What makes invasive species so successful?

Definitions

- Non-native: Alien, outside its native range
  - Exotic, introduced, weedy, non-indigenous
  - Not normally part of ecosystem
  - Established, self-sustaining population
- '10% rule'

  ~10% survive

  ~10% of these become invasive
- Human activities involved
- What is an invasive species? –one that is aggressive and threatens local biodiversity.

Common Characteristics of Successful Invasives

- Few natural enemies
  - Predators
  - Competitors
  - Parasites and diseases
- High reproductive rate
- Long lived
- Good dispersal
- Generalists
- Pioneer species

Why worry about invasive species?

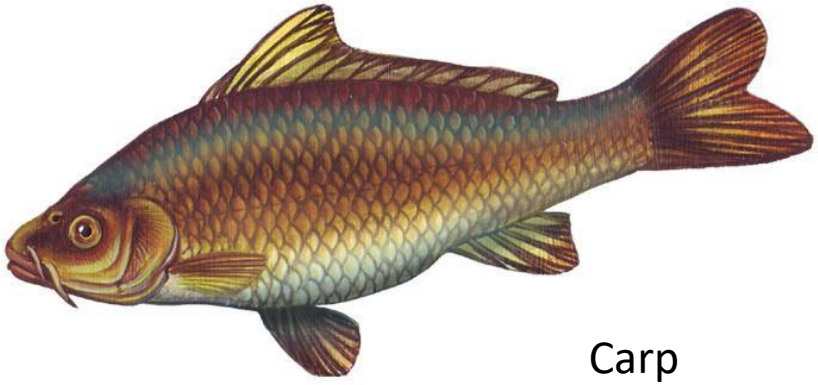
- Tend to crowd out /replace native species
- Can severely damage ecosystem health
- Harm human activities (agriculture, forestry, fisheries, recreation)
  - $137 billion/ year in damages and pest control costs (Pimentel, 2000)

$37 million loss to mid-Atlantic apple production in 2010 alone

There are more than 100 invasive species in the Hudson River, including many of our most familiar plants and animals

Zebra mussels

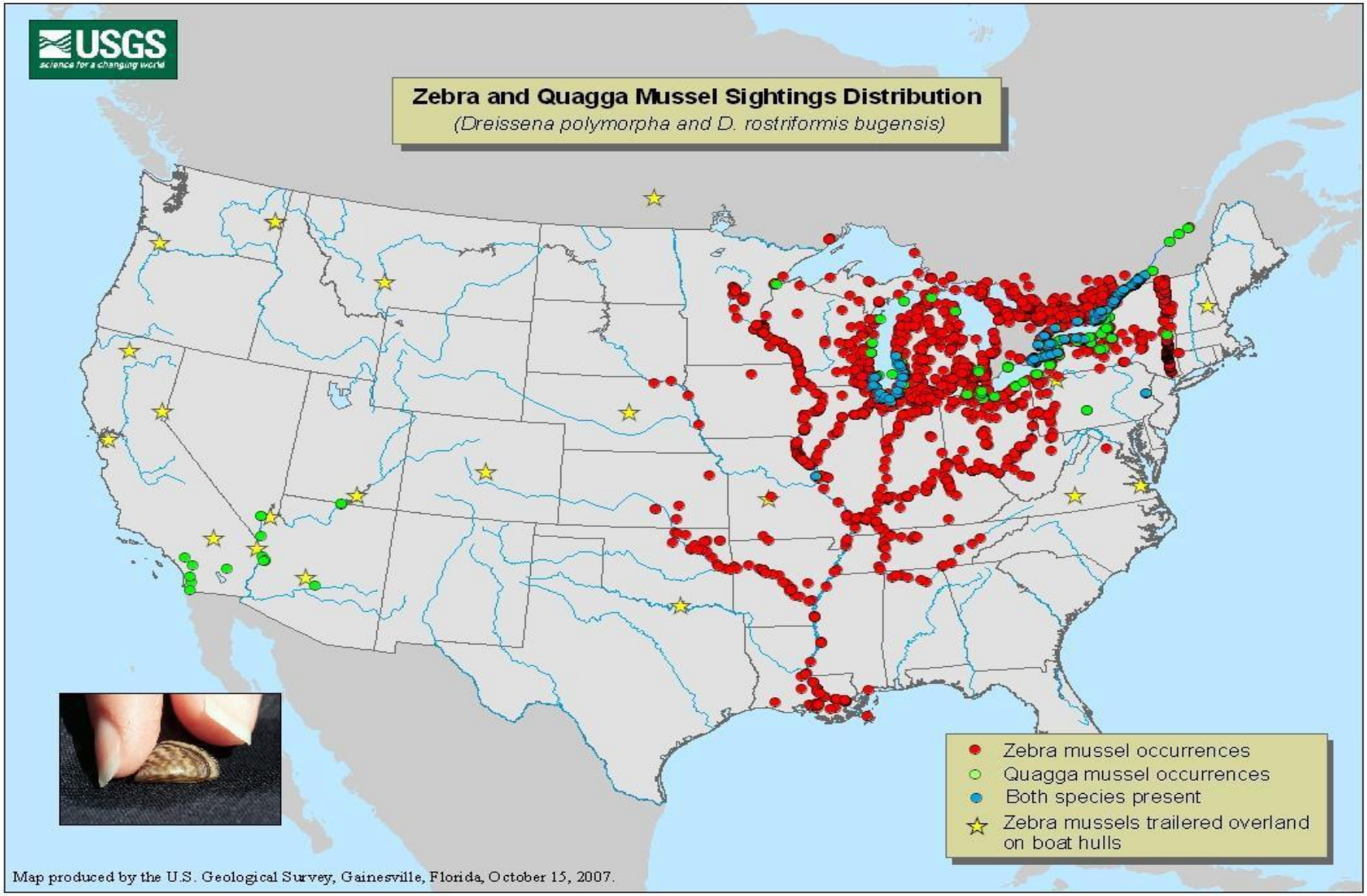
Seed from water chestnut



Carp

plant

Extent of zebra mussels in the US



Life history

Mature at 1 year

Live 6 - 7 years

Up to 700,000 /m^2

Filter feeders (plankton)
Eaten by some fish, ducks, crayfish &crabs

Growth

Filter Feeding:
1 liter water /day

USGS

Settle on hard surfaces

40,000-1,000,000 eggs /year

Settling:
10,000 /m^3 /day

Larvae
(Veliger)
500,000 / m^3

95% die

200,000,000 sperm

Warm water, external fertilization

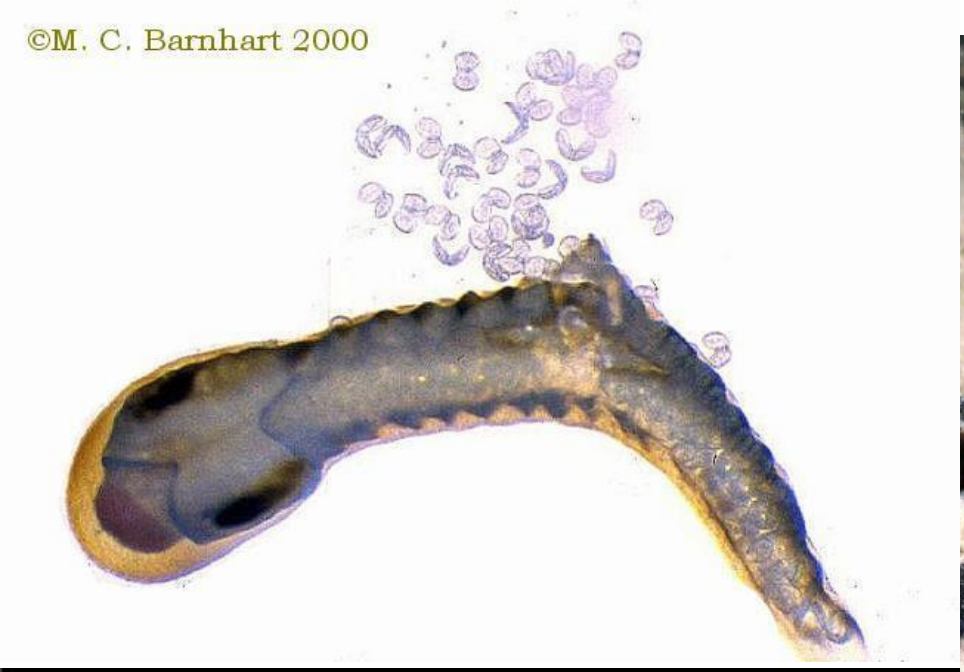
Native pearly mussels

Invasive zebra mussels

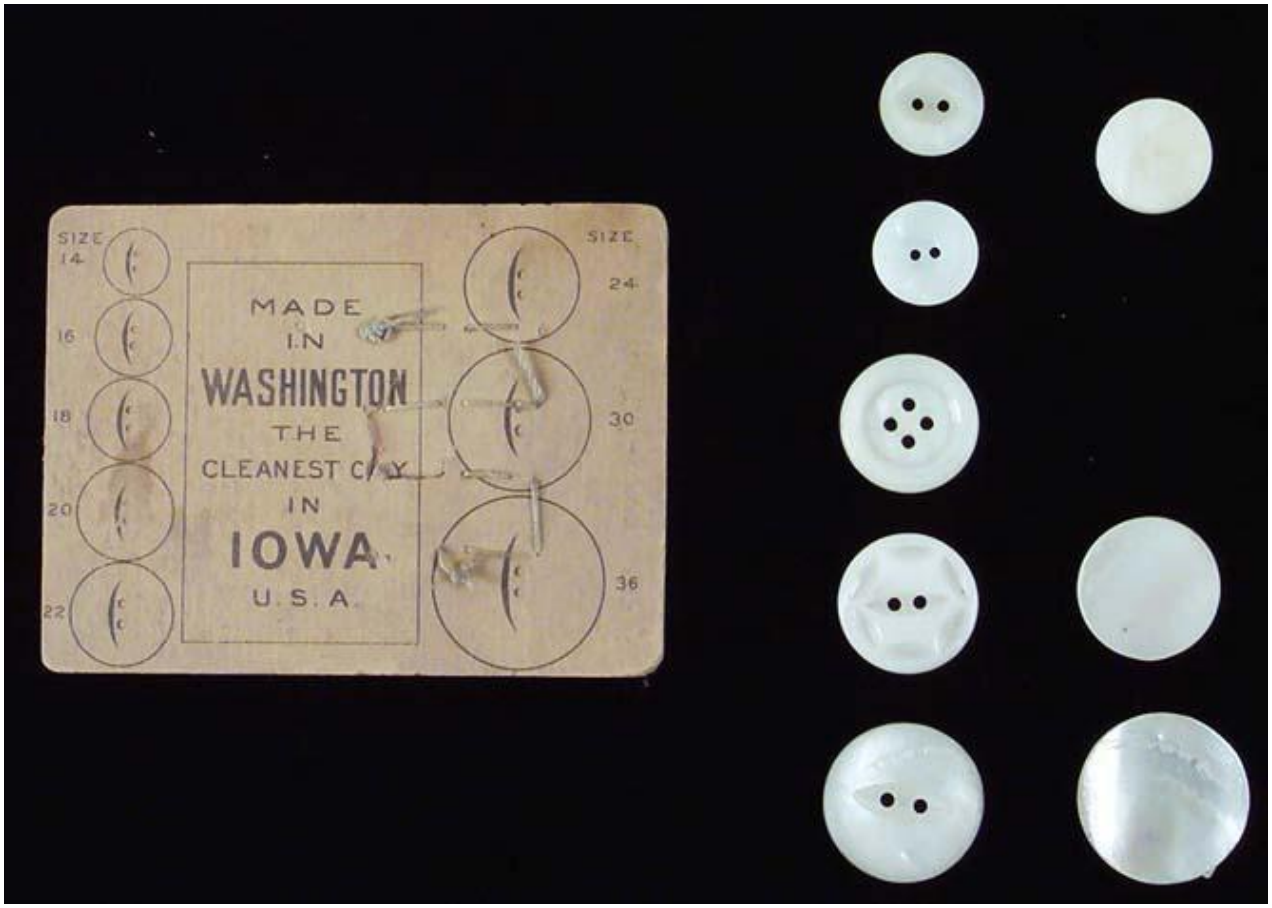
Cary IES

What do you think happened to the native pearly mus population when the zebra mussels invaded?

Pearly Mussels Lure Fish then release their larvae (glochidia) which attach to the gills of the fish!

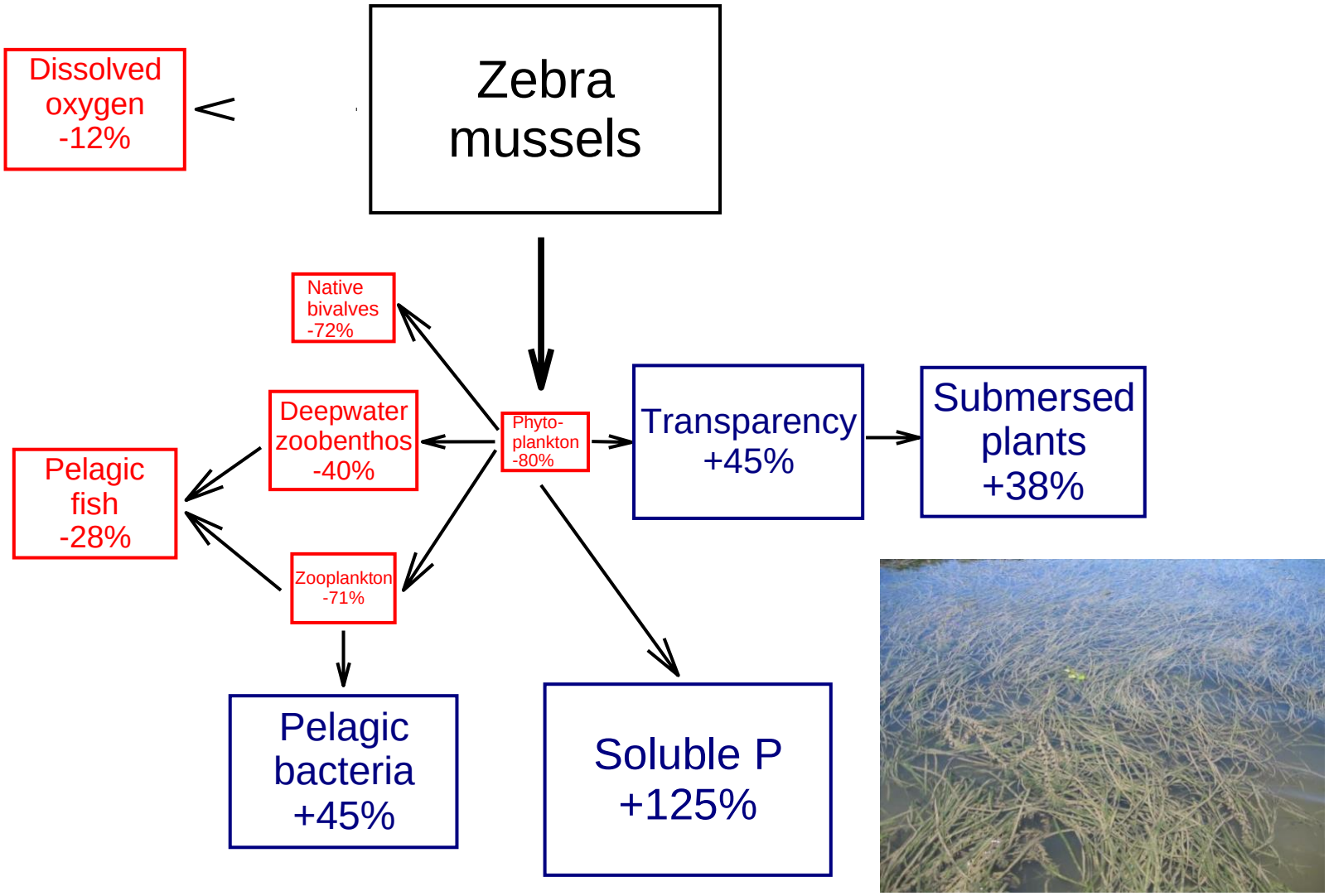


http://www.youtube.com/watch?v=I0YTBj0WHkU

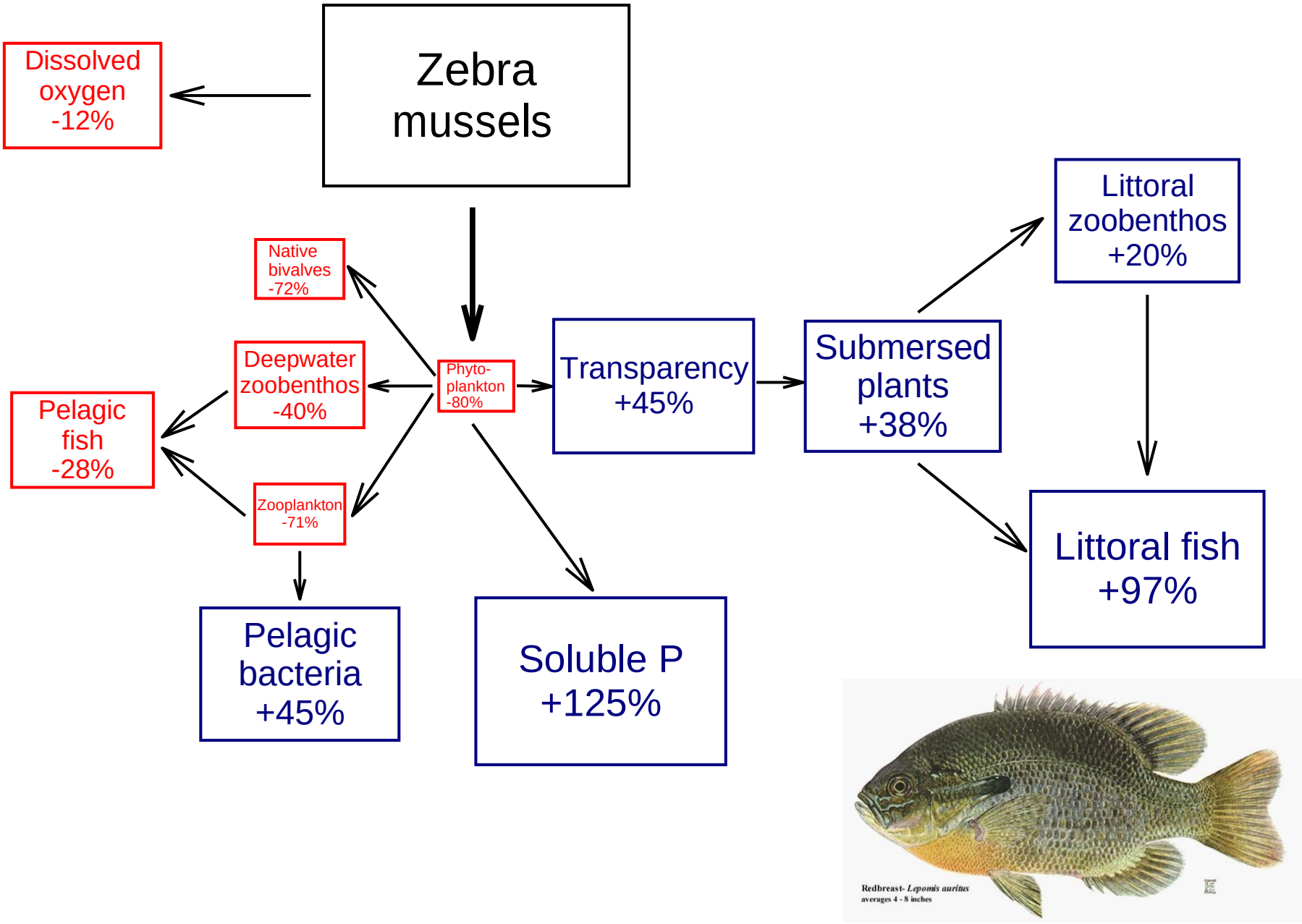


Illinois State Museum

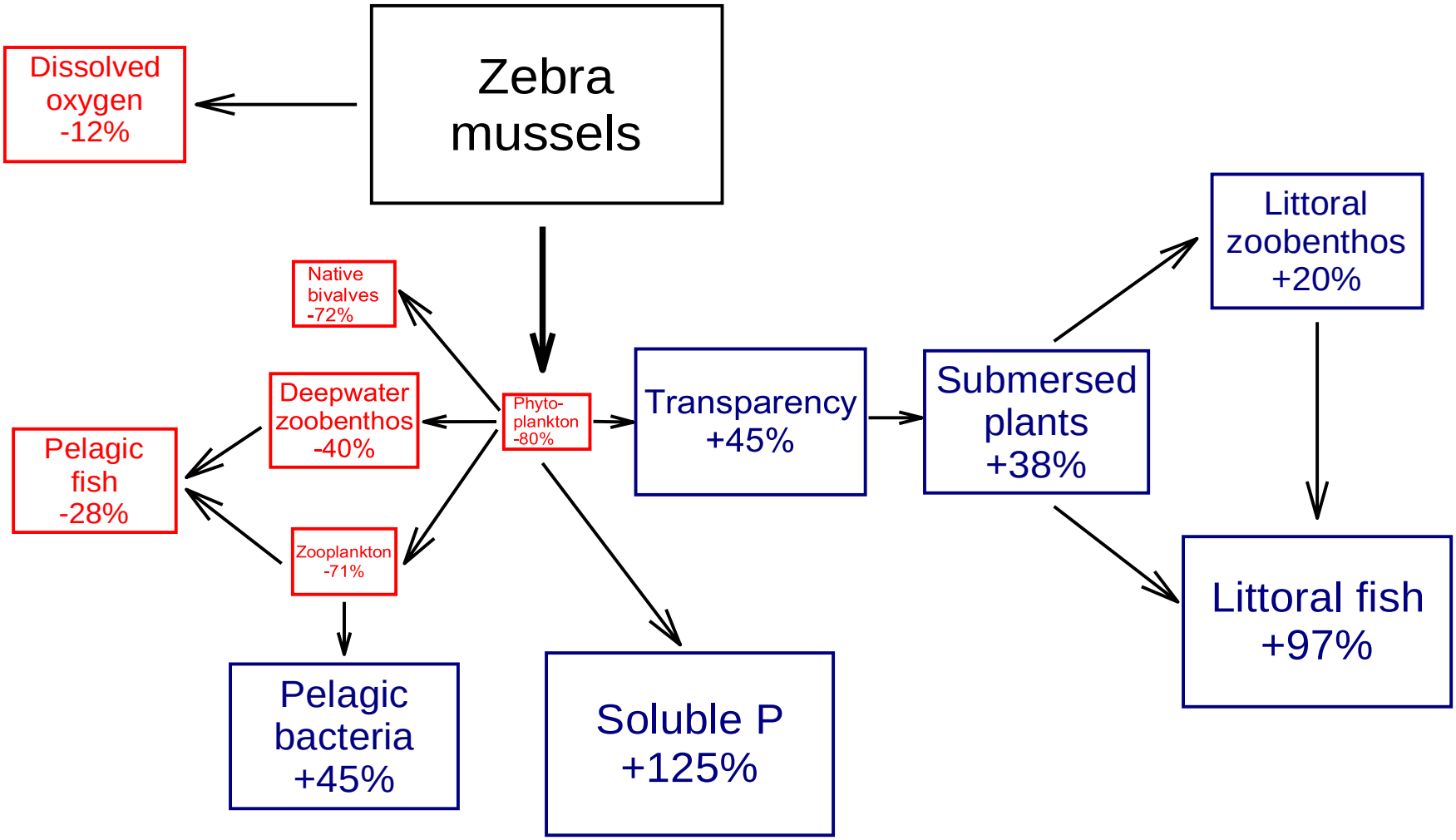
Early Invasion Years, 1993-2004



Early Invasion Years, 1993-2004



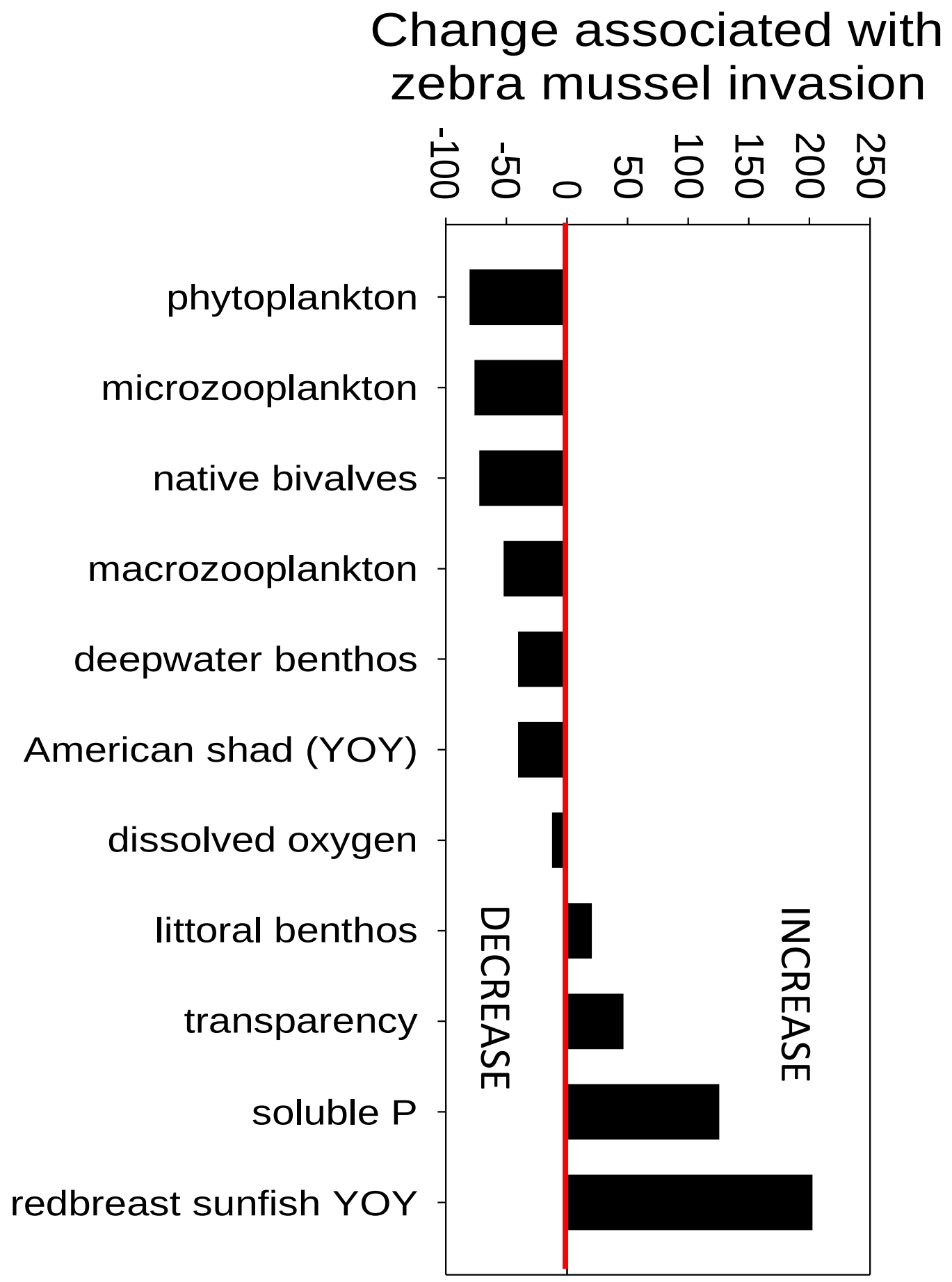
Early Invasion Years, 1993-2004



Food web in the open water

Food web in the shallows

View: Results


Change associated with zebra mussel invasion
-100
-50
0
50
100
150
200
250
phytoplankton
microzooplankton
native bivalves
macrozooplankton
deepwater benthos
American shad (YOY)
dissolved oxygen
littoral benthos
transparency
soluble P
redbreast sunfish YOY
DECREASE
INCREASE

Zebra Mussels

Small

Medium

Large

- Scientists noticed a change in the numbers of different size classes beginning about 2005.
- What do you notice?
- Think about the food web: What do zebra mussels eat?
- Do different size classes eat different organisms?

Zebra Mussel Population Dynamics: Size Classes

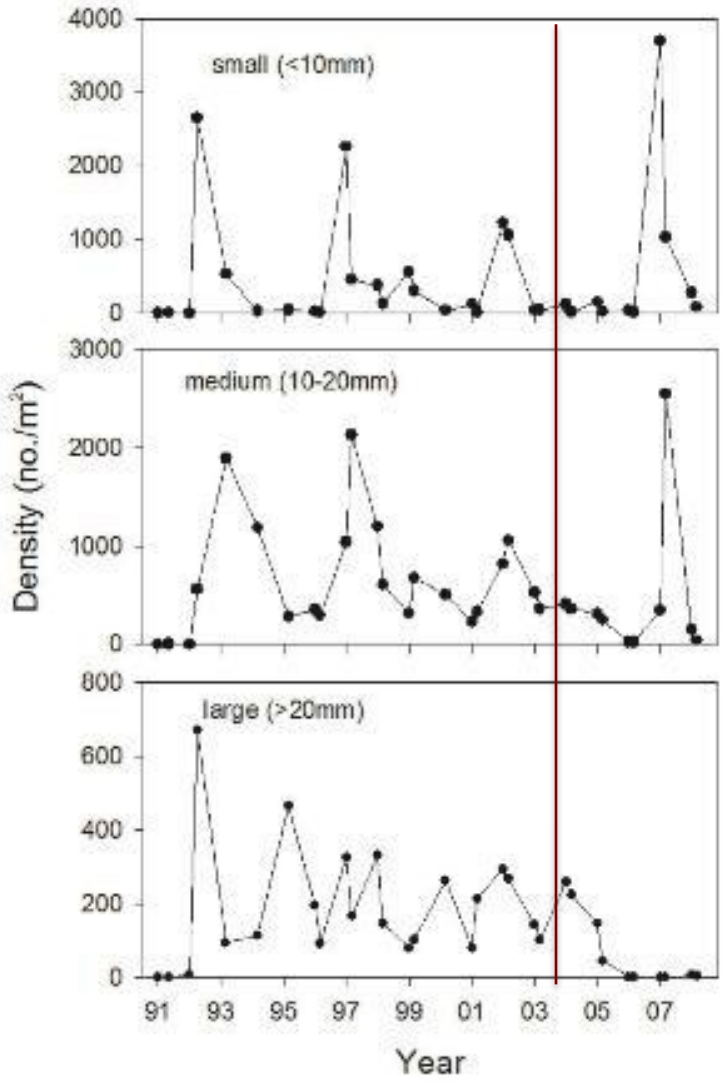
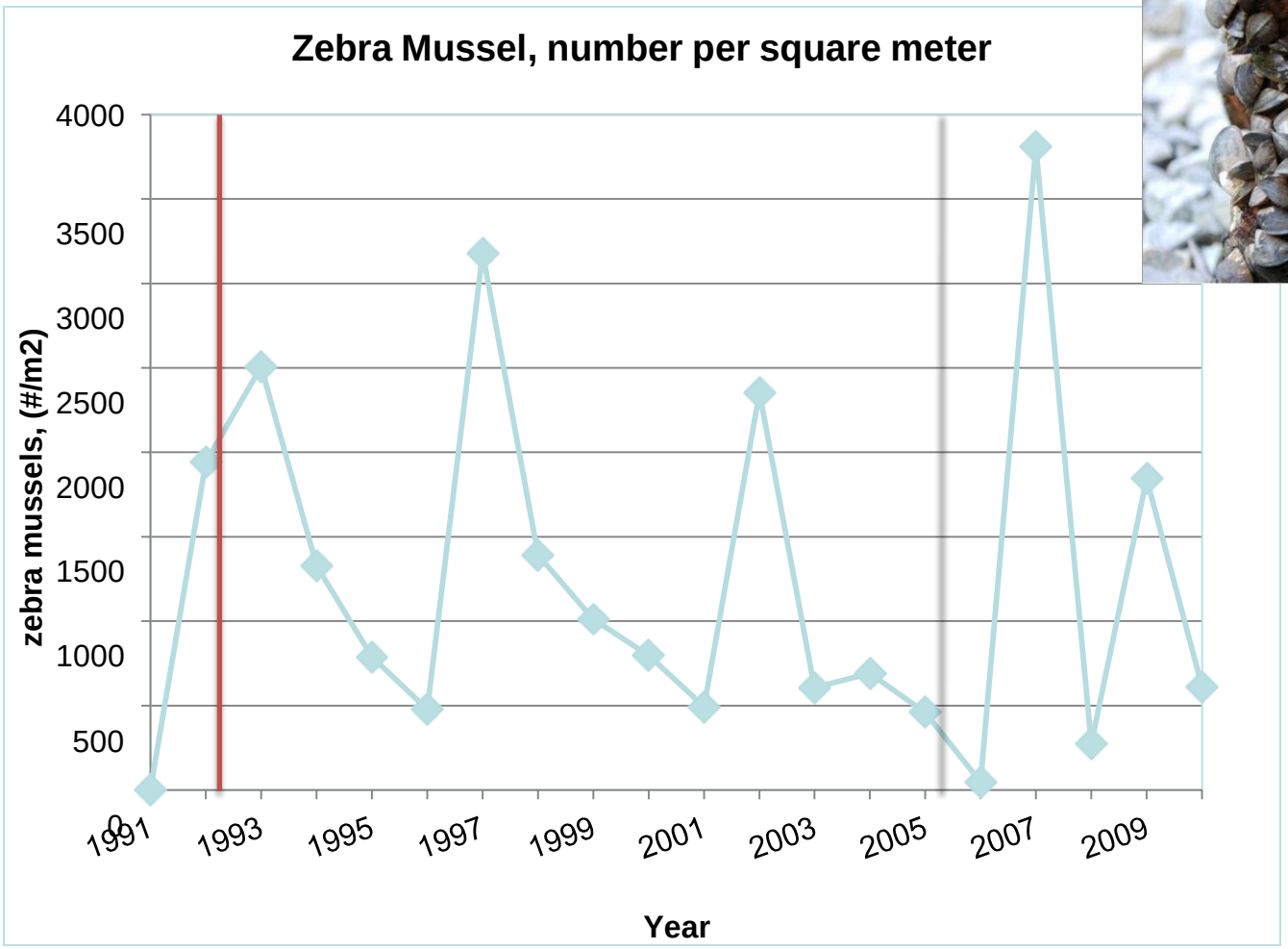
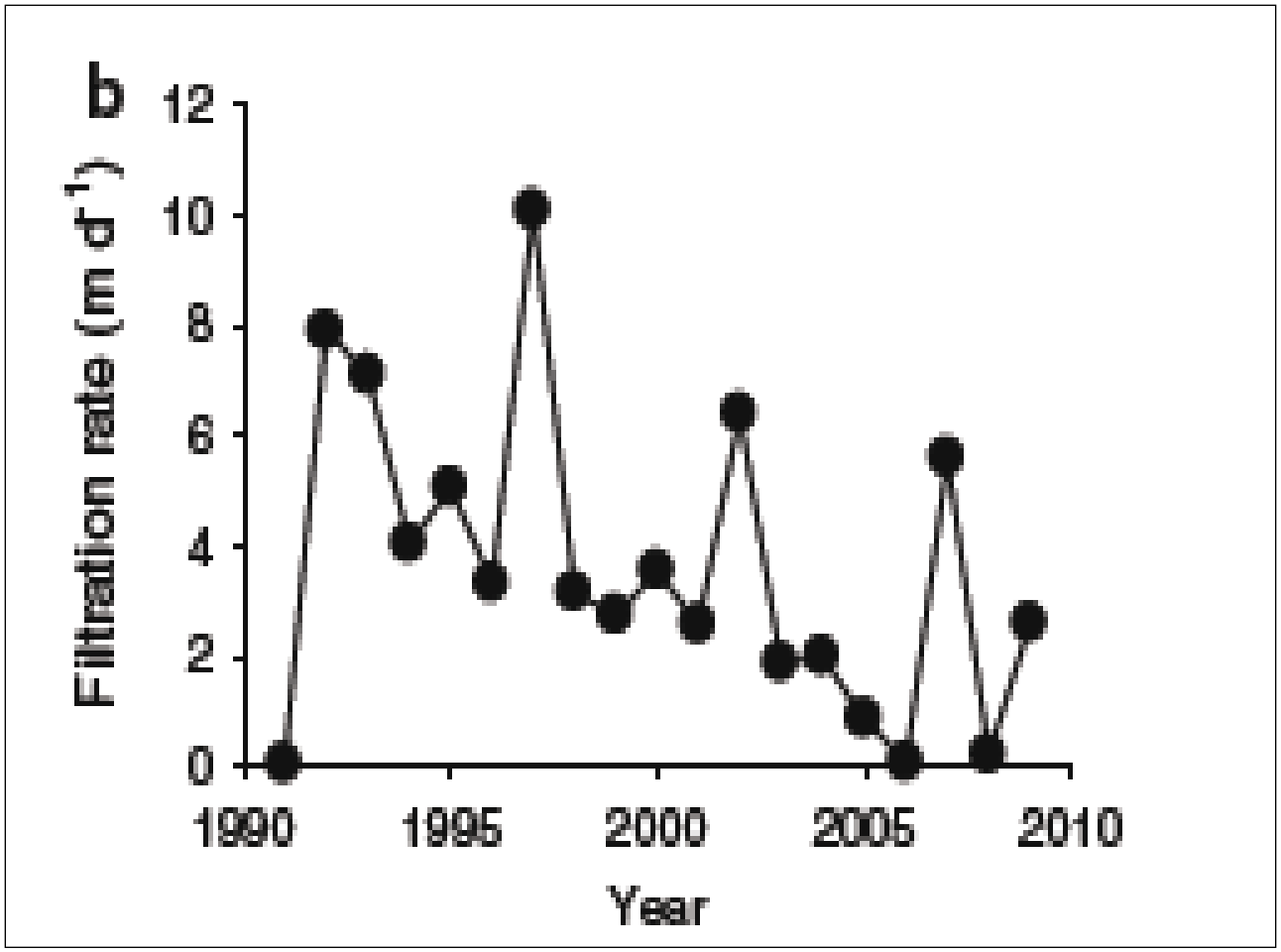


Fig. 1. Zebra mussel population dynamics for small 0–10 mm, medium 10–20 mm, and large 20–30 mm size classes. Data are for the freshwater Hudson River estuary.

What does the population look like now?

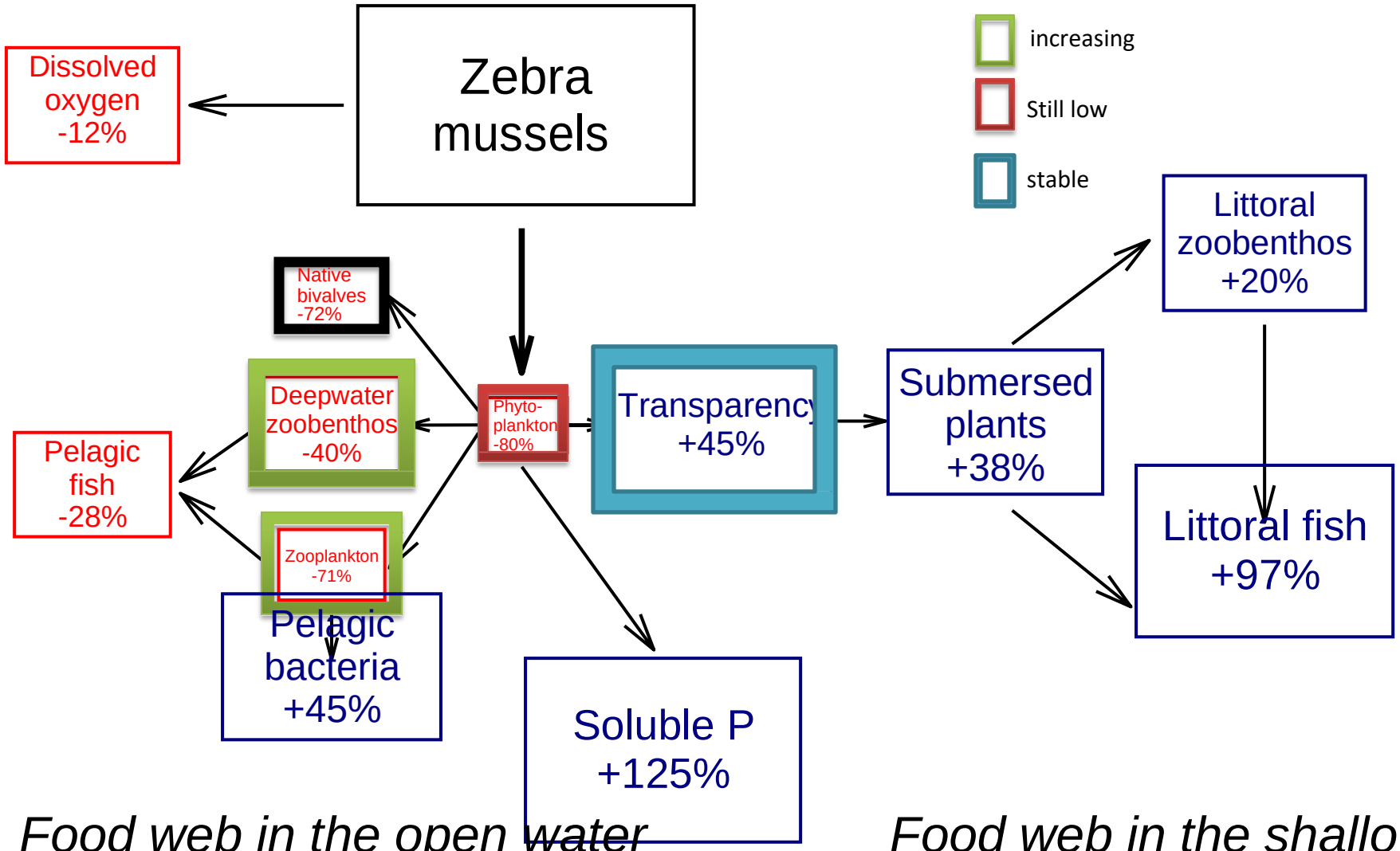


How much water do they filter?



Zebra mussels filter all the water in the Hudson River basin every 1-4 days.

Later Invasion Years, 2005-2009



Food web in the open water

Food web in the shallows

What was eating the large zebra mussels?

Blue crabs
and
pumpkin seed fish