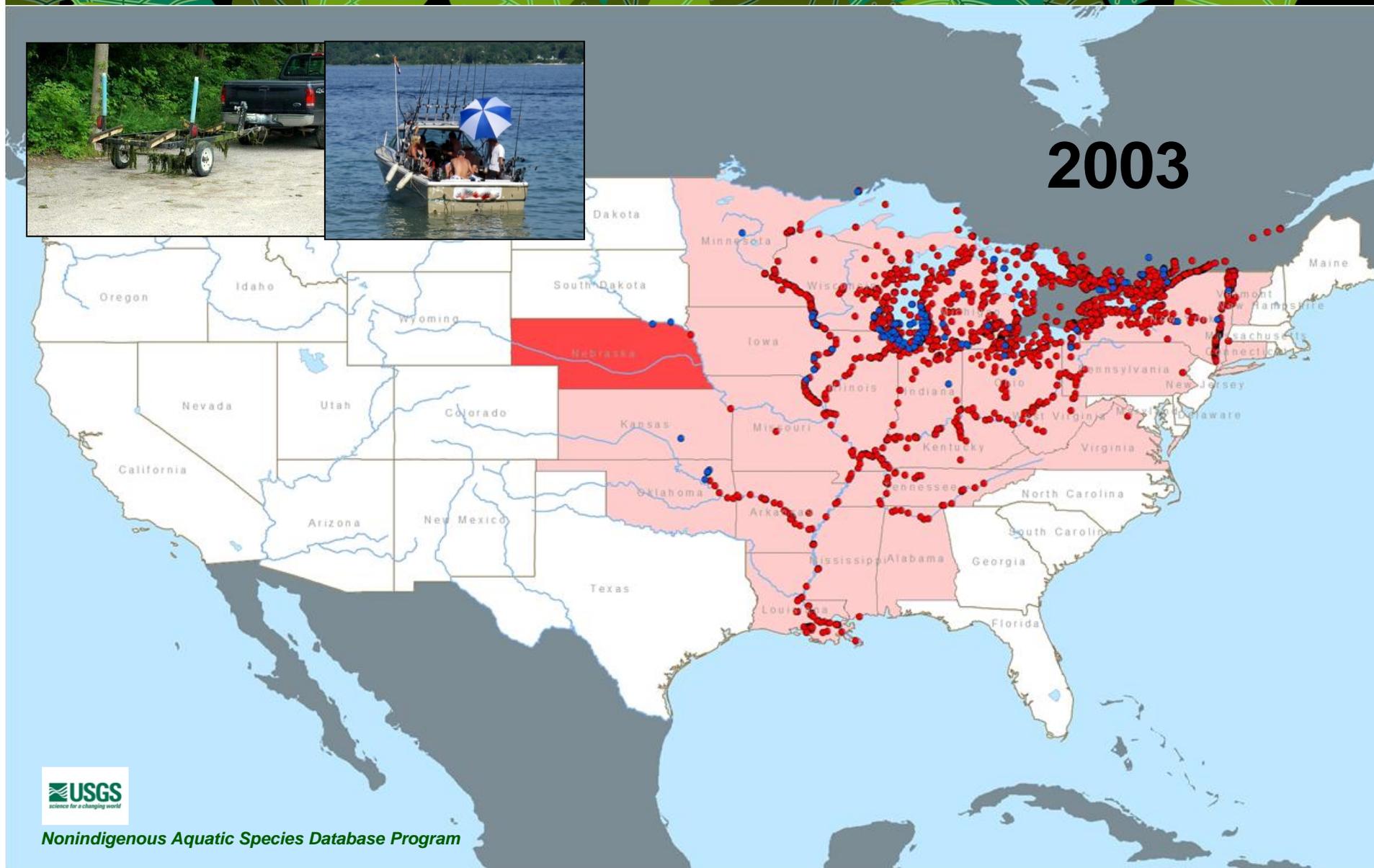


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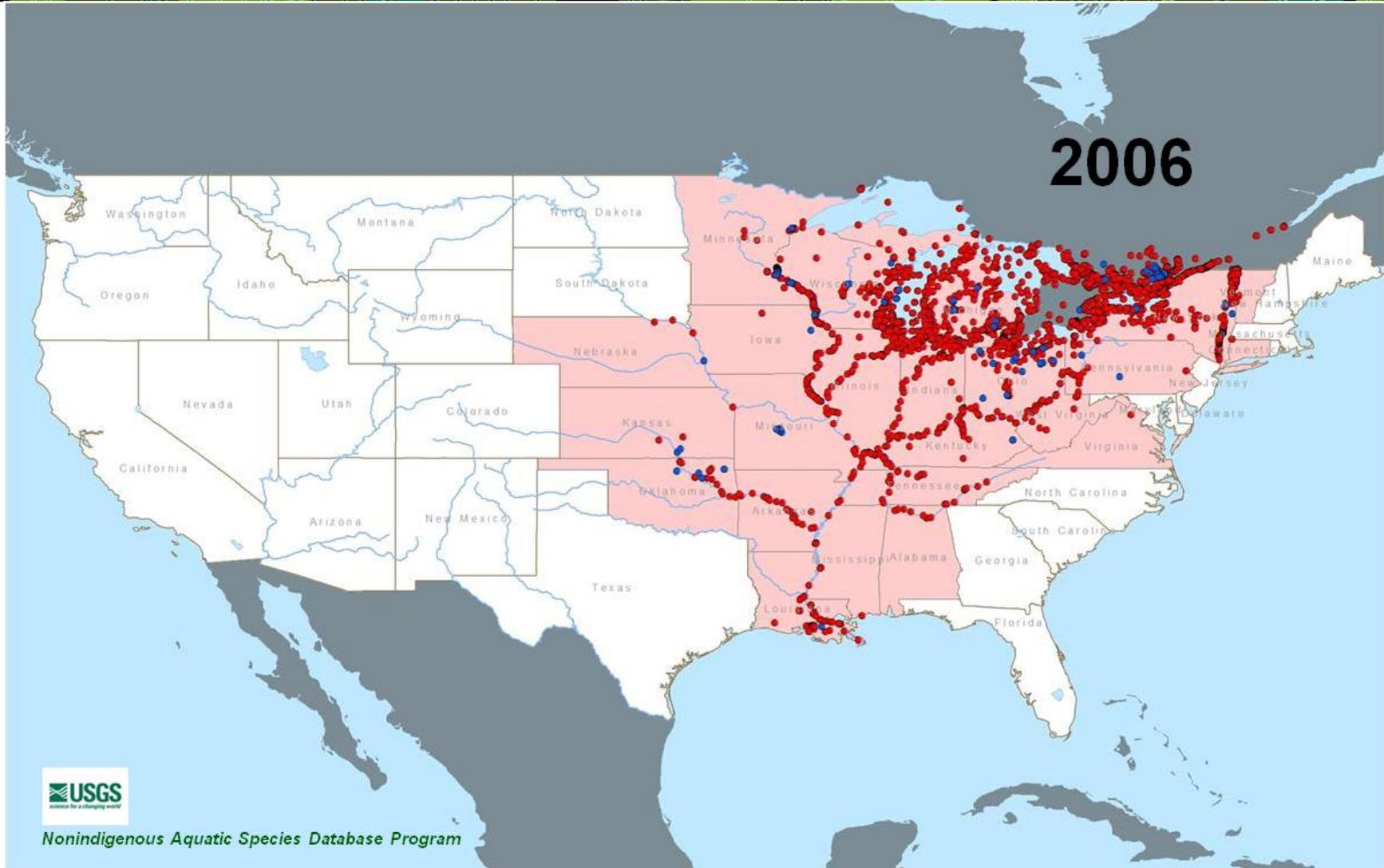


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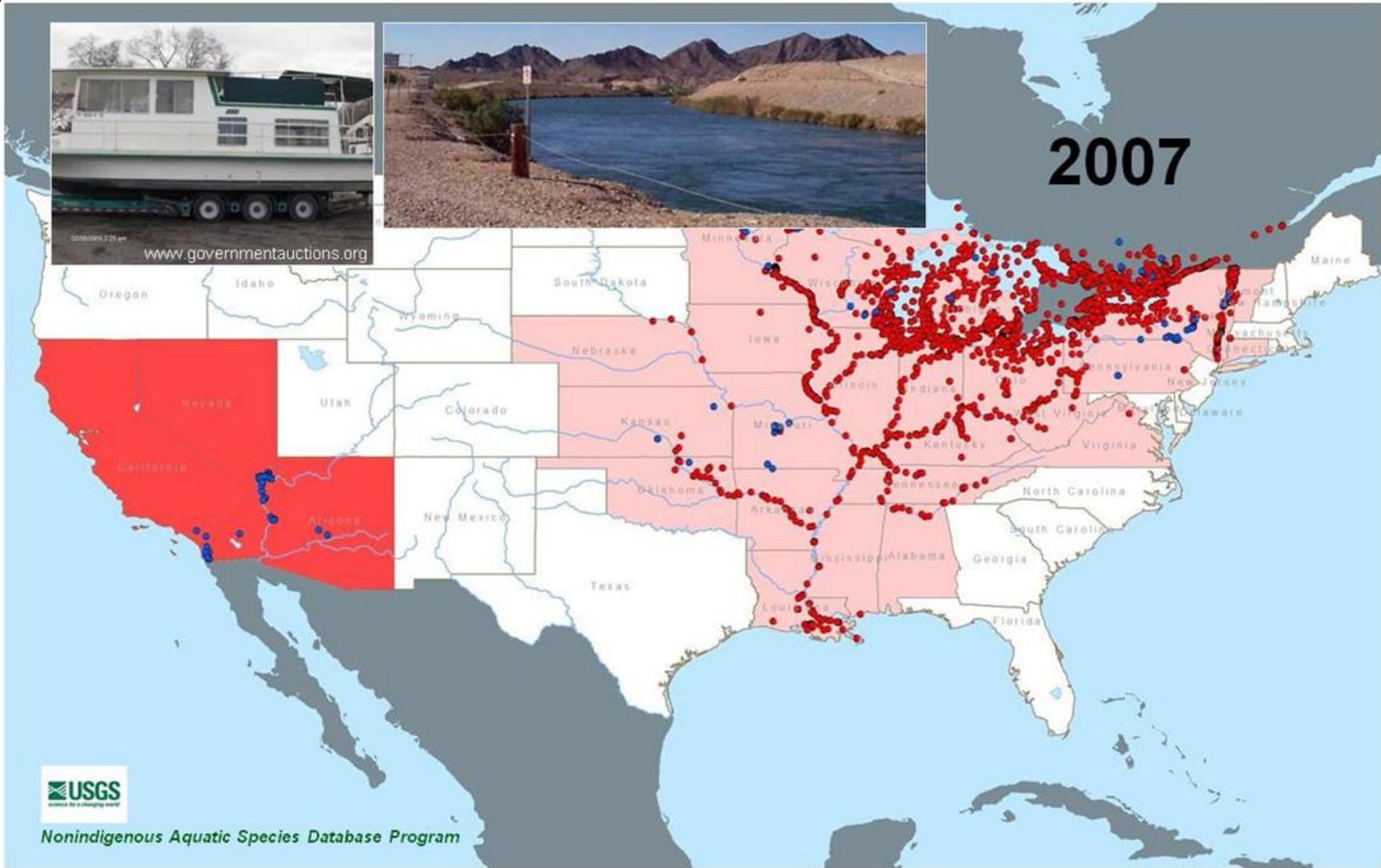


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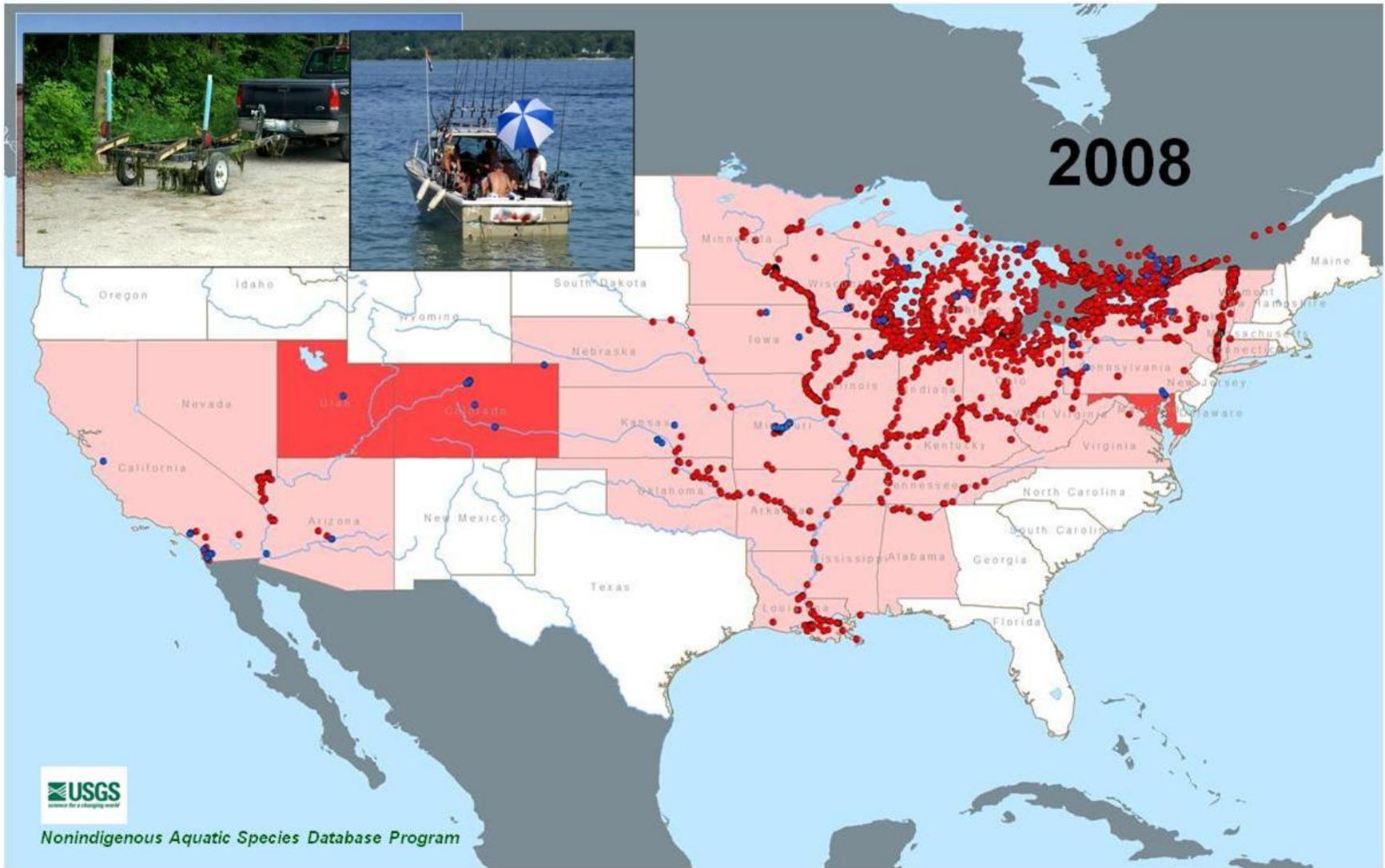


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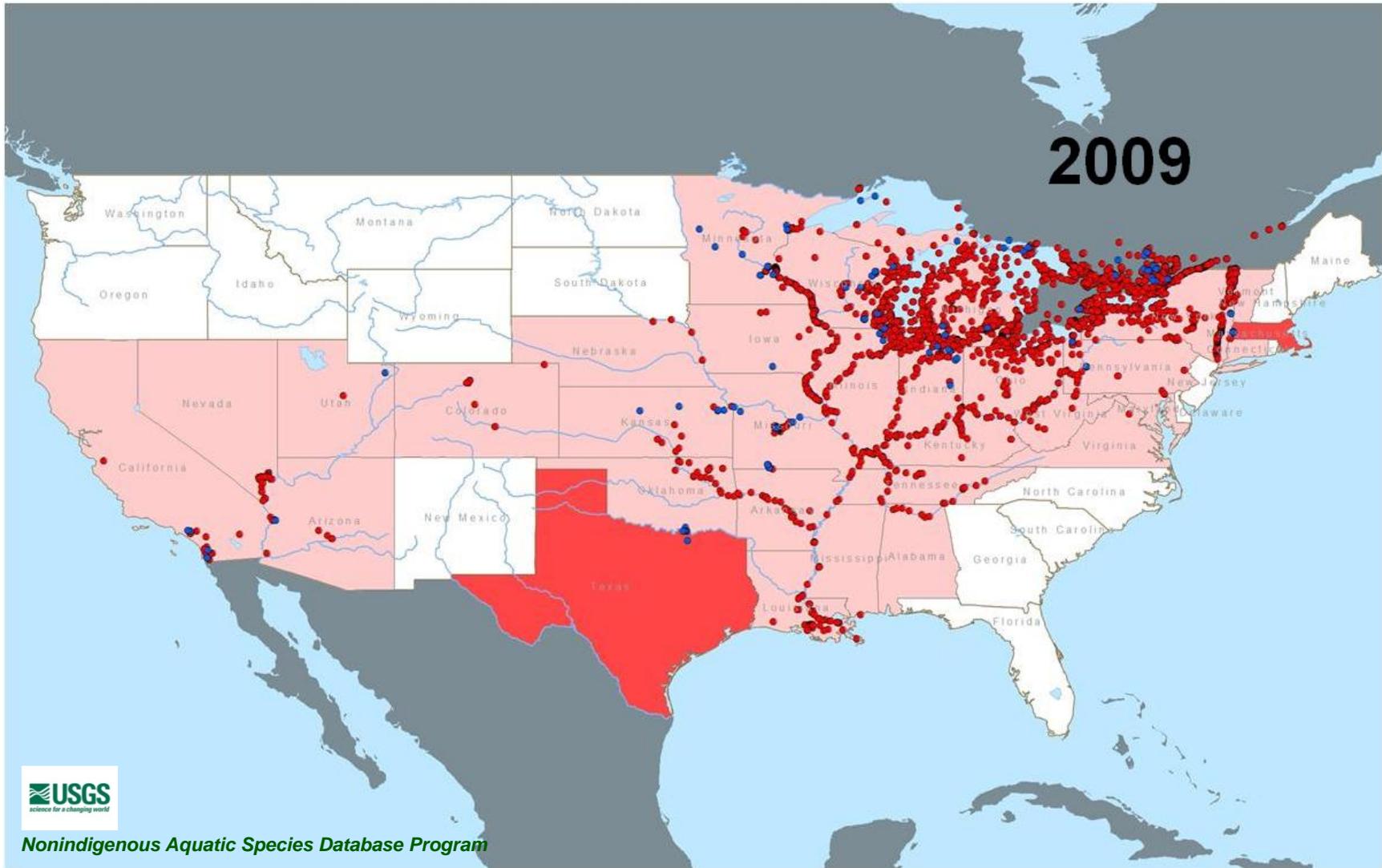


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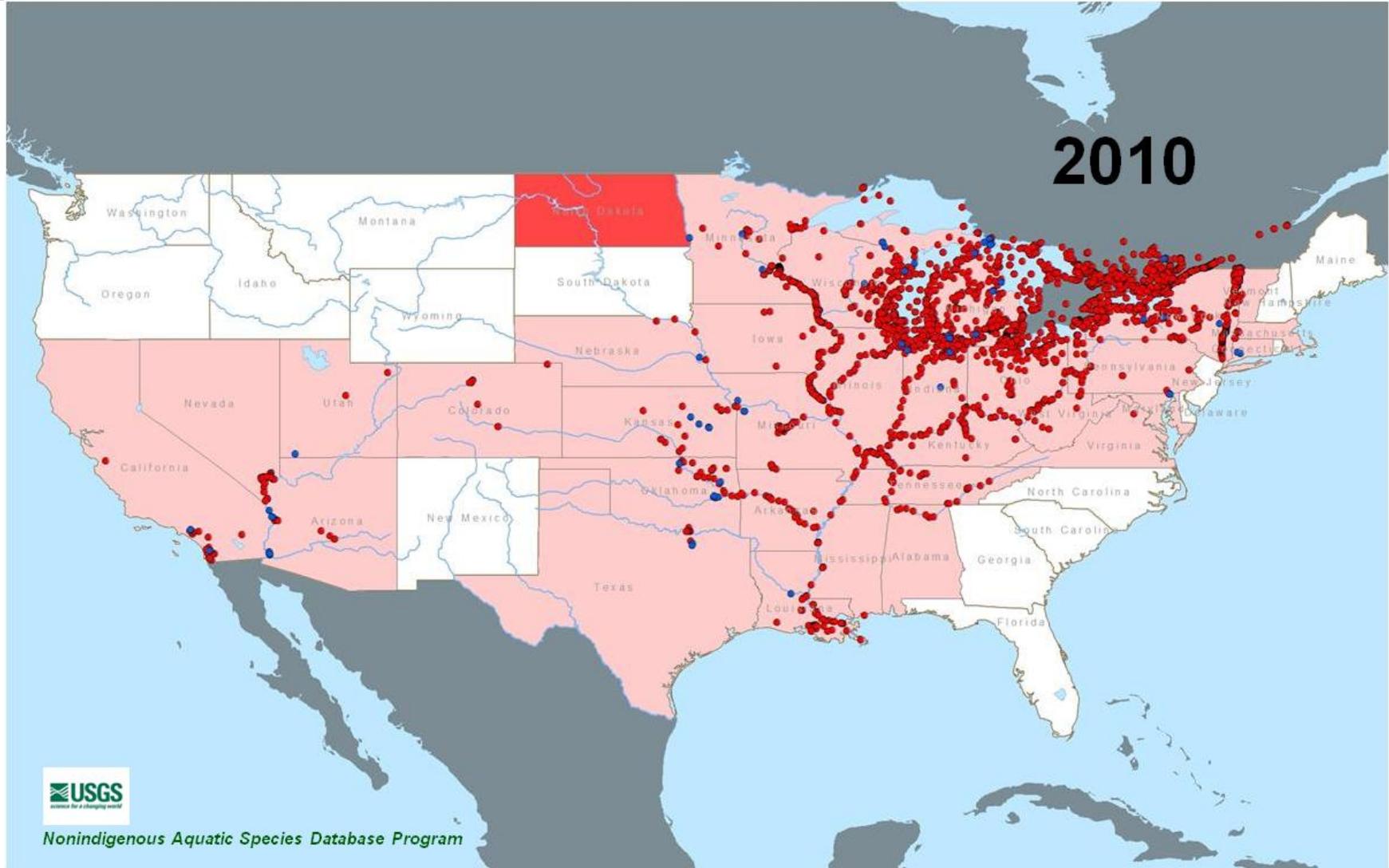


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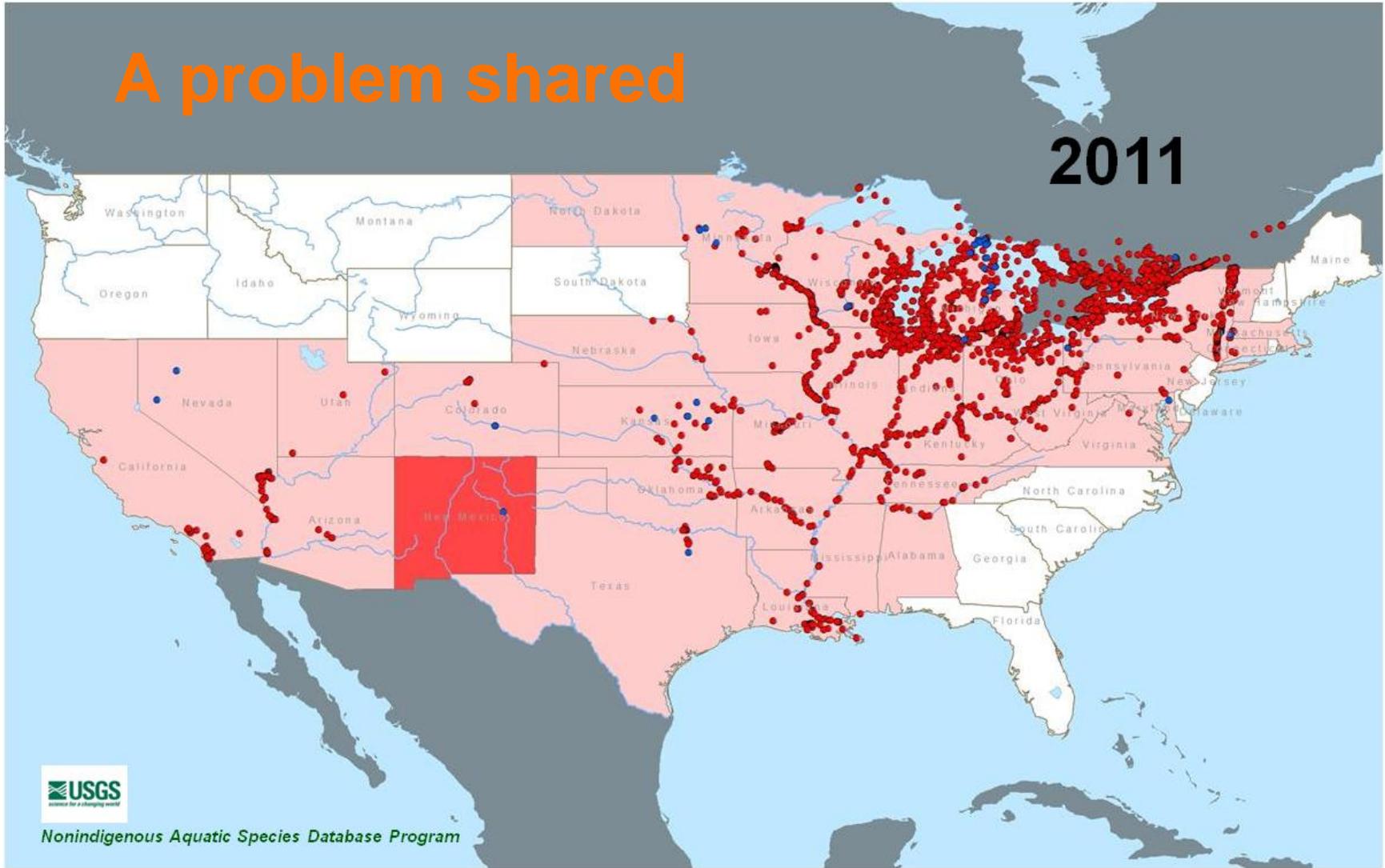
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## A problem shared

2011





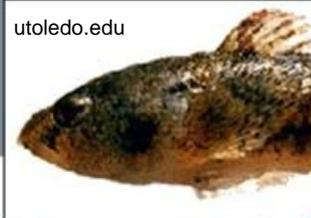
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# Invasive species poised to invade Mississippi River via canal

Water chestnut



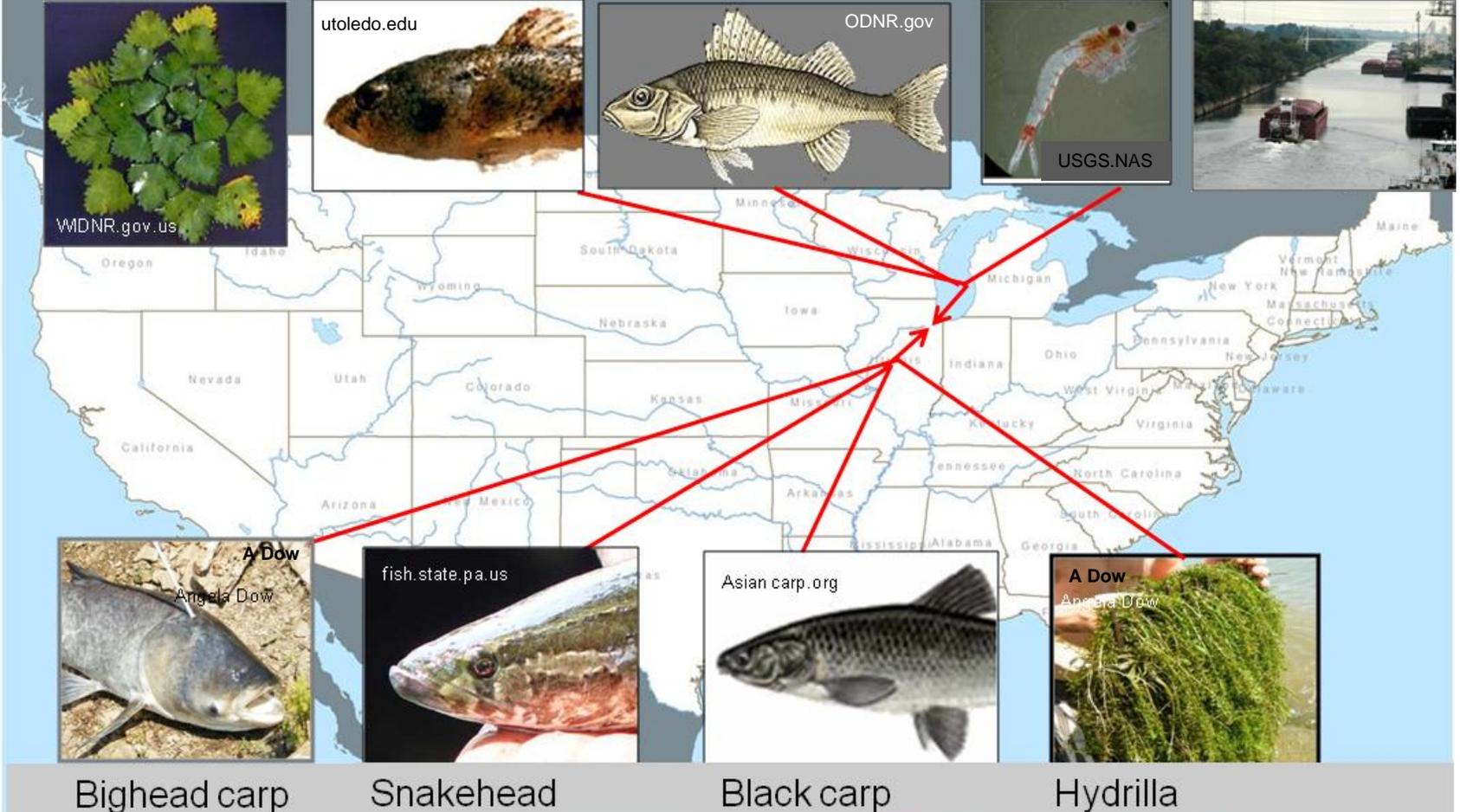
Tubenose goby



Eurasian ruffe



Bloody red shrimp



Bighead carp



Snakehead



Black carp

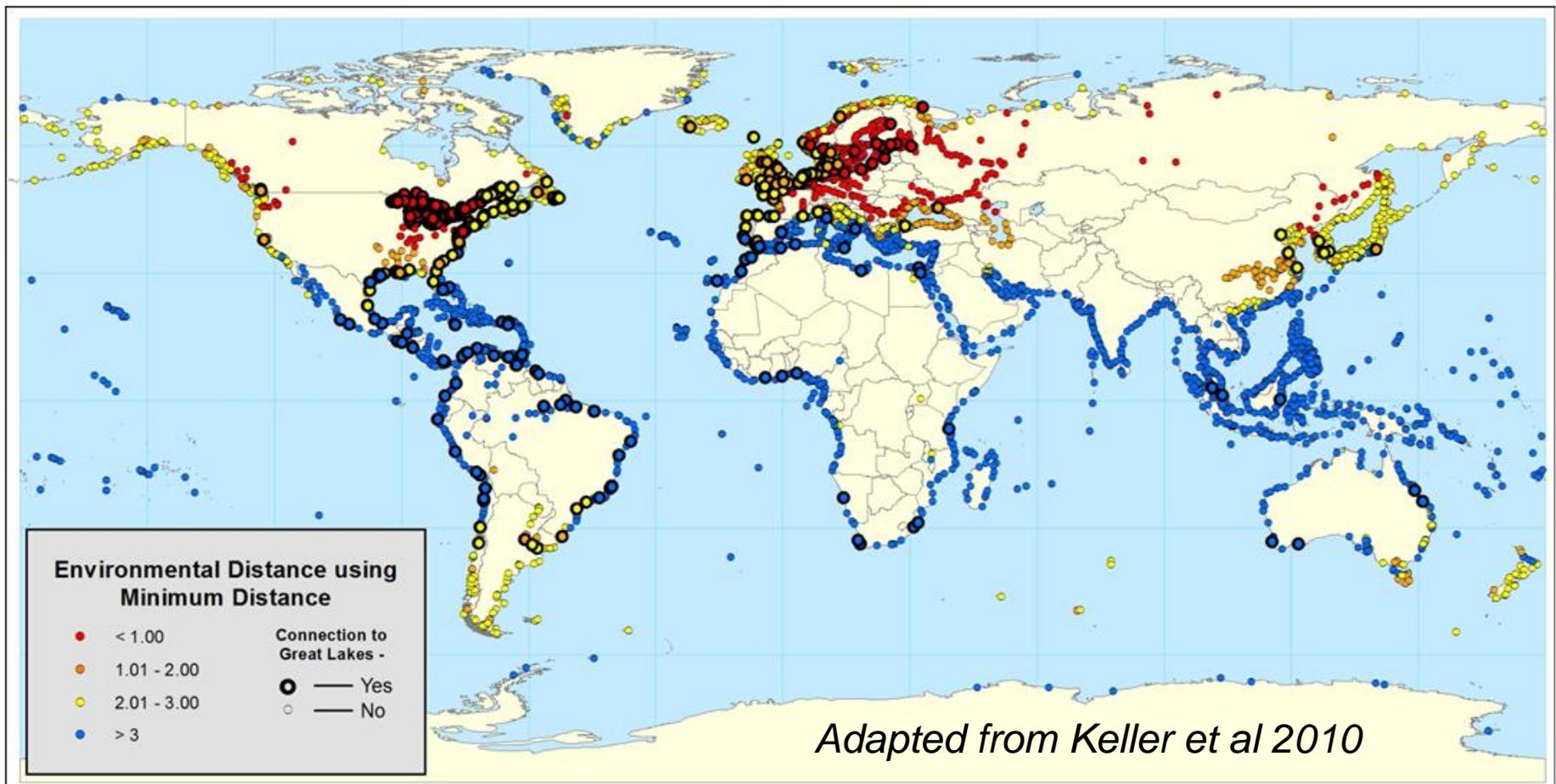


Hydrilla

# Invasive species poised to invade Great Lakes via canal

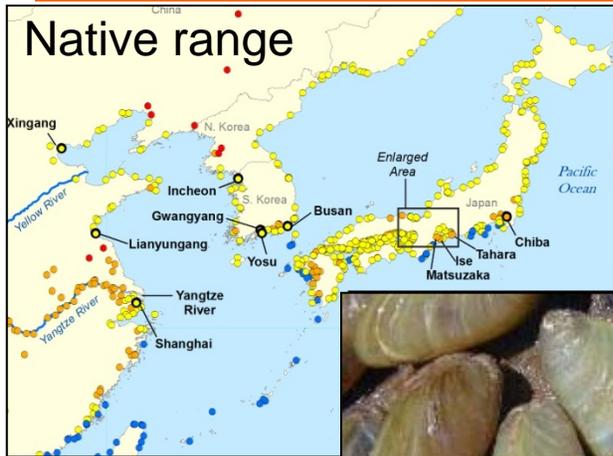


## Global ports linked to the Great Lakes

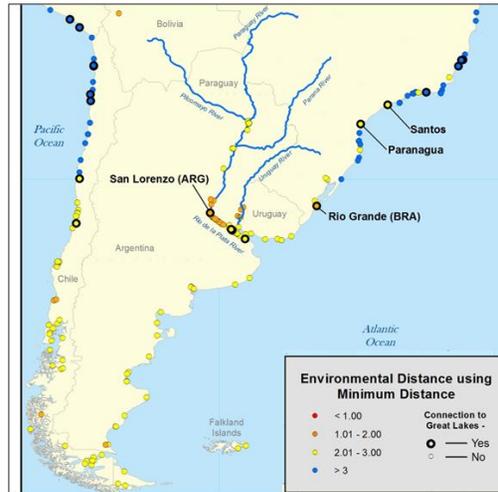




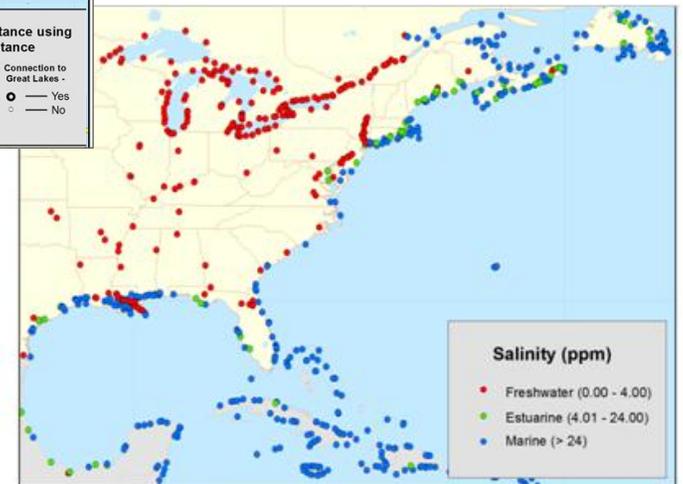
# Golden mussel



## Invaded range



Freshwater and estuarine US ports

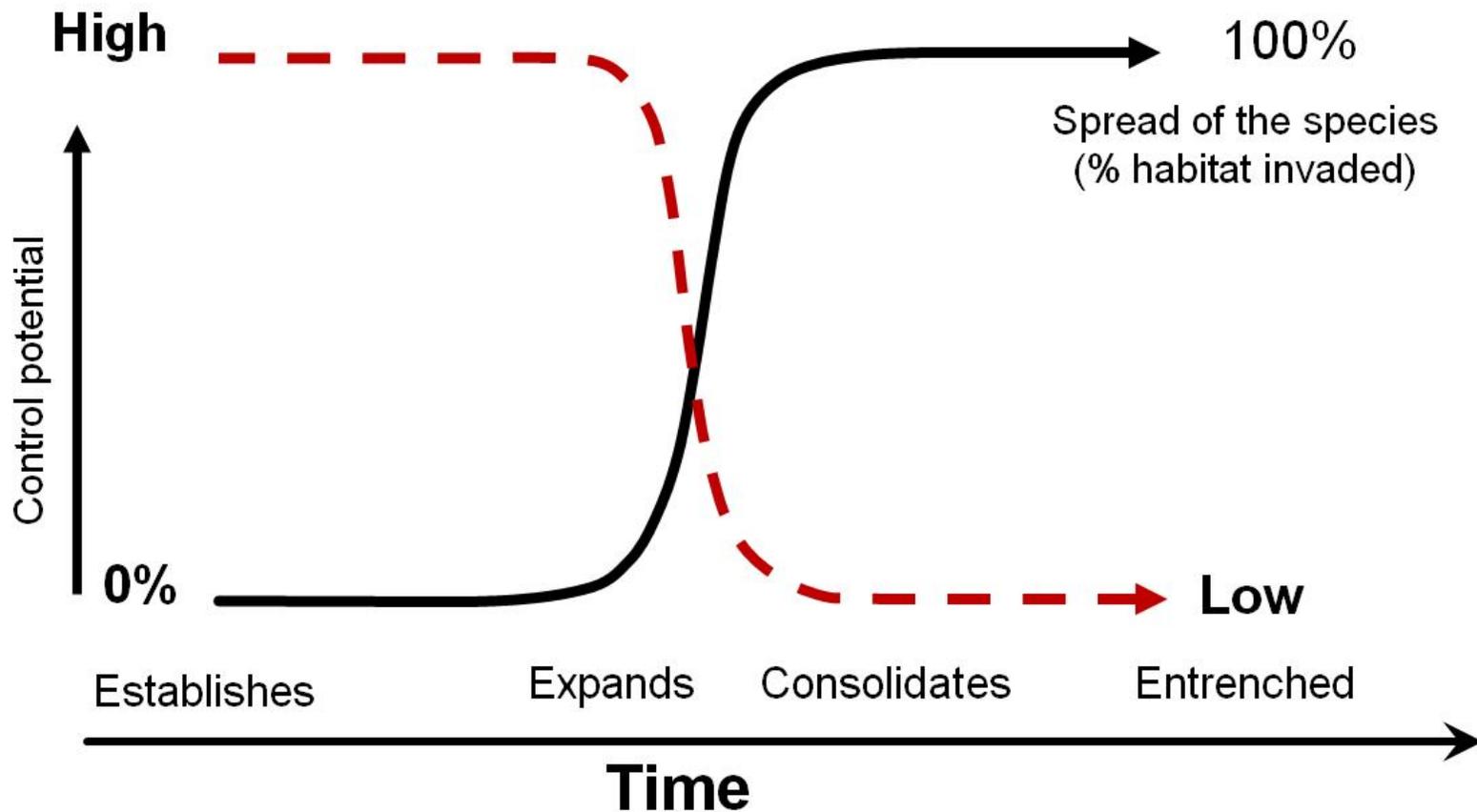


Panama canal expansion project

Adapted from Keller et al 2010



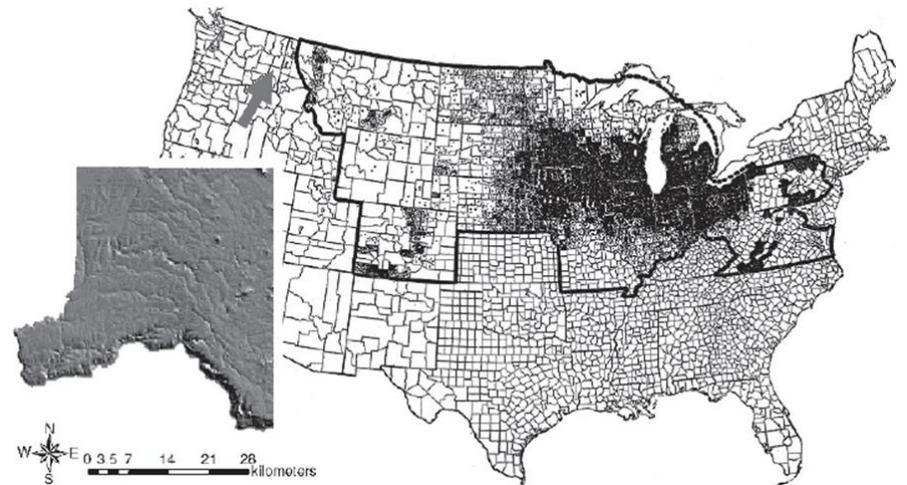
## Opportunity for successful response





## Successful control or eradications

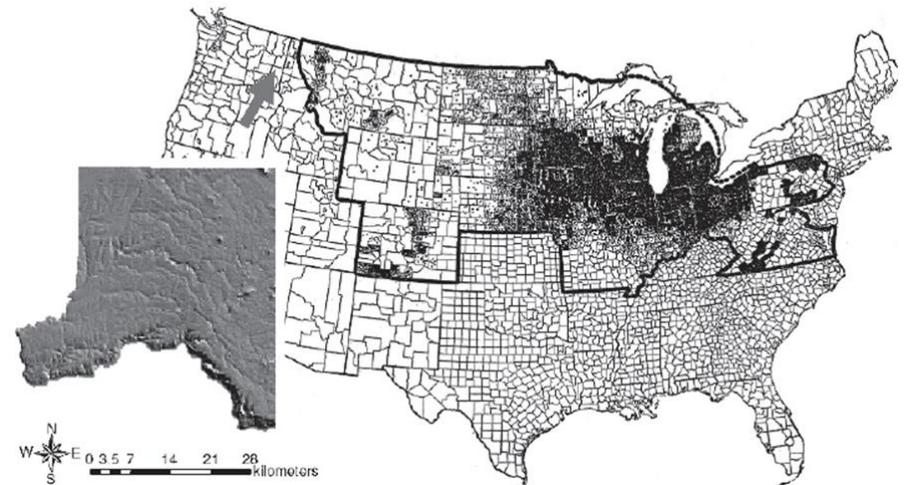
1. Small pox (Global)
2. Screw worm (Southern U.S. and Mexico)
3. European barberry
4. Witch weed
5. *Caulerpa taxifolia*





## Prevention more cost effective -

1. Small pox (Global) cost ~
2. Screw work (Southern U.S. and Mexico) Cost ~
3. European barberry costs ~
4. Witch weed
5. *Caulerpa taxifolia*





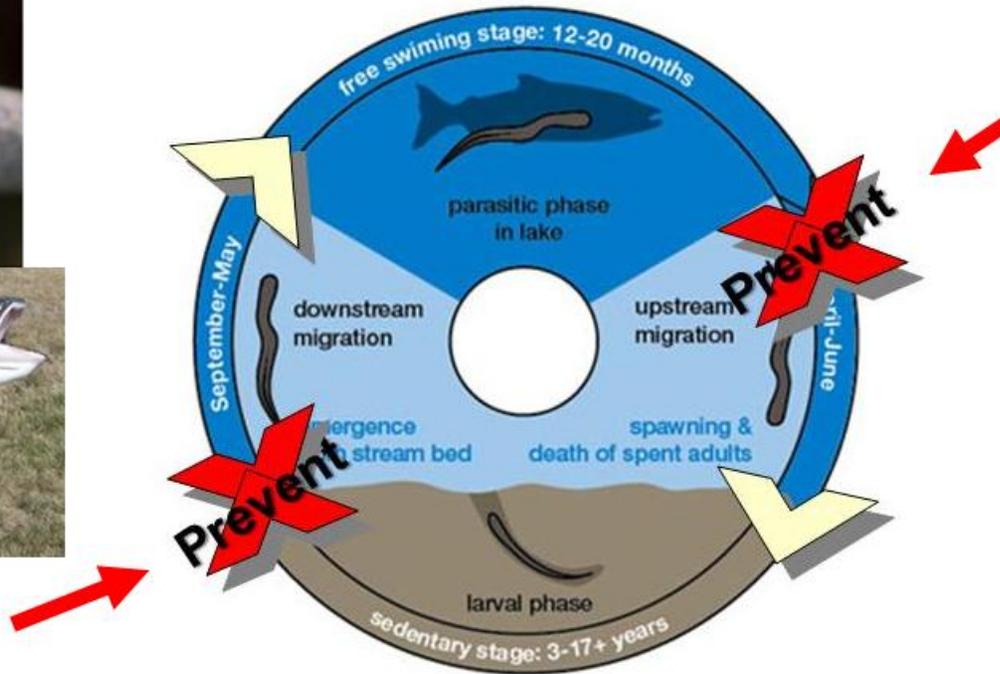
# Sea lamprey control program



Lawrence GLFC.org



Gaden GLFC.org



USFWS.gov

traps & barriers,  
prevent access to  
spawning habitat

lampricides kill  
larvae

*Successfully control sea lamprey impacts: @\$20 million/yr  
- Protects GL fishery value: \$5-7 billion*



# Only as strong as weakest link

## Bait dealers



## Pet Trade



*Peters and Lodge, Fisheries, 2009*



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# Solutions

1. Prevention
2. Early Detection
3. Rapid Response
4. Eradication
5. Control





## Overview of (Patchwork) Law and Policy

- Animal Health Protection Act
- Plant Protection Act
- National Invasive Species Management Plan
- State and regional invasive species councils
- State laws
- Lacey Act
- Common Law
  - Public Nuisance
  - Trespass
- Ballast water laws
- Laws pertaining to channels



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## Ballast Water

- **International Standards**
- **National Invasive Species Act**
  - Coast Guard rules
- **Clean Water Act**
  - EPA Vessel General Permit
  - State Certifications
- **State Laws**
- **Congressional Action**

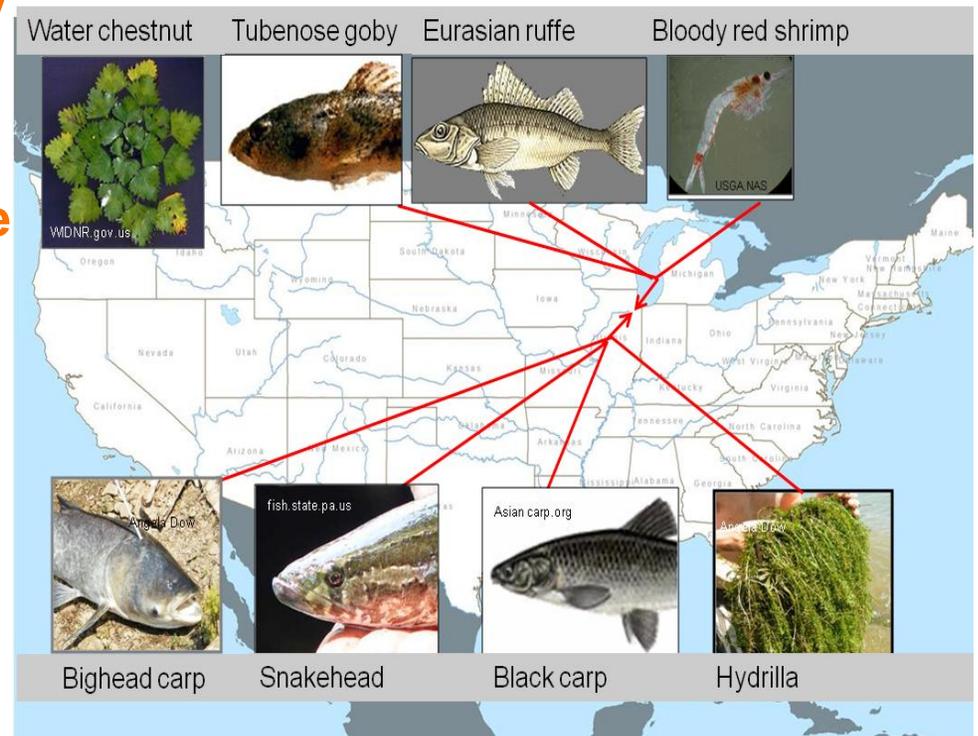




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# Canals and Channels: Chicago Case Study

- **Flood control: Corps, local agency**
- **Lock management: Same**
- **Pollution control: EPA, IL DNR**
- **Combined Sewer Overflows: Same**
- **Biocide application: IL DNR**
- **Channel navigation: Corps, Coast Guard**
- **Boat/ship safety: Coast Guard**
- **Toxic hot spot stabilization and cleanup: IL DNR, IL EPA, US EPA**





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