

Illinois' Exotic Freshwater Mollusks - Distributions and Implications



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What is an Exotic Species?

Exotic = Nonindigenous = Non-native = Alien

- Organism found living beyond its historic native range



Invasive = Nuisance

- Alien species that causes economic or environmental harm



Exotic Mollusks in North America

Of ~1,000 freshwater mollusks, 3% (22 species) are introduced

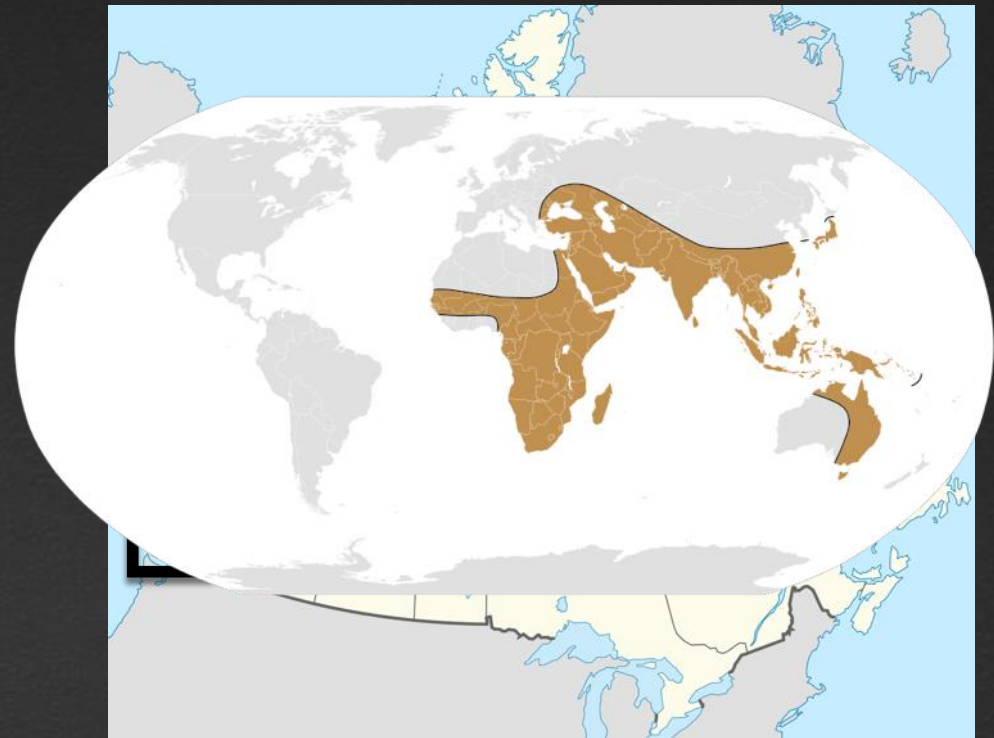
Of 700 species of gastropods, 15 are introduced

Of 300 species of bivalves, 7 are introduced



Asian Clams - Genus *Corbicula*

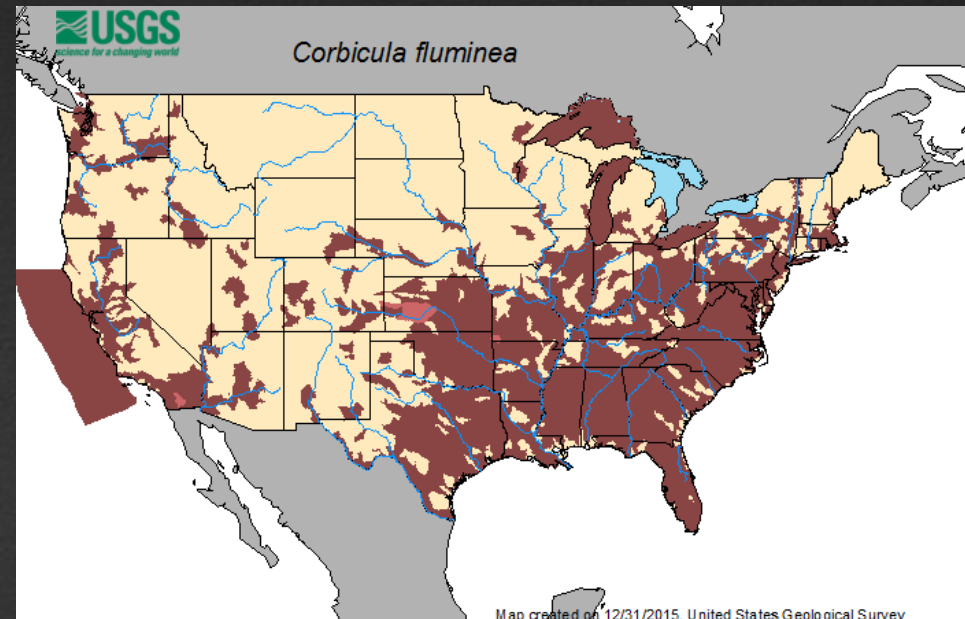
- Corbicula* endemic to Africa, southern Asia, & eastern Australia
- first recorded in North America in 1924 in British Columbia
 - introduced by Chinese immigrants to become a food source



Asian Clams - Genus *Corbicula*

Corbicula since has spread throughout the U.S. & Mexico

- dispersal = human induced and natural (current & fish?)
- northern expansion likely limited by temperature



Asian Clams - Genus *Corbicula*

“Hyper-invasive alien” with great biofouling capabilities

>\$1,000,000,000 damages to power plants & water systems

Also alter benthic substrates & compete with native species



Corbicula in Lake Tahoe



Corbicula in Salt Fork, Vermilion County, Illinois

Animal Reproduction



Asian Clams - Genus *Corbicula*

Corbicula taxonomy is muddled and unclear, as is the number of species established in North America

Genetics a “mess” because of reproductive behavior

- Sexual
- Asexual

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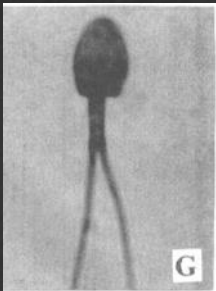
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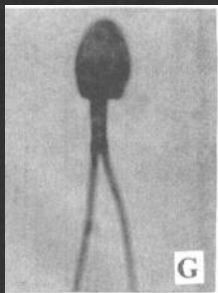
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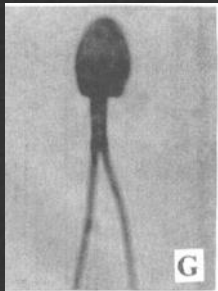
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Genetics a “mess” because of reproductive behavior

—Sexual

- Asexual (clonal) are hermaphroditic who reproduce through androgenesis (offspring are clones of father)...
- Mitochondrial & nuclear DNA give different results



Chromosomes =
2N or 3N or 4N

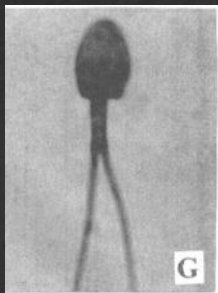
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Genetics a “mess” because of reproductive behavior

—Sexual

- Asexual (clonal) are hermaphroditic who reproduce through androgenesis (offspring are clones of father) but can "cross-fertilization" with others!!!
 - Mitochondrial & nuclear DNA give different results



Chromosomes =
2N or 3N or 4N

Corbicula reproduction

As told by Jim Carrey in *Liar Liar*

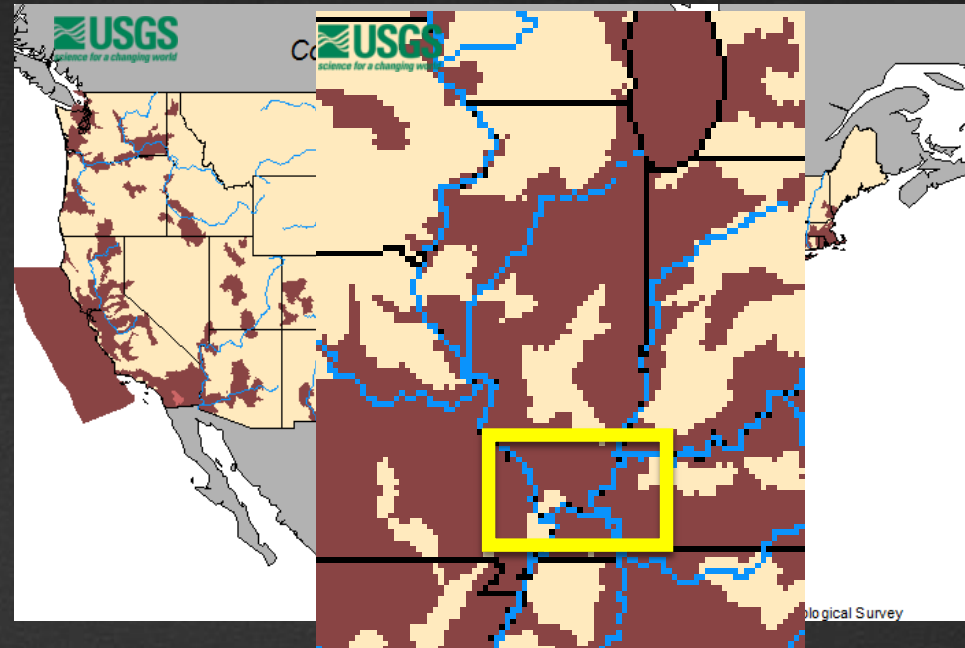


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Corbicula fluminea

The Midwest long recognized as having only *C. fluminea*

- First occurrence in Illinois in 1957 in the Ohio River



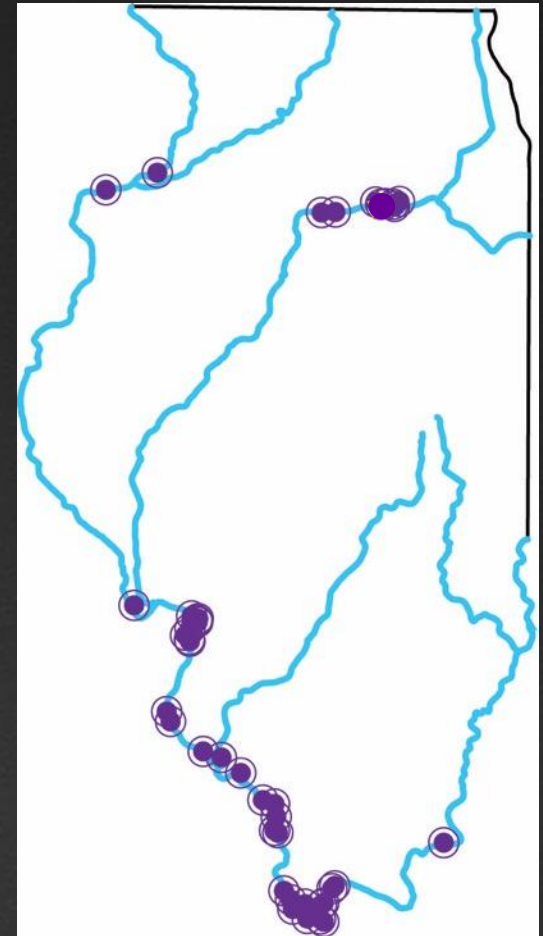
Corbicula cf. largillierti

Corbicula cf. largillierti might have invaded from southern U.S.

- First occurrence in Illinois in 2008 in the Ohio River
- Also found in Miss. & Illinois rivers



Differences = purple nacre and tight, compressed ridges

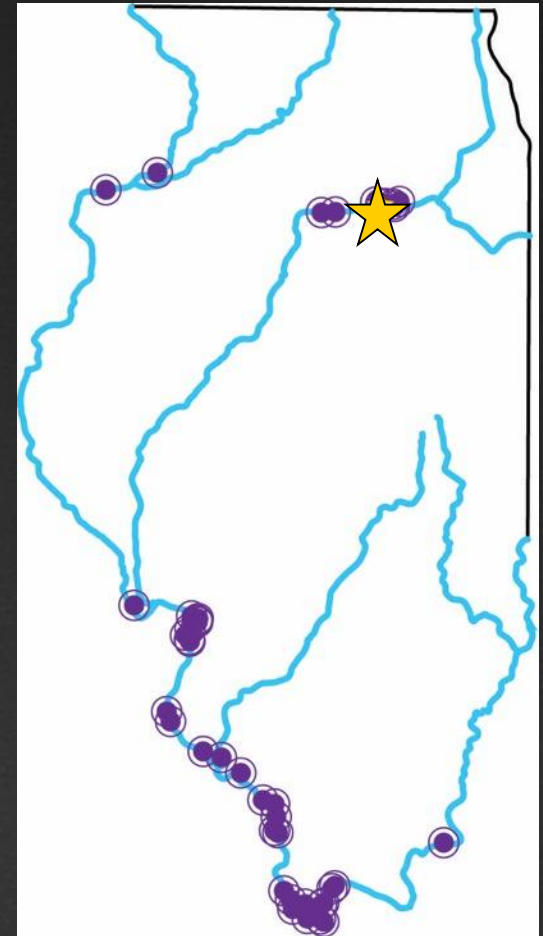


Mystery Corbiculid

Corbicula ??? found in Illinois River, Marseilles, Oct. 2015



Differences = creamy nacre, purple lateral teeth, rust-colored rays and ridges not as pronounced



Are we crazy?

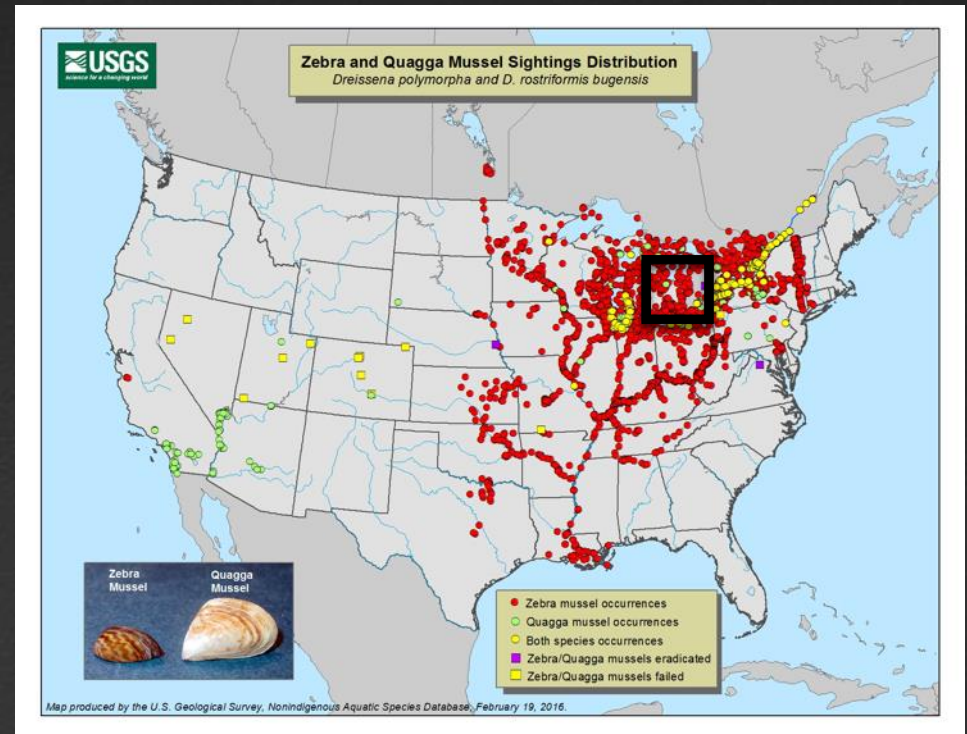
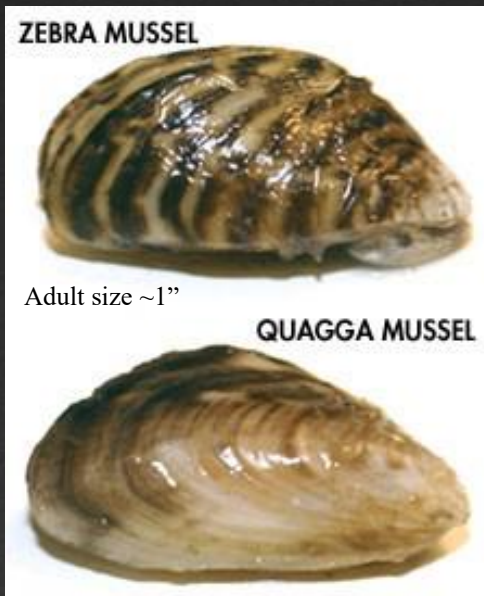
- All three “species” occur syntopically in the Illinois River
- >250 indiv. of each collected
- Genomic & morphometric assessment verifying this discovery is a novel invasion
- 28S genotype identified 3 forms



Zebra / Quagga Mussel - Genus *Dreissena*

Dreissena endemic to Black, Caspian, and Azov seas

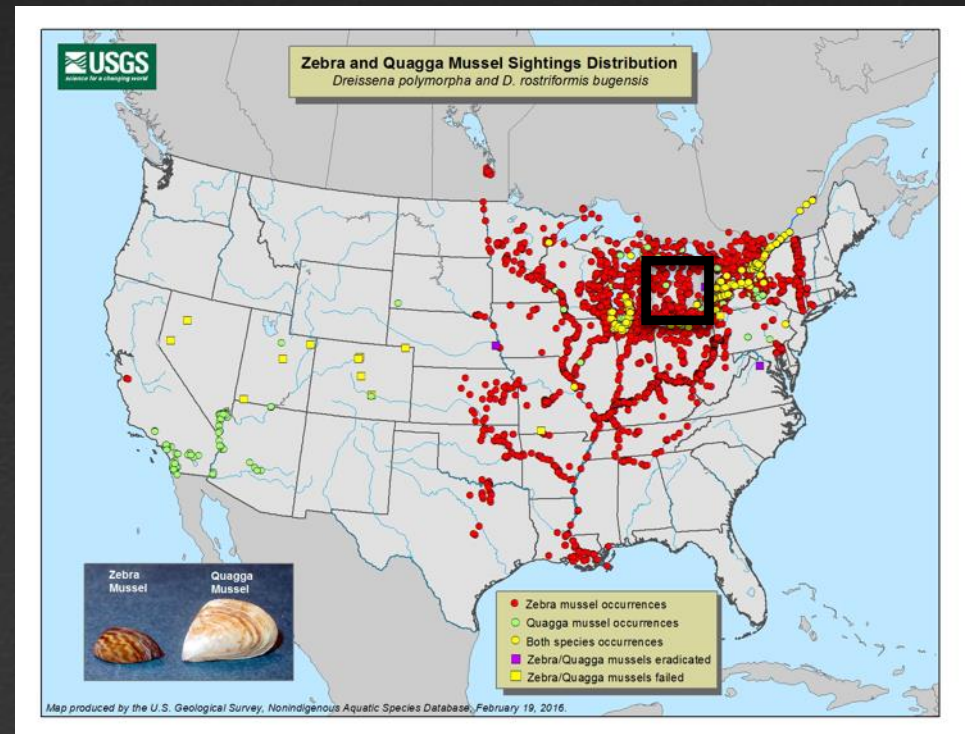
- first recorded in North America in 1986 in Lake Erie
- introduced by via ballast waters



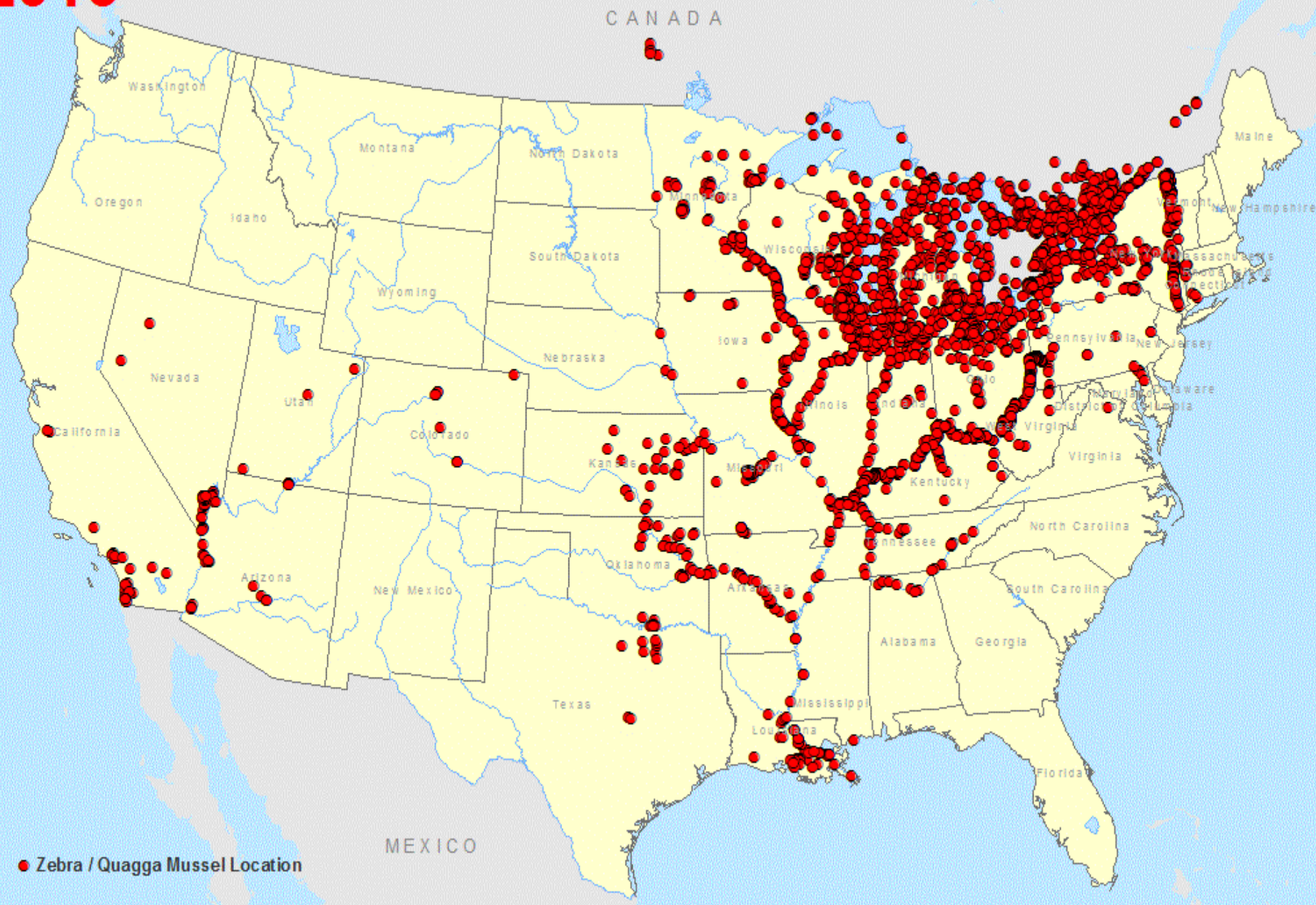
Zebra / Quagga Mussel - Genus *Dreissena*

Dreissena since has spread throughout the U.S. & Mexico

- dispersal = human induced and natural (waterways & fish?)
- Illinois & Mississippi rivers major arteries in dispersal



2013



● Zebra / Quagga Mussel Location

Source: U.S. Geological Survey, Nonindigenous Aquatic Species Database, April 2014

Zebra / Quagga Mussel - Genus *Dreissena*

“Hyper-invasive alien” with great biofouling capabilities

>\$1,000,000,000 damages to power plants & water systems

Also alter benthic substrates & compete with native species

Effects include

- Increased cost of locomotion
- Interfering with respiration / feeding
- Depleting the food source



Dreissena growing on native mussel



Dreissena growing on native snail

Zebra / Quagga Mussel - Genus *Dreissena*



Zebra / Quagga Mussel - Genus *Dreissena*

Can we control? If so, how?



by Marrone Bio Innovations



Dreissena in intake pipe



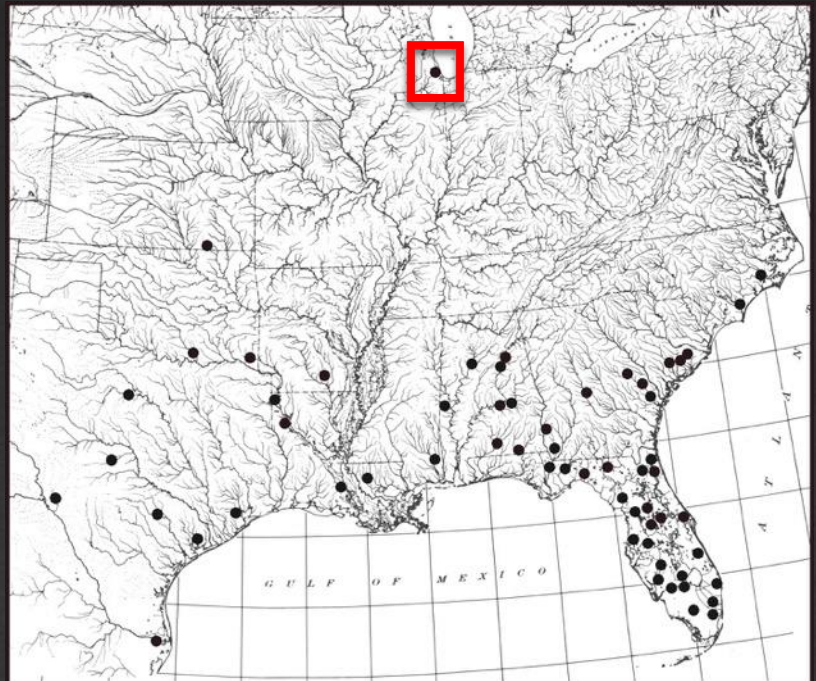
Dreissena growing on native mussel

Mottled Fingernail Clam - *Eupera cubensis*

Native to Atlantic Slope drainage from Texas to North Carolina

- discovered in the Chicago Sanitary & Ship Canal in 2006
- transported on aquatic veg or gear affixed to shipping vessel

Adult size ~1/4"

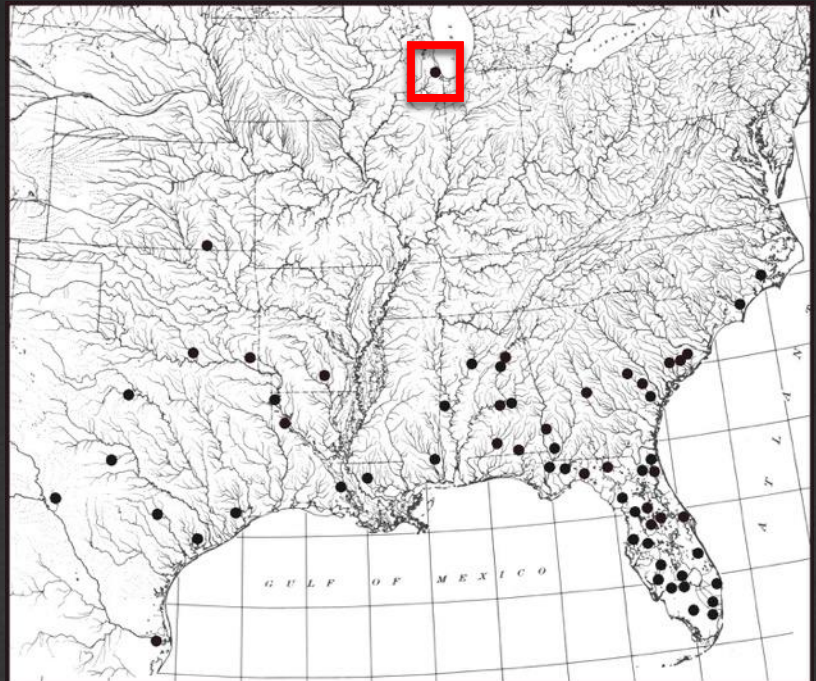


Mottled Fingernail Clam - *Eupera cubensis*

Invasion threat appears to be benign

- dispersal = unknown / limited
- immediate effects expected to be minimal

Adult size ~1/4"



Mystery Snails – Genus *Bellamyia*

Bellamyia chinensis endemic to southeast Asia & eastern Russia

- first recorded in North America in 1890 in San Francisco
- introduced by sailors returning from Yokohama & by Chinese immigrants to become a food source

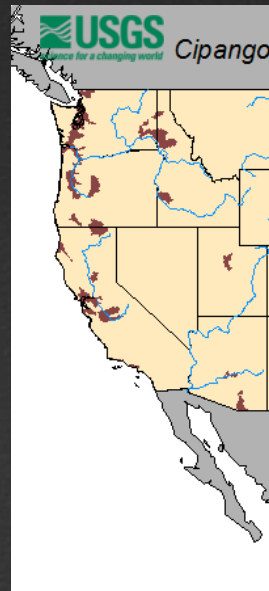
Adult size ~2.5"



Mystery Snails – Genus *Bellamyia*

Bellamyia chinensis spread throughout U.S. (& southern Canada)

- first appeared in Chicago's Jackson Park 1938
- dispersal = human (aquarium) and natural (flooding)



Mystery Snails – Genus *Bellamya*

Bellamya chinensis effects not fully understood

- might negatively effect native snail fauna???
- known to harbor “nasty” human parasites in Asia
- can be biofoulers



Mystery Snails – Genus *Bellamyia*

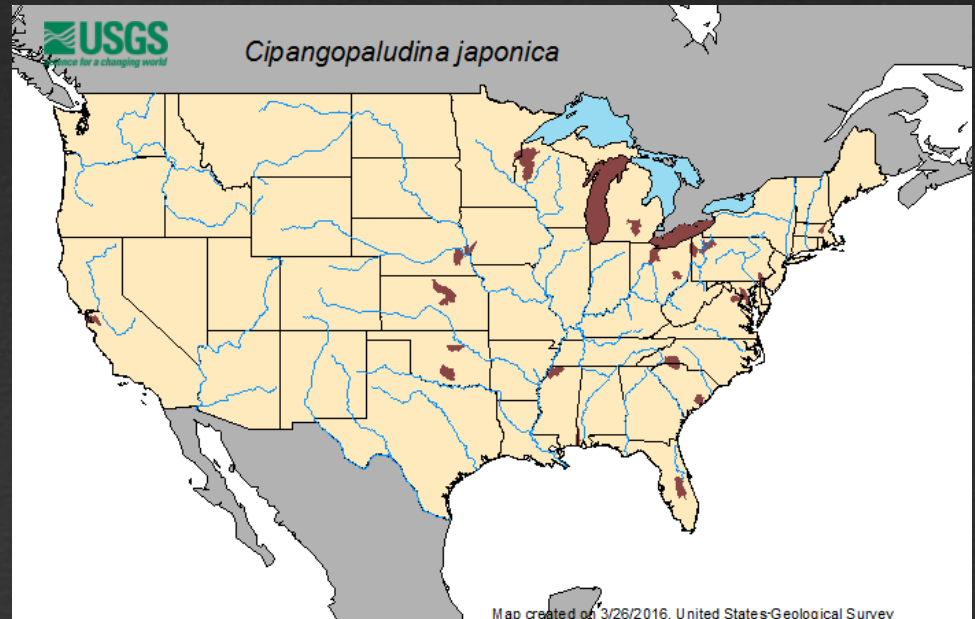
Bellamyia taxonomy and identification confusing

- *Bellamyia japonica* hasn't been reported in Illinois... yet
- similar to *B. chinensis* in terms of life history & invasion



B. chinensis

B. japonica



Mud Bithynia – *Bithynia tentaculata*

Endemic to Europe, from Scandinavia to Greece

- first recorded in North America in 1871 in Lake Michigan
- introduced via ballast waters?



Mud Bithynia – *Bithynia tentaculata*

- “once quite a nuisance to the people of Chicago, getting into the water pipes and so abundant that in Lake View a tumbler full was taken from the faucet at one time” (Baker, 1928)
- intermediate hosts for flukes that cause waterfowl die-offs



New Zealand Mudsnail – *Potamopyrgus antipodarum*

Potamopyrgus antipodarum endemic to New Zealand

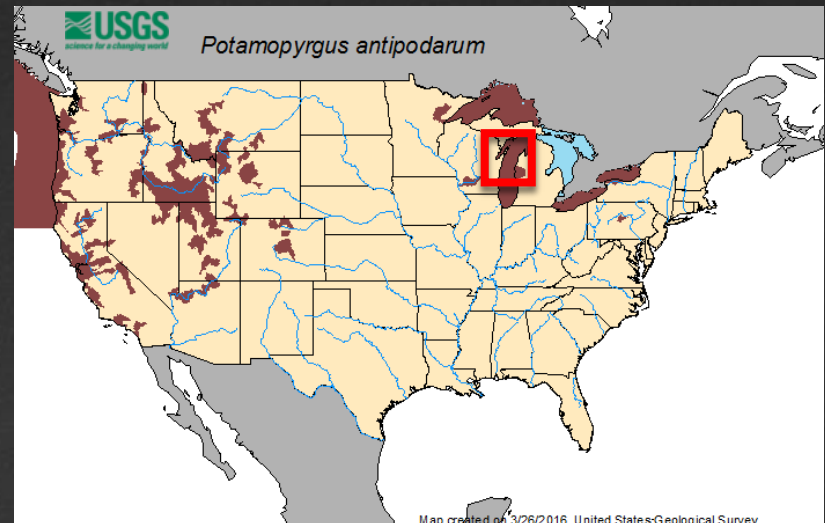
- first recorded in North America in 1987 in Snake River, ID
- introduced from ships from Europe, where there are nonindigenous, or in water of live gamefish shipped from infested waters to western rivers in U.S.



New Zealand Mudsnail – *Potamopyrgus antipodarum*

Potamopyrgus antipodarum endemic to New Zealand

- first recorded in Illinois in Great Lakes in 2006
- reported to pass through the digestive tracks of fish alive
- may reduce or eliminate native mollusks



Knocking on Illinois' door



Big-ear Radix – *Radix auricularia*



Applesnails – *Pomacea* sp.



Golden Mussel – *Limnoperna fortunei*

What have we learned

- Some exotics are invasive, whereas others are benign
- Exotics can spread a variety of ways, including
 - humans (intentional or unintentional)
 - naturally (fish passage, birds, or waterway connections)
- Accurate species delimitations are essential in developing predictive invasion / dispersal models and assessing potential effects on aquatic ecosystems
- Cumulative exotic biomasses could interfere with native mollusks, including negative effects on restoration efforts of threatened and endangered species

Please keep a look out

