



Quagga Mussel Risk Assessment

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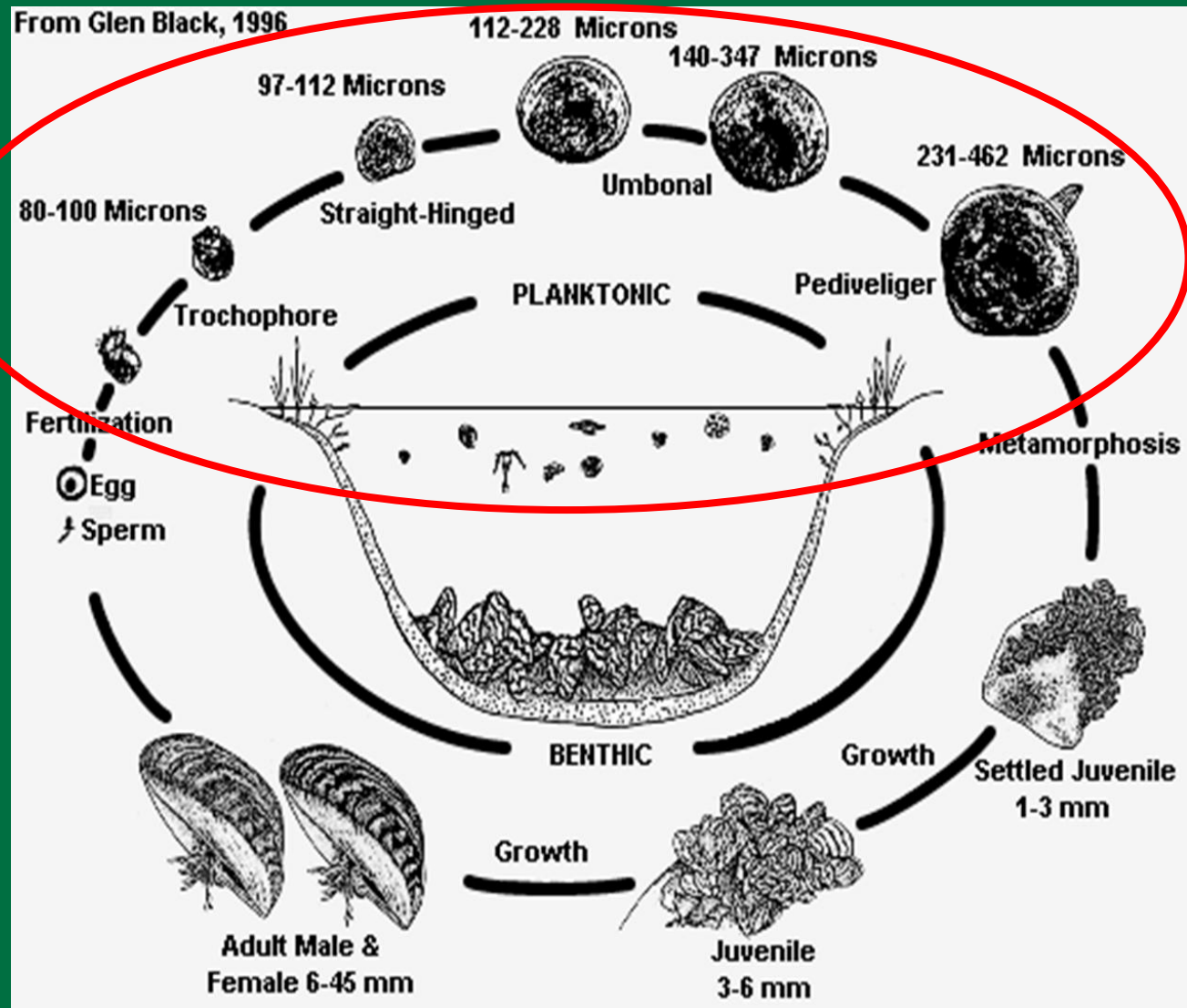
Outline

- **Background: life cycle, ecological impacts in eastern US**
- **Risk of attaining high densities in the CRe**
- **Risk of ecological impacts in the CRe**

Life Cycle

- Larval life stages are free-floating
- Time to settlement is 1-4 weeks
- Populations in rivers therefore require an upstream lake/reservoir

From
http://ucanr.edu/sites/WAEMA/P/Quagga_and_Zebra_Mussels/Eurasian_Mussels_101___Characteristics_of_an_Extreme_Invaser/Reproduction_and_Life_Cycle/



Ecological Impacts of Quagga Mussel

Before Invasion

- Native/endangered mussels
- Water column food web prominent
 - Benthic food webs present

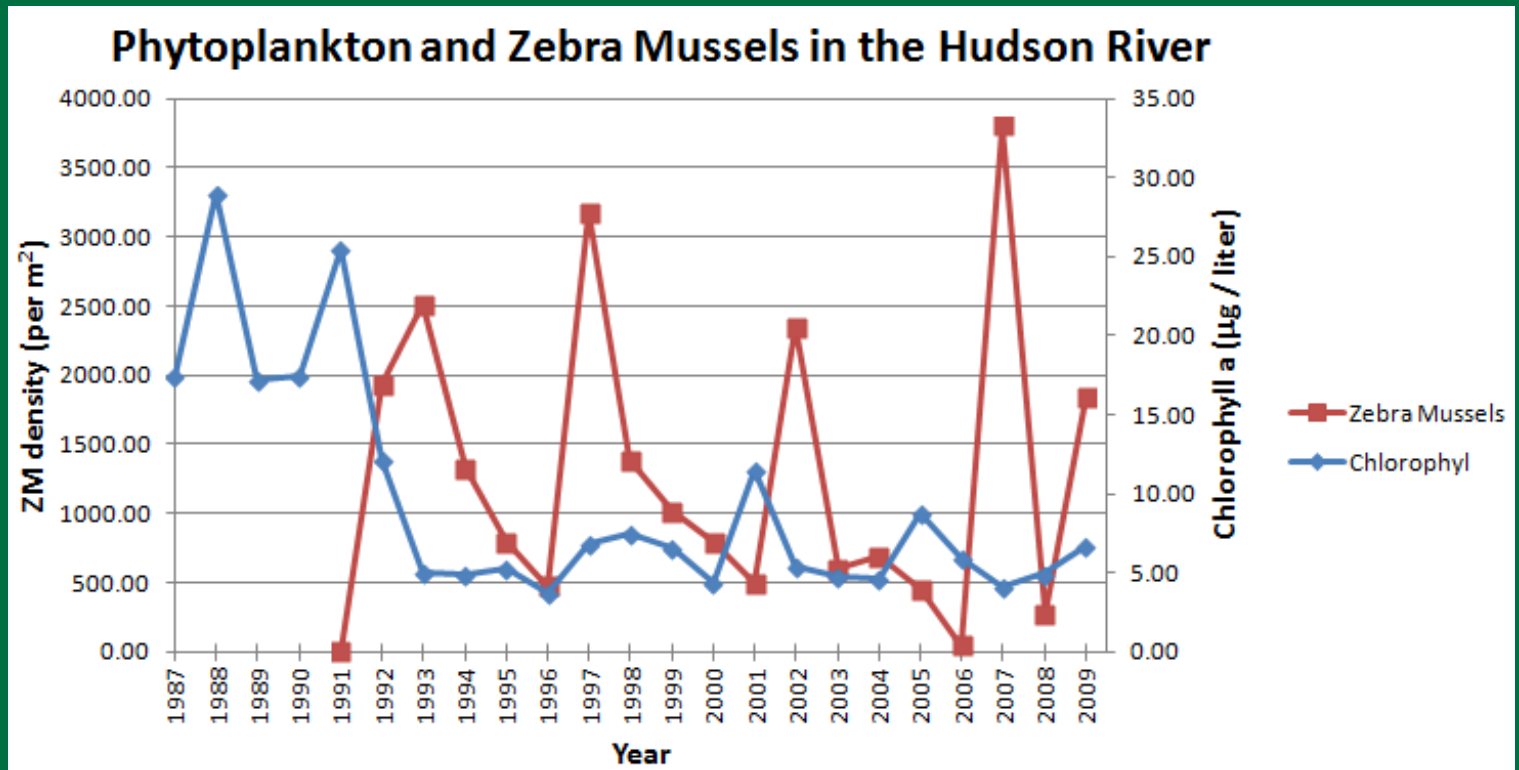


After Invasion

- Zebra mussel density of $\sim 1000/\text{m}^2$
- Native mussels declined/extirpated
 - Water column food web declined
 - Benthic food webs increased

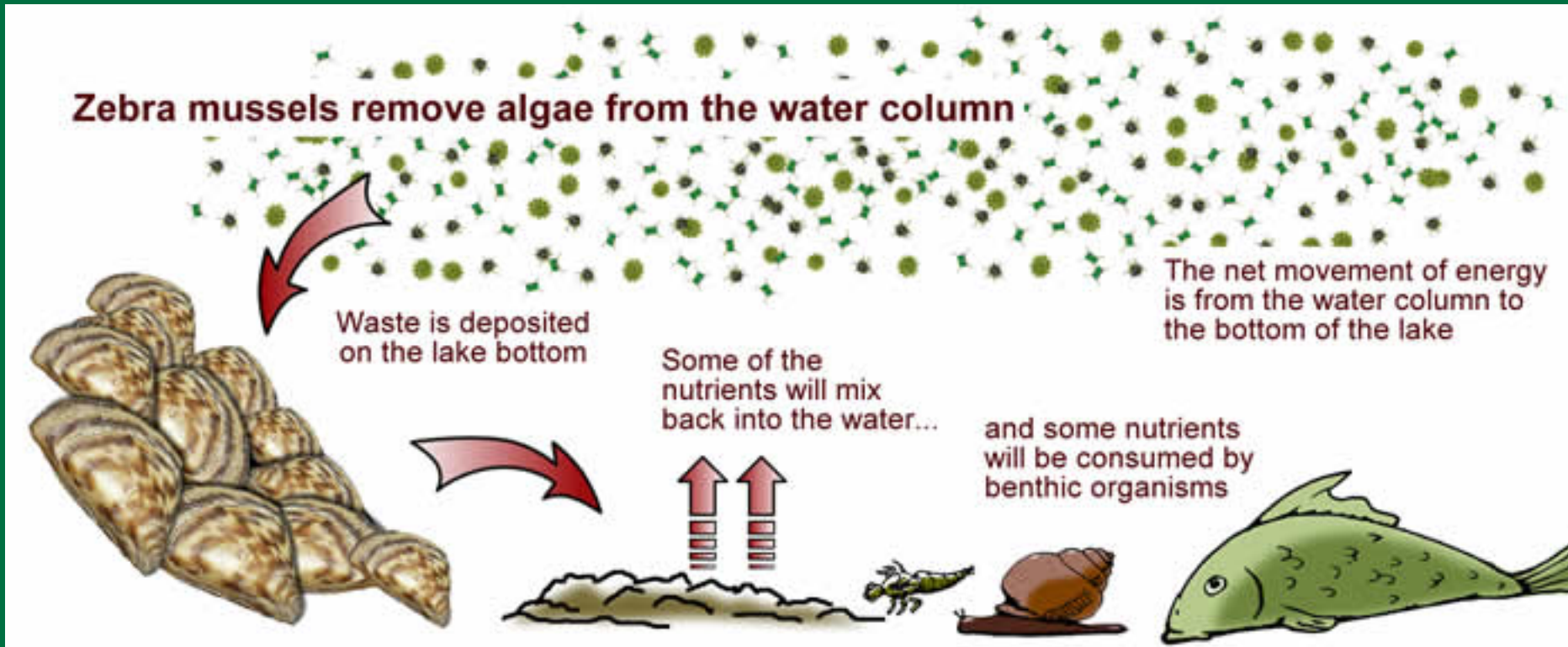


Ecological Impacts of Quagga Mussel



<http://www.caryinstitute.org/educators/teaching-materials/changing-hudson-project>

Ecological Impacts—Summary



Outline

- Background: life cycle, ecological impacts in eastern US
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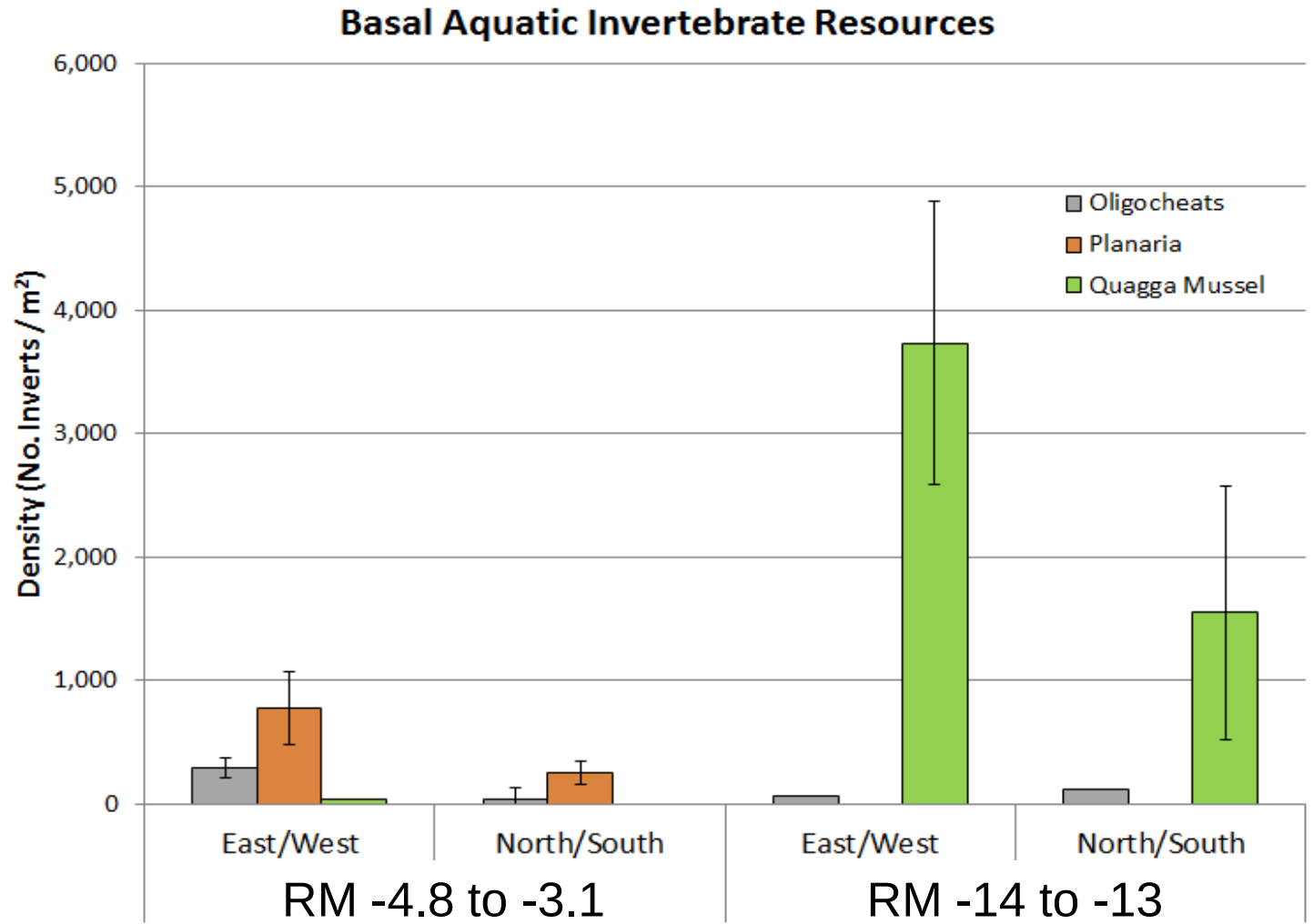
Risk of attaining high densities

Larval transport

- Larvae are fragile and easily killed in turbulent flow
 - 90% of larvae alive at a lake outlet stream, but only 40% alive 18km downstream (Horvath and Lamberti 1999)
- Rapids will likely be a significant source of mortality
 - Prediction: Downstream decline in abundance

Risk of attaining high densities

Larval transport—Glen Canyon



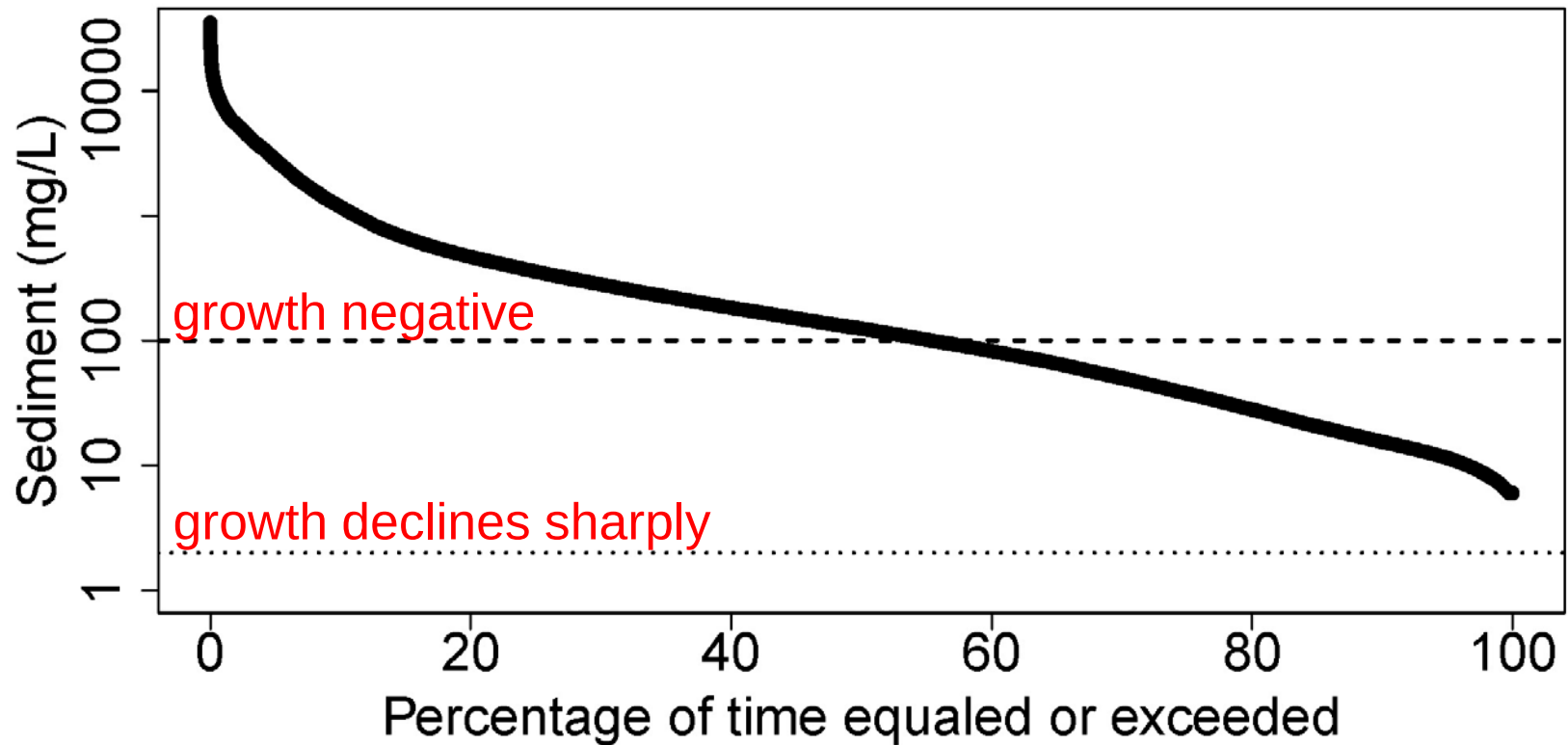
Risk of attaining high densities

Suspended sediment

- Adult mussels filter feed on suspended organic matter (algae and detritus)
- Mussel growth is negatively affected by suspended sediment
- Lab studies
 - growth declined sharply when suspended sediment >1 mg/L
 - growth was negative when suspended sediment >100 mg/L

Risk of attaining high densities Suspended sediment

Suspended Sediment at Grand Canyon 1997–2014



Outline

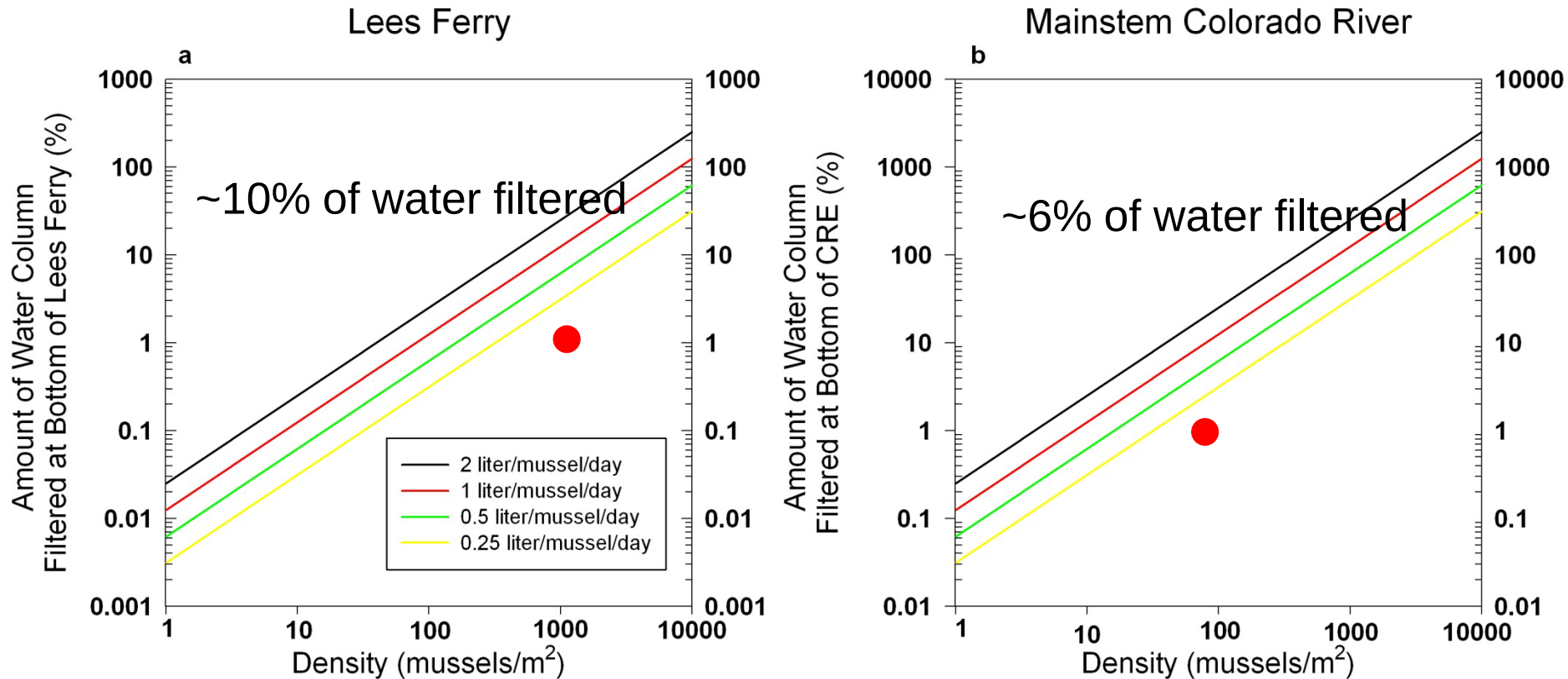
- Background: life cycle, ecological impacts in eastern US
- Risk of attaining high densities in the CRe
- **Risk of ecological impacts in the CRe**

Risk of ecological impacts

- Magnitude of impact will depend on mussel density and filtration rate
- Key question: how much water can be filtered as water travels through Glen and Grand Canyon?

Risk of ecological impacts

Water Clearance Potential for *Dreissena*
at Various Densities and Filtration Rates



Conclusions

DON'T MOVE A MUSSEL



Quagga Mussels Have Invaded Arizona

Before leaving any lake, please:

- **DRAIN** the water from the boat, livewell and the lower unit
- **CLEAN** the hull and remove all plant and animal material
- **DRY** the boat and **INSPECT** all exposed surfaces

After you visit a lake or other body of water, the

Fish Department asks you to

your boat for a 14-day period will aid
in catching hitchhikers on your boat, such as
quagga larvae.

NOW IT'S THE LAW

Protect Your Boat | Protect The Environment



For more information visit www.azgfd.gov/mussels
Arizona Game and Fish Department