We didn’t plan to talk about it, and only a few of you asked. . .

But information pertinent to what we are studying has emerged regarding:

Zebra Mussels
Behold: the Zebra Mussel

Photo courtesy of David Strayer, Inst. of Ecosystem Studies
Background

- Zebra mussels are thought to have made their way into the U.S. from Europe, via the hulls of freighters.
- Zebra mussels began to clog industrial water intakes in the Great Lakes in the early 1980’s, and have since become a problem in many U.S. rivers and lakes.
- Locally, Zebra mussels invaded the northern end of Cayuga Lake, and have now migrated to the southern end.
Why are we concerned about Zebra mussels?

- The costs associated with removing mussels from clogged pipes are not trivial.
- Zebra mussels also pose a threat to freshwater ecosystems.
  - They are able to outgrow native clam species by 10 to 20 X.
  - There are only one or two species of fish in the Great Lakes that feed on Zebra mussels, so the predators that control their population size in Europe are not present.
  - Because they feed on microscopic algae and other phytoplankton, Zebra mussels remove a food source that would otherwise be available to other members of the ecosystem.
Quagga mussels (cousins of Zebra mussels) were found in Lake Mead in Jan. 2007!

- In fear of the Zebra mussel, western states began inspecting boats in 1998.
- It didn’t work! Quagga mussels probably arrived circa 2005.
- After being found at Lake Mead, divers looked downstream and also found them at Lake Havasu, near the intake to the Colorado R. aqueduct.

- Concern: impact on power production at Hoover dam, Lake Mead drinking water plants and farm irrigation systems.
- Fortunately Quagga mussels like deep cool water and may not do well in the aqueduct and connected irrigation systems.
These guys will attach to anything
Spread of Zebra mussels through the Hudson River


Data courtesy of David Strayer, Inst. of Ecosystem Studies
Population dynamics of Zebra mussels in the Hudson R.

Data courtesy of David Strayer, Inst. of Ecosystem Studies
Zebra mussels have the capacity to filter a lot of water

Filtration rate in the Hudson River

Data courtesy of David Strayer, Inst. of Ecosystem Studies
Here's what Zebra mussels have done to plankton levels in the Hudson River

Data courtesy of David Strayer, Inst. of Ecosystem Studies
Use of Zebra mussels in water purification??

- In the Netherlands, Zebra Mussels have successfully been used to purify eutrophic lakes (i.e., lakes with high levels of algae populations caused by societal input of nutrients).
  - However, in the Netherlands species of ducks and fish are natural predators and hold Zebra mussel populations in check.

- Zebra mussels have also been tested in Europe as a biofilter media. Sacks of mussels have been suspended in effluent streams from chemical treatment plants, and can significantly reduce pollutant levels.
  - However, the mussels must then be disposed of as a hazardous waste.

- The most exotic use we found for Zebra mussels was as pollution alarm systems.
  - Specially designed electrodes were placed in the mussels. When pollutants that the mussels are sensitive to flow through the system, the mussels close, complete the electrical circuit, and set off an alarm.
Methods of Zebra mussel control

- **Poison**
  - oxidants such as chlorine, ozone, and potassium permanganate work to kill Zebra mussels inside of pipes (but can not be released into the environment without harming other organisms).
  - after the mussels are killed, the shells will still adhere to pipes and must be mechanically removed.

- **Scrapping**
  - It's expensive, but divers can effectively hack away at Zebra mussel colonies and remove them.

- **Experimental**
  - UV light, electrification, ultrasonics, and microorganisms that infect Zebra mussels, have been considered.
But what’s really interesting is the ability of Zebra mussels to alter dissolved oxygen levels

Caraco et al., 2000

Frequency distribution of O$_2$ levels in the Hudson River.

Data courtesy of David Strayer, Inst. of Ecosystem Studies
So what’s missing from our D.O. model?

Maybe it’s Zese guys

Photo courtesy of David Strayer, Inst. of Ecosystem Studies