

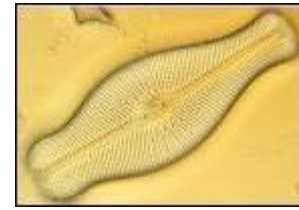
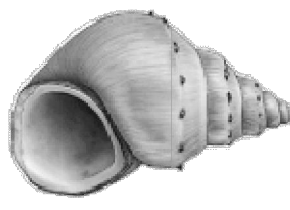
Lindsay Chadderton, TNC



Defining an invasive species

- Occurs by human influence outside its natural range
- Spread widely and become locally abundant
- Cause net harm to environment, economy, or human health

Lodge et al 2006: Ecological Society of America Report on Biological invasions



Invasion process



Silver carp native range
(Kolar et al 2007)

➤ Imported into U.S. early 1970's for aquaculture and water quality purposes

Uptake from native range



Introduction from pathway



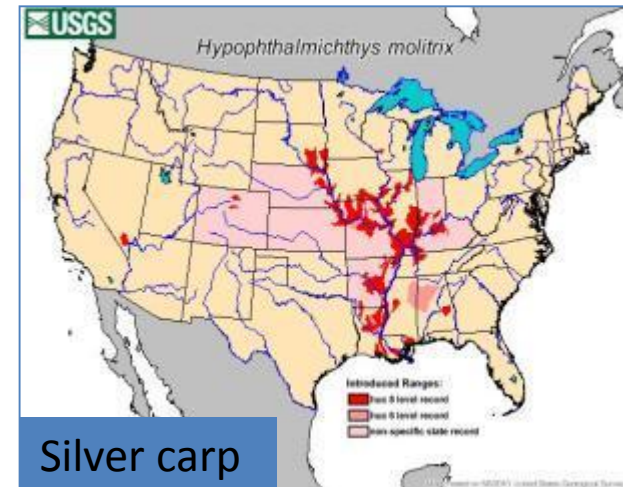
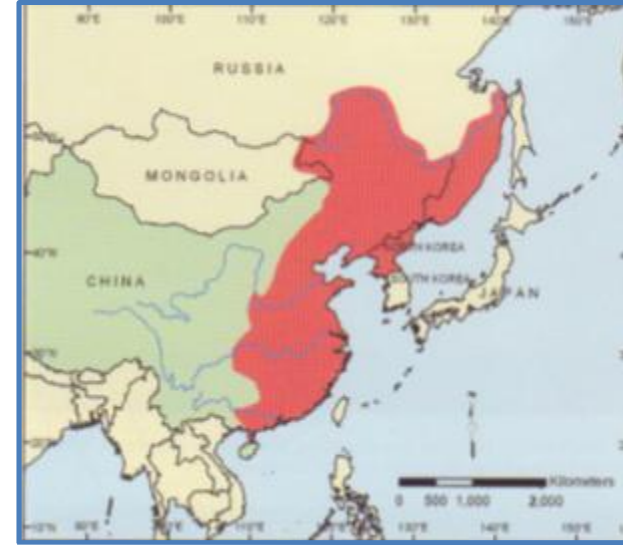
Establishment



Spread



Ecological impact



Invasion

process

Introduction from
pathway



Establishment



Spread within GL



**Ecological
impact**

- Altered water quality
- May cause nuisance algal blooms & enhance toxic blue green algae
- Removal of large zooplankton – may compete with native planktivores and larval fish (e.g. walleye)
- Growing evidence of declines in native fish communities in Mississippi

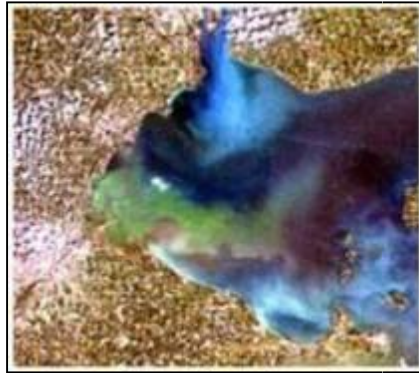


Glizzard Shad (20-40 cm)



Threadfin Shad (2-15 cm)

Zebra mussel impacts



Market costs: \$100-200 million annually - clog water intake pipes



Non-market costs: extirpation of native clams & impacts recreation



Invasive are economically expensive

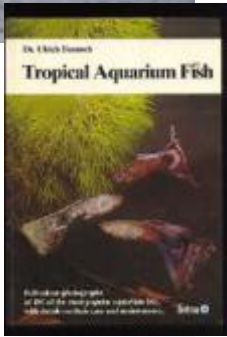
*–annual costs to US estimated at \$120+ billion annually
(Pimmental et al. 2005)*

- nearly double the annual cost of natural disasters

- Purple loose strife – \$45M/yr
- Aquatic weeds – \$110/yr
- Feral Swine \$800M
- Zebra mussels \$1000M



Four major pathways of Invasion



Uptake from native range



Introduction from pathway



Establishment



Spread



Ecological impact

➤ Maritime shipping

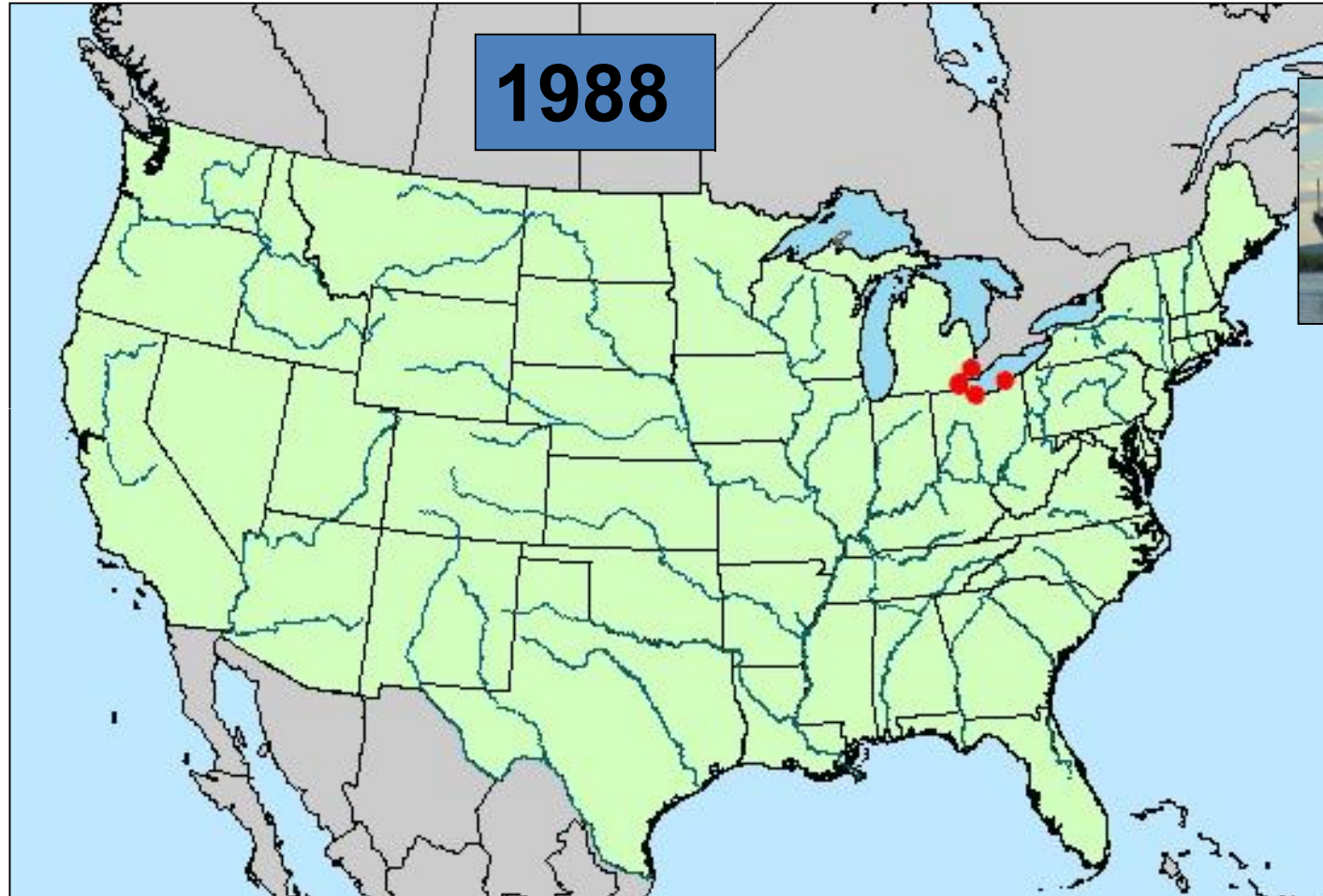
➤ Trade in Live organisms

- aquarium
- water gardens
- live food
- Aquaculture

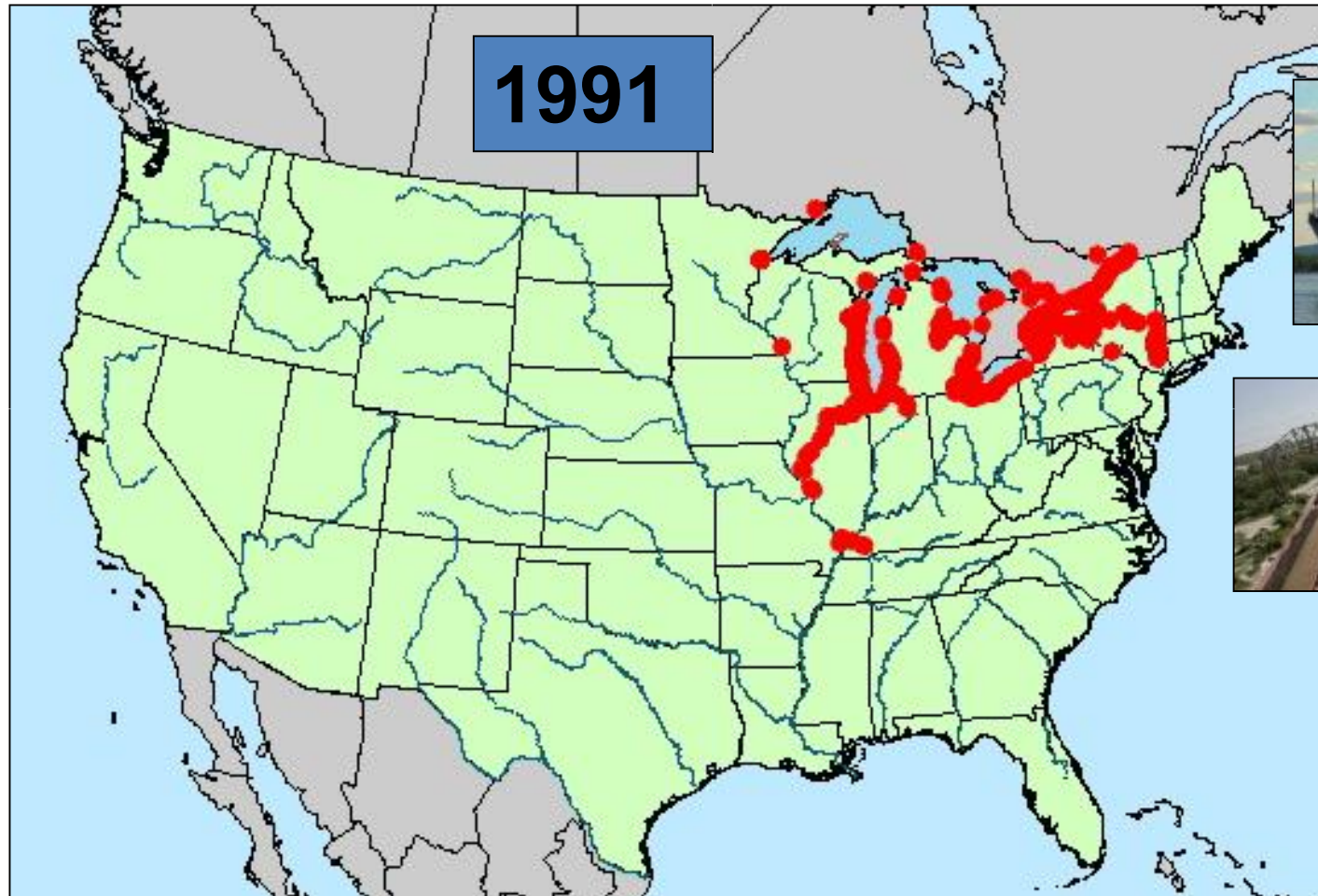
➤ Canals

➤ Recreational boats

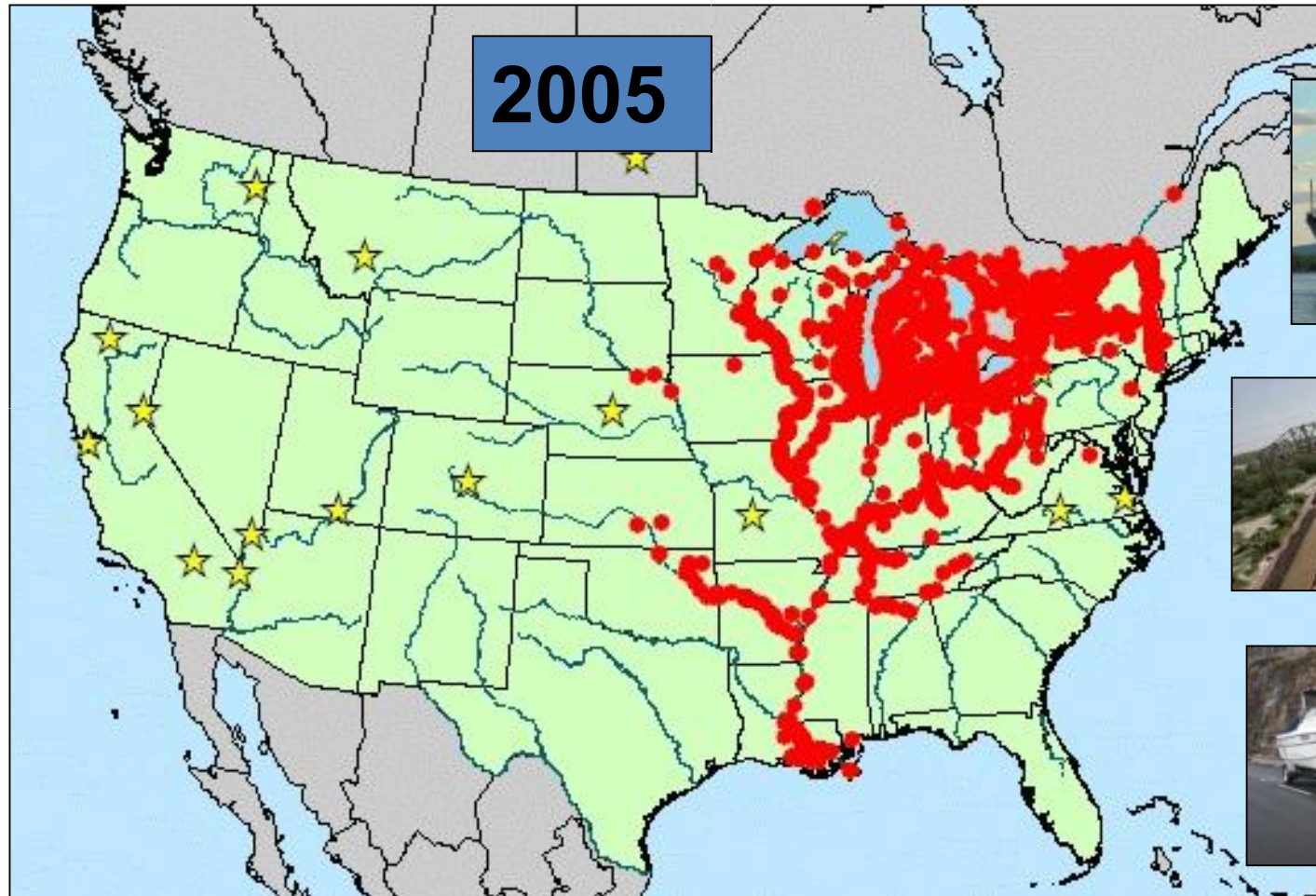
Zebra mussel invasion process



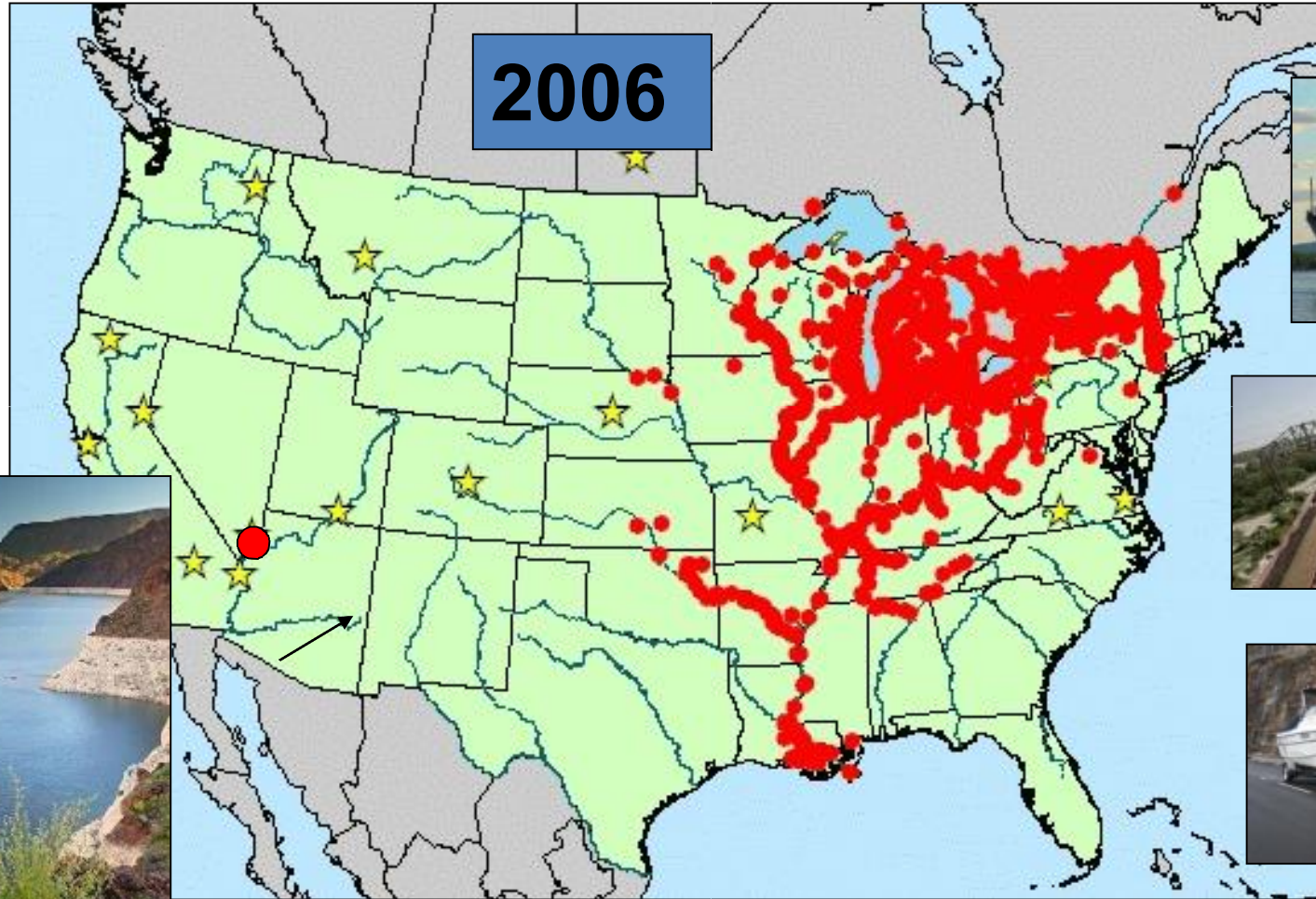
Zebra mussel invasion process



Zebra mussel invasion process

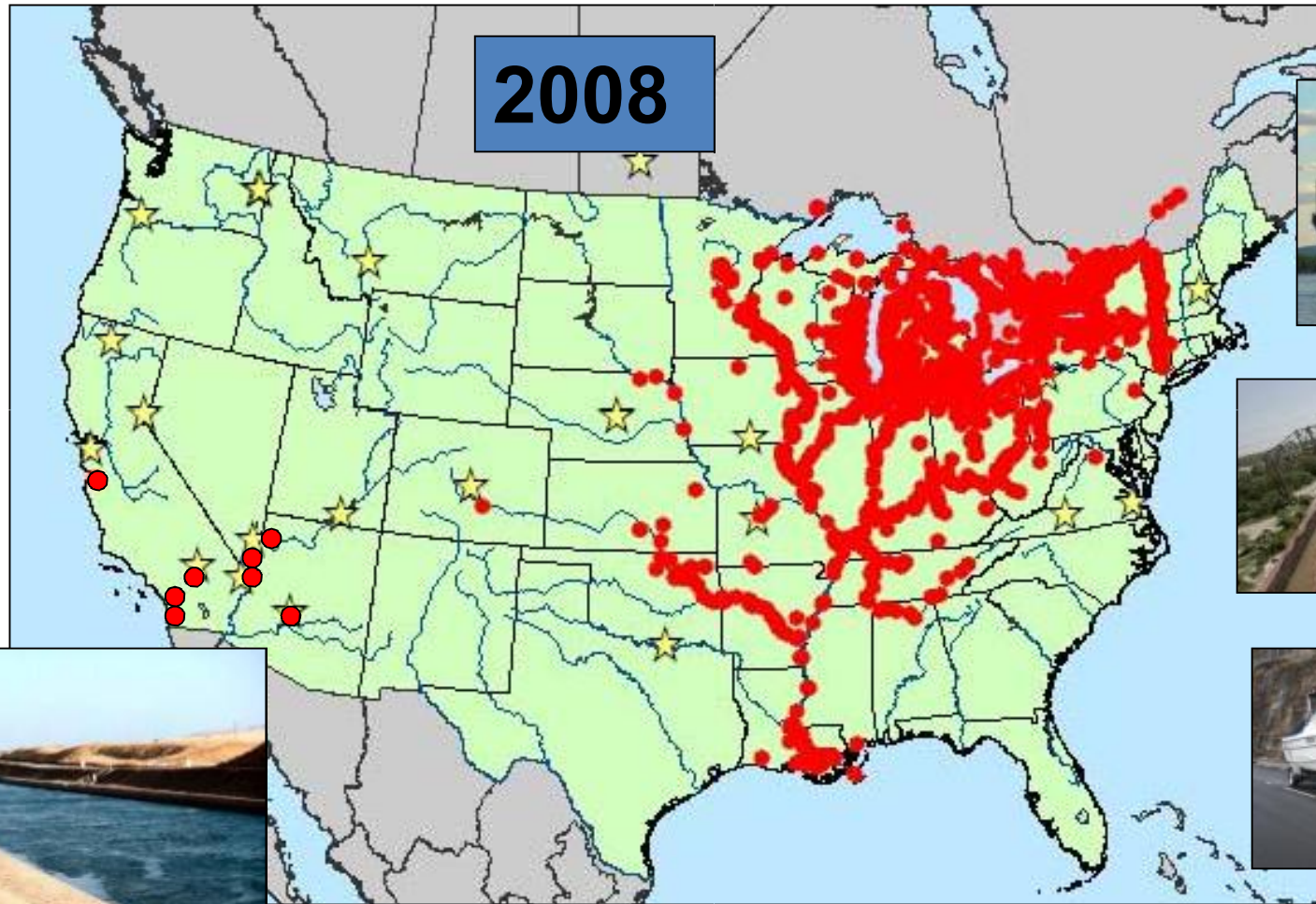


Zebra mussel invasion process



Lake Mead

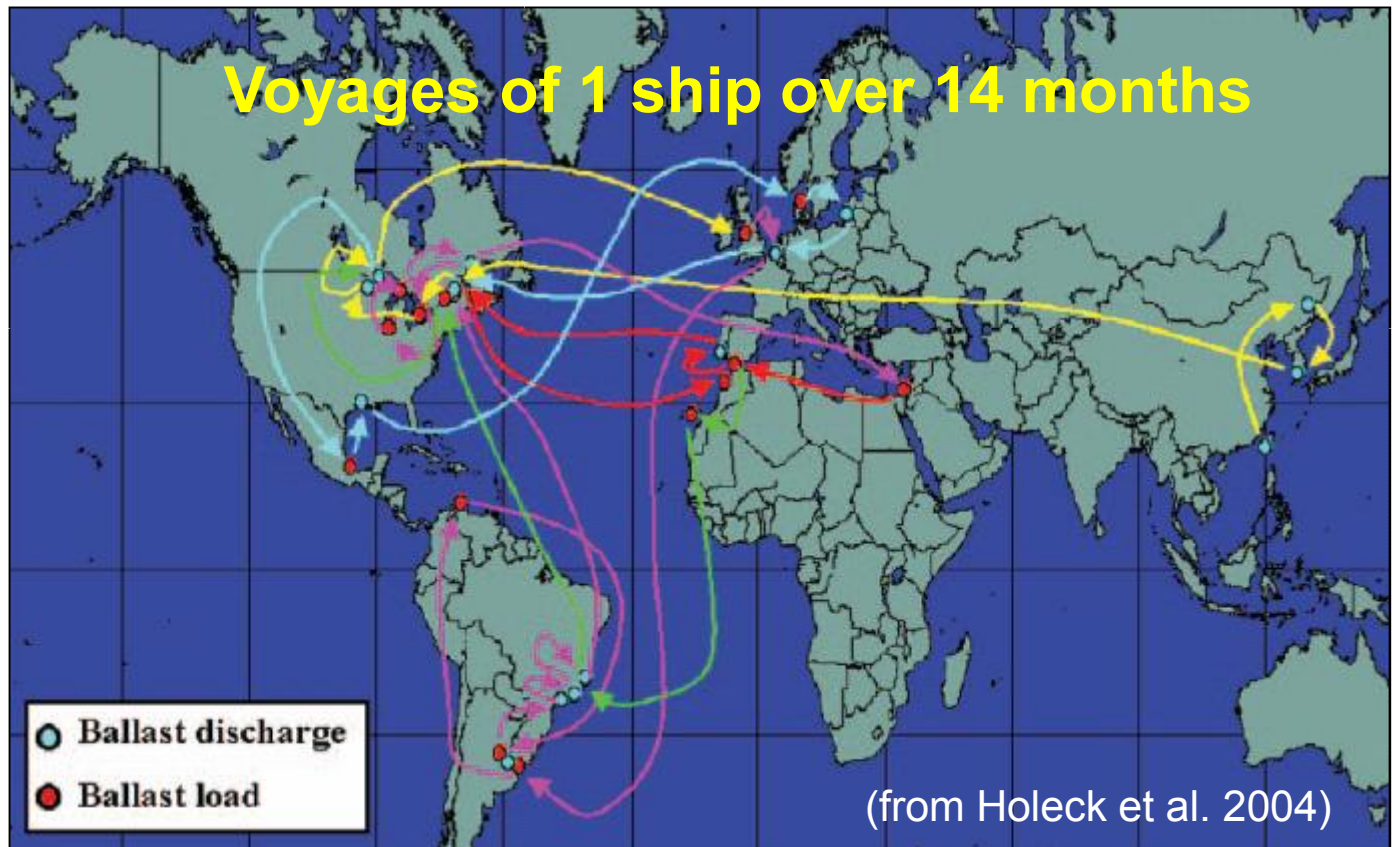
Zebra mussel invasion process



New Zealand Mud snail: Multiple North American invasion events

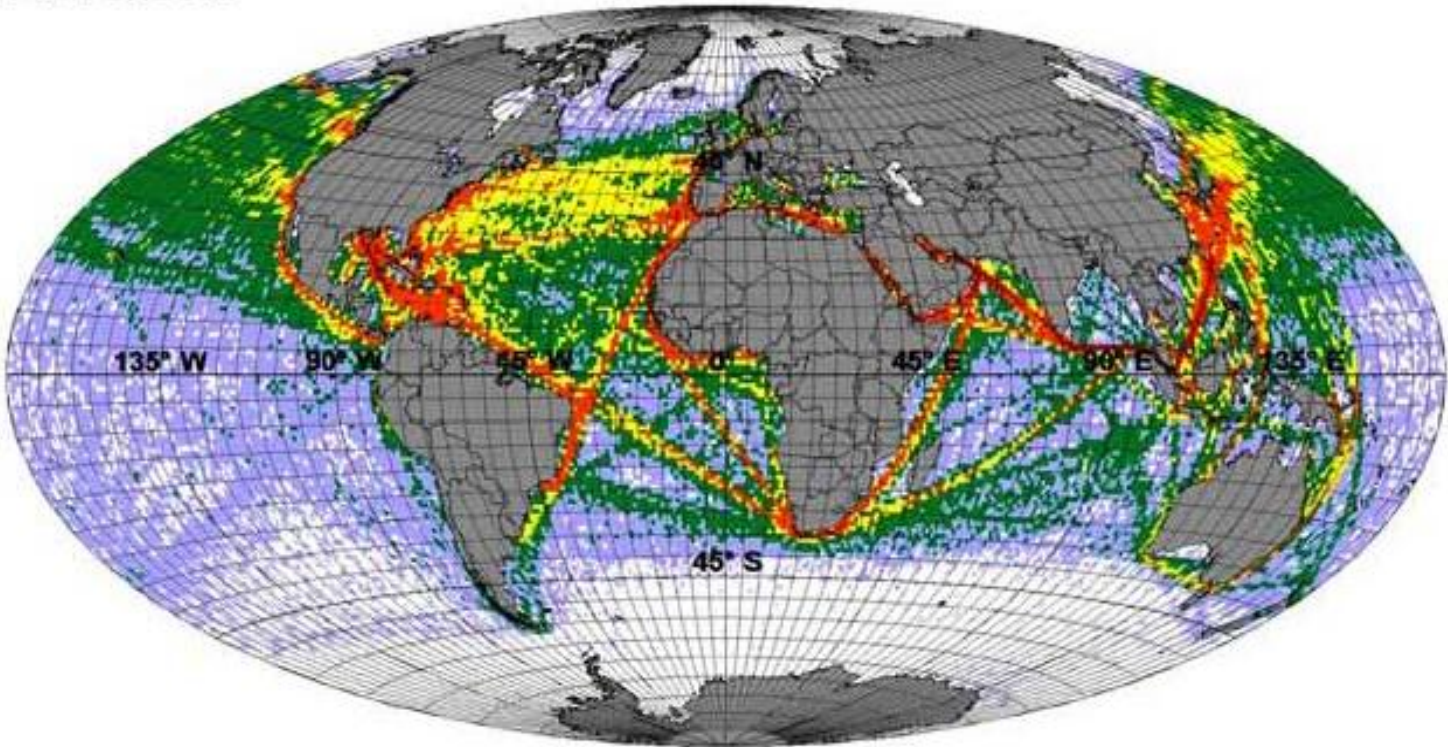


Great Lakes connected by shipping to the world

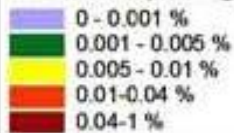


Network Linkages: Global Ship Traffic

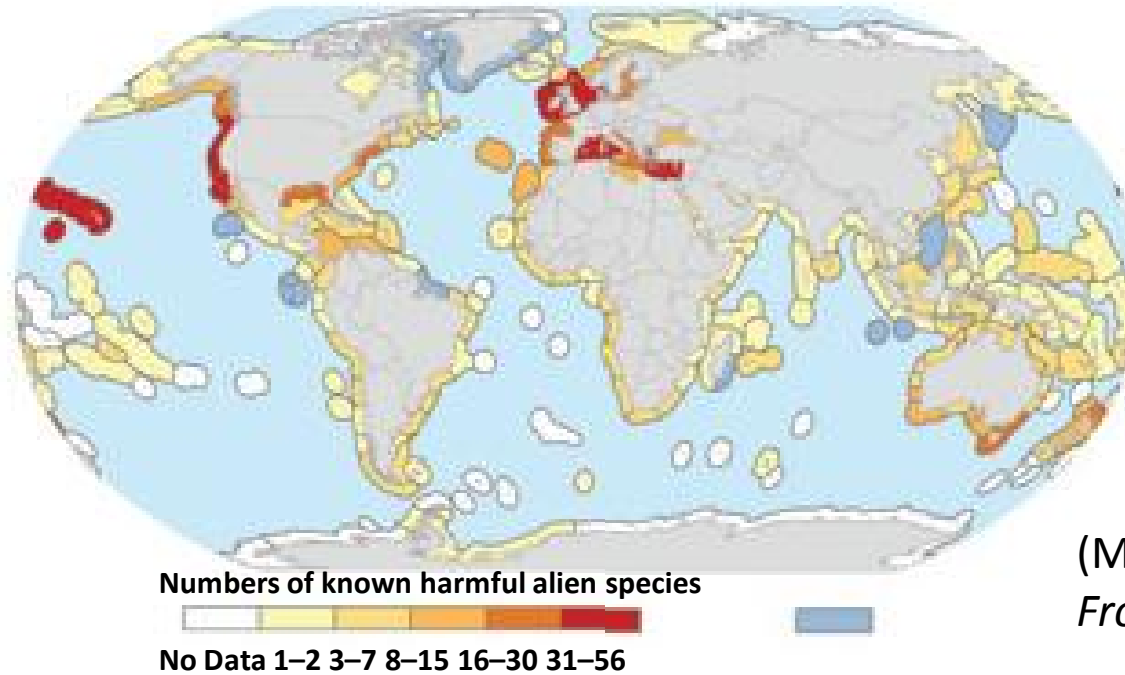
All vessels



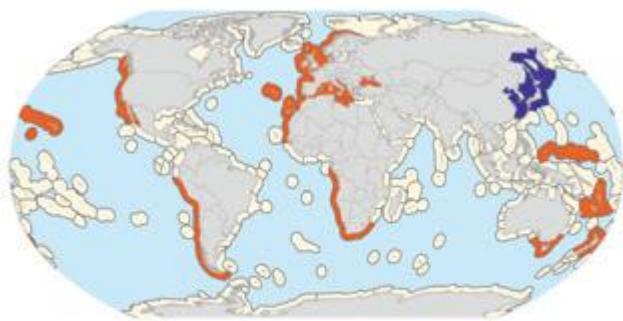
Relative reporting frequency weighted by ship size.



Distribution of marine invasive species



(Molnar et al 2008)
Frontiers in Ecology



Pacific Oyster

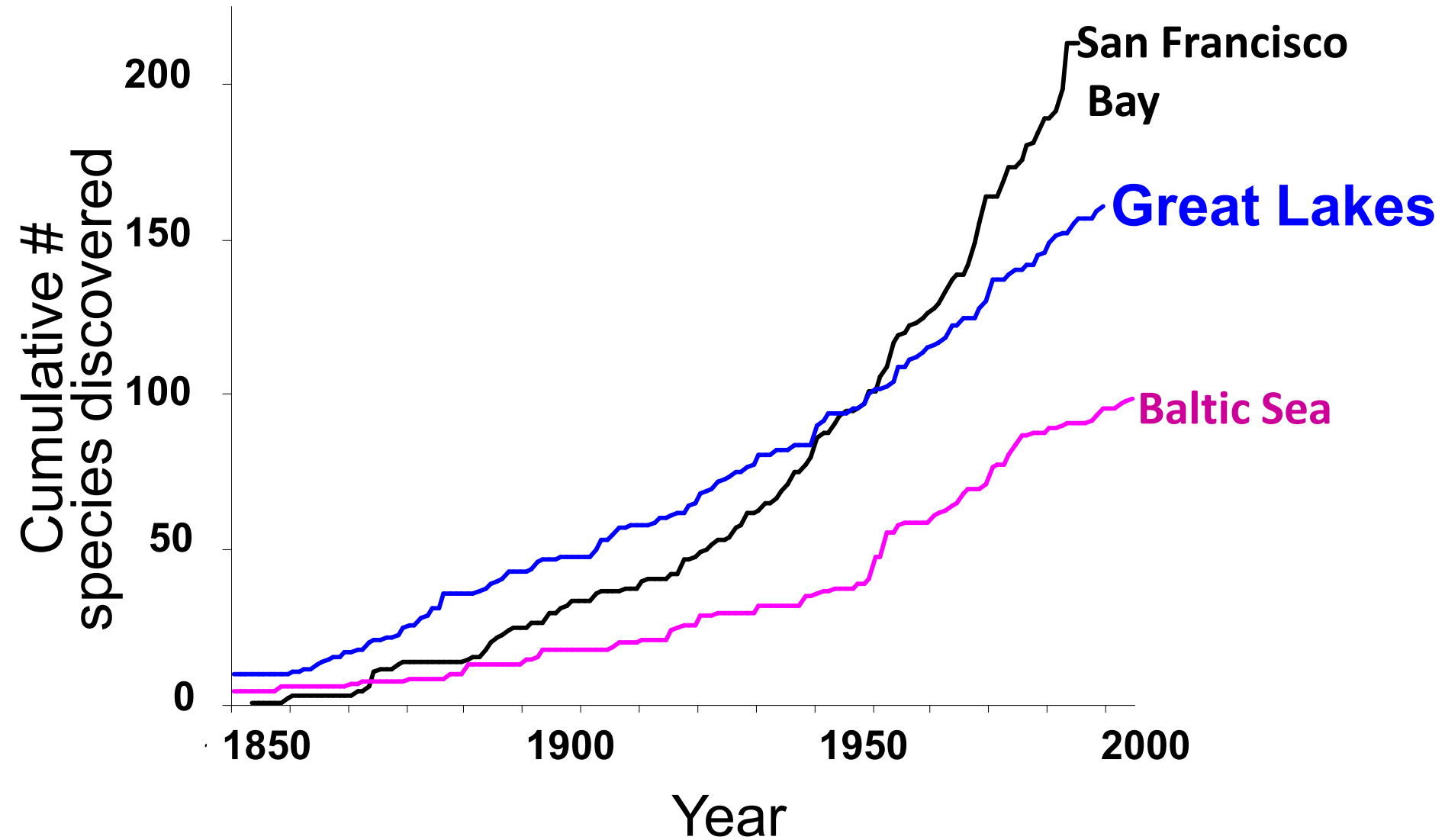


NABIS.govt.nz



www.coastalwiki.org/

Alien species in aquatic ecosystems

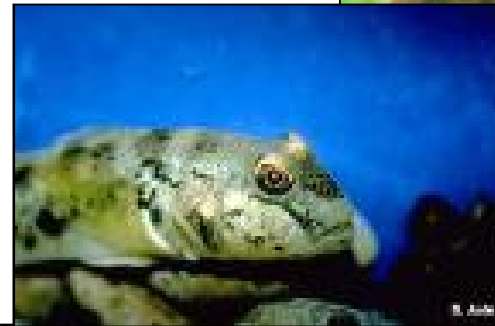


Prevention most cost effective solution

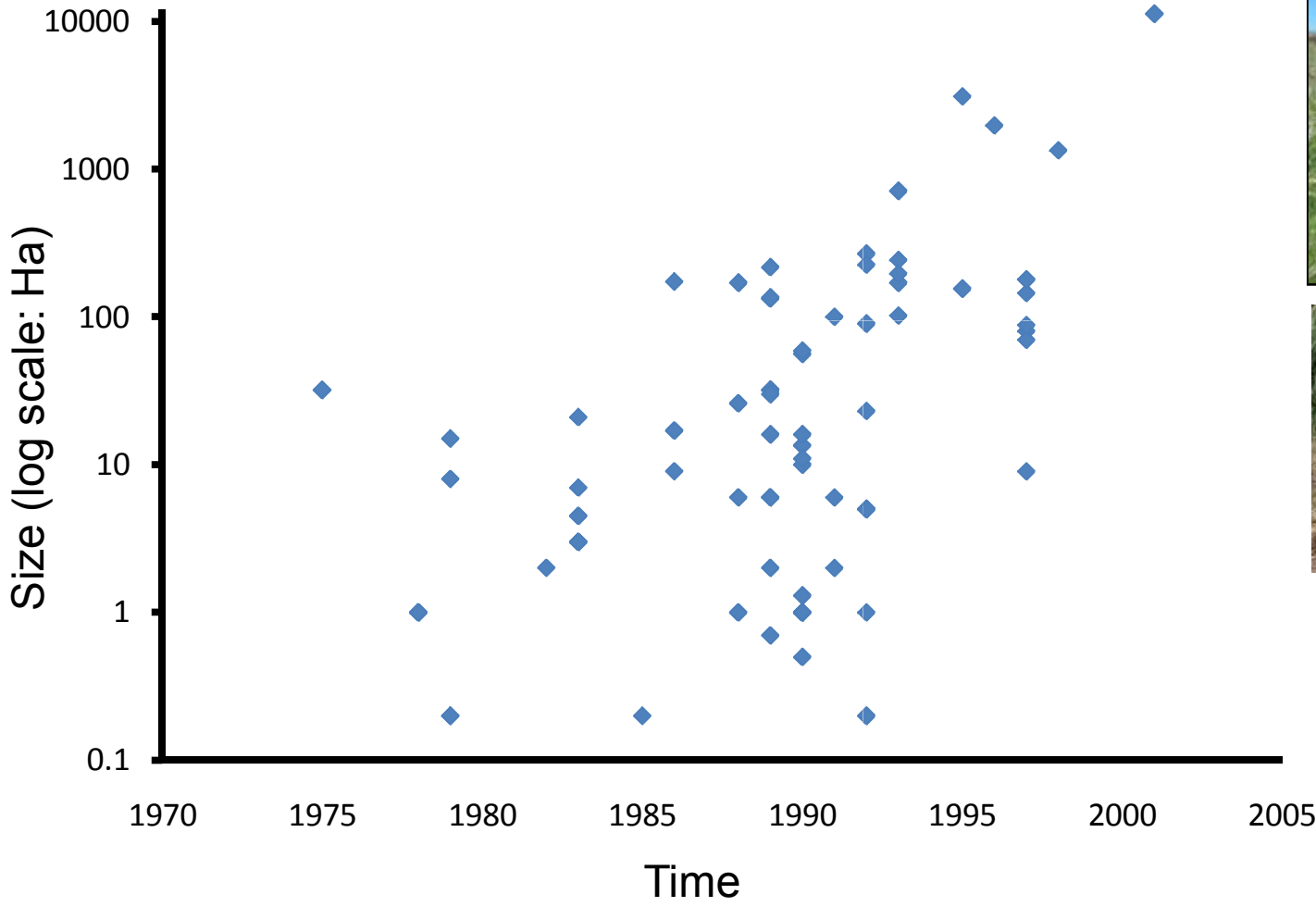
- Federal legislation (HR 669)
Non-Native Wildlife Invasion Prevention Act:
- Ballast water exchange and treatment
- Hydrological separation (CAWS)
- Boat washing and inspection



Controlling existing pests



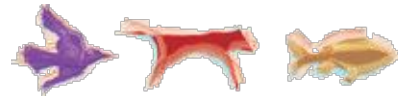
NZ history of successful island rat eradications



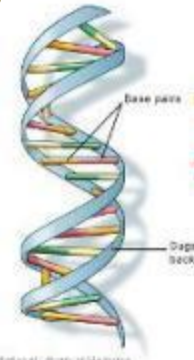
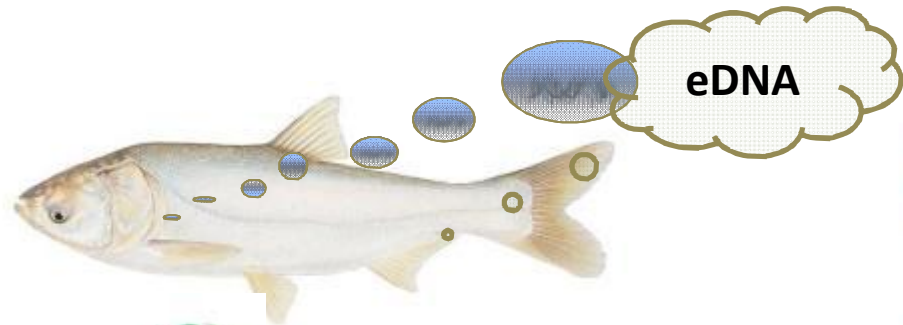
Lakes and rivers

Islands in a sea of land





Invasive Animals CRC
University of Minnesota



Invasive species is a problem with solutions

- **Partnerships and long-term collaborations**
- **Sustained research and policy development**
- **Preventing new introductions**
- **Controlling species already present**



Evidence of hybridization with US native species