

Consequences Of Zebra Mussel Invasion in the Hudson

Organism	Change: Increase? Decrease? No change?
Unionidae (freshwater pearly mussels)	
Sphaeriidae (fingernail clams)	
Centrarchidae (fish in vegetated shallows e.g. sunfish, pumpkinseed)	
Alosa (open water fish, e.g. shad)	
Phytoplankton/ Chlorophyll A	
Copepods (zooplankton)	
Copepod nauplii (larval stage of zooplankton)	
Bacterial Abundance (decomposers)	
Rotifers (Zooplankton)	
Cladocera (zooplankton)	

Zebra mussels cover large areas of the environment, crowding out native (and threatened) bivalves, sometimes growing on top of them.



Cary IES

Invasive zebra mussels



Cary IES

Native pearly mussels

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

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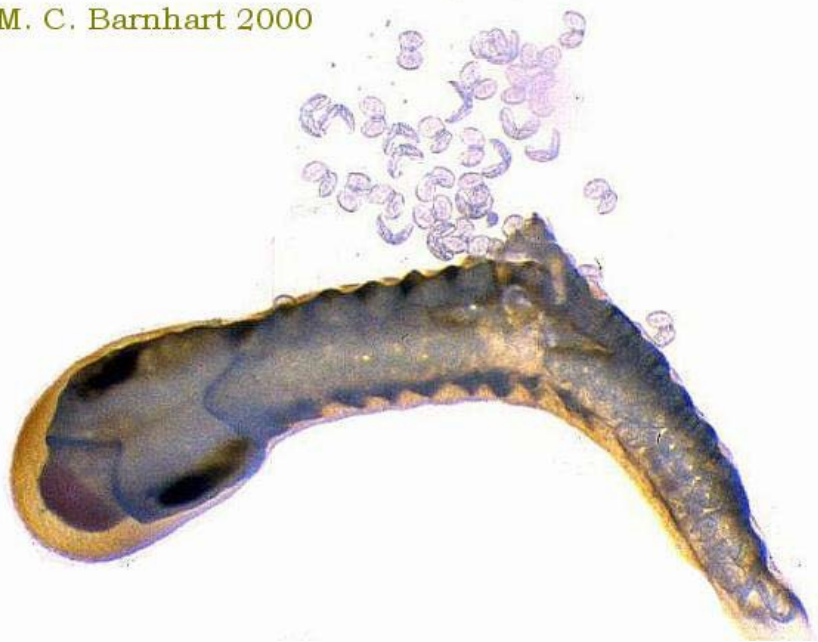
Our native pearly mussels, part of the *Unionidae* family, are amazing organisms that are seriously threatened. While they might not be as cute as other threatened organisms, they have really interesting symbiotic relationships with fish (see next slide).



Pearly Mussels Lure Fish then release their larvae (glochidia) which attach

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Villosa iris
Swan Creek, Taney Co, Missouri
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Pearly mussels have an amazing relationship with fish; they release their larvae (glochidia) into the water, where they latch onto the gills of a host fish. This is a "parasitic" relationship, although we're unsure of whether the larvae actually harm the fish or not. Each pearly mussel has its own fish host

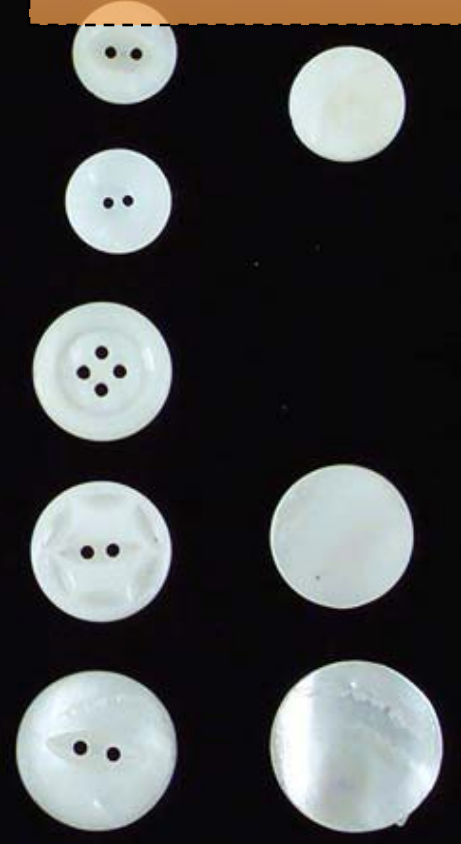


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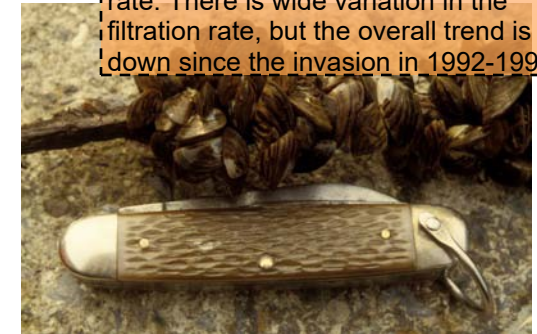
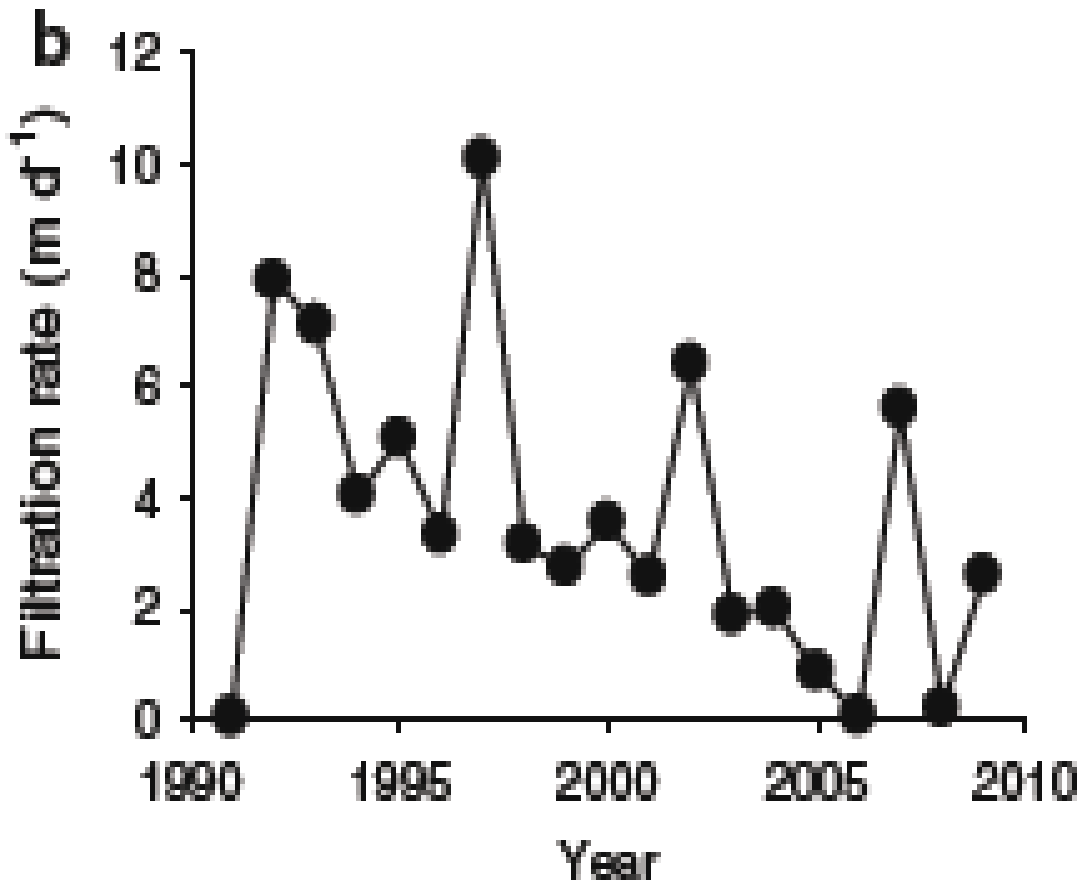
<http://www.youtube.com/watch?v=I0YTBj0WH>

Follow the link to a video of freshwater mussel behavior in the streams of Missouri. These mussels' flesh looks and moves like small fish. Images in this slide demonstrate the economic importance of pearly mussels. Before plastics, mussel shells were used to make buttons.



How much water do they

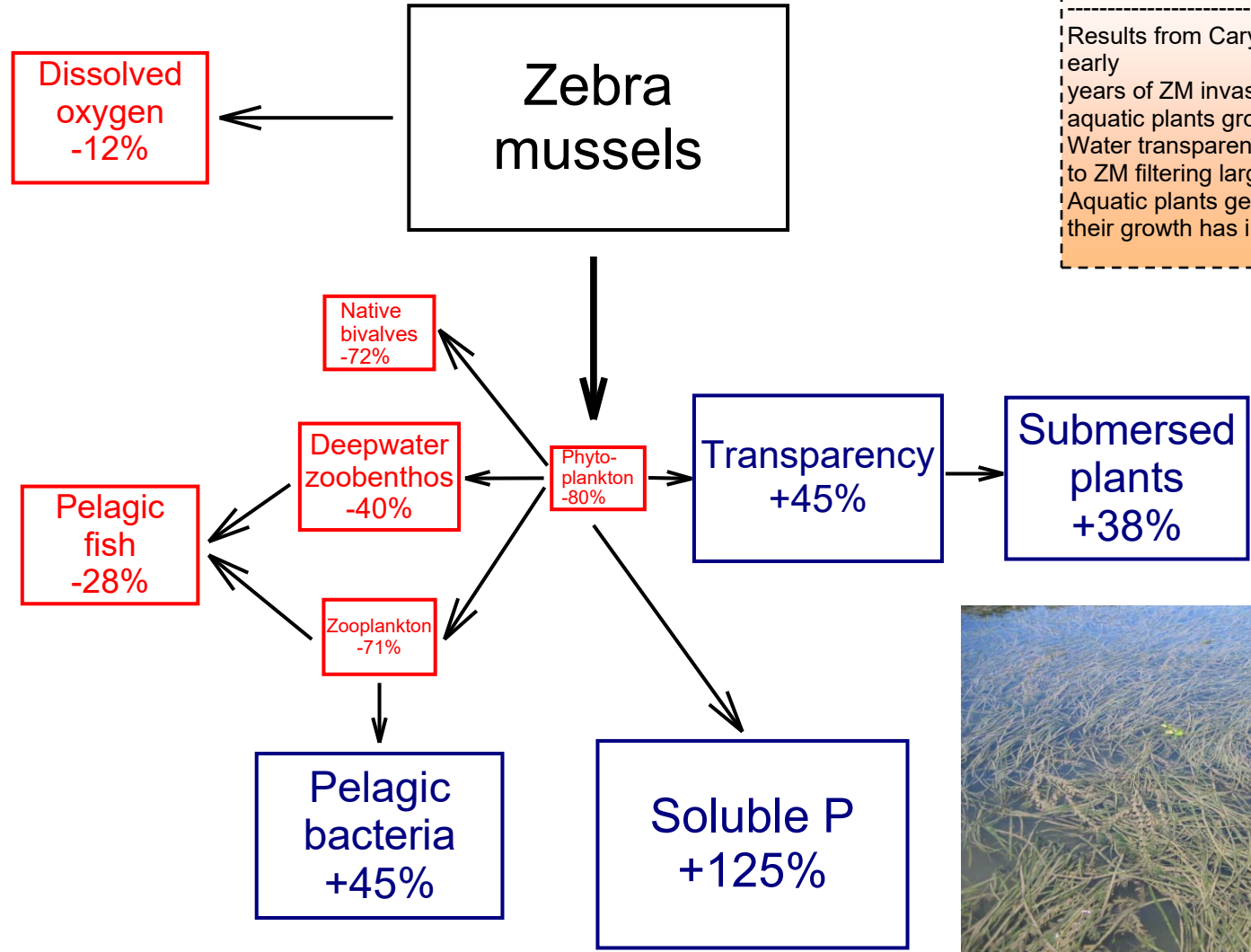
Zebra mussels filter a lot of the Hudson River every day; even in times of low population levels, they still filter 30-40% of the river every day. The cyclic nature of zebra mussel population is evident in the fluctuations in filtration rate. There is wide variation in the filtration rate, but the overall trend is down since the invasion in 1992-1993.



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

Early Invasion Years, 1993-2004

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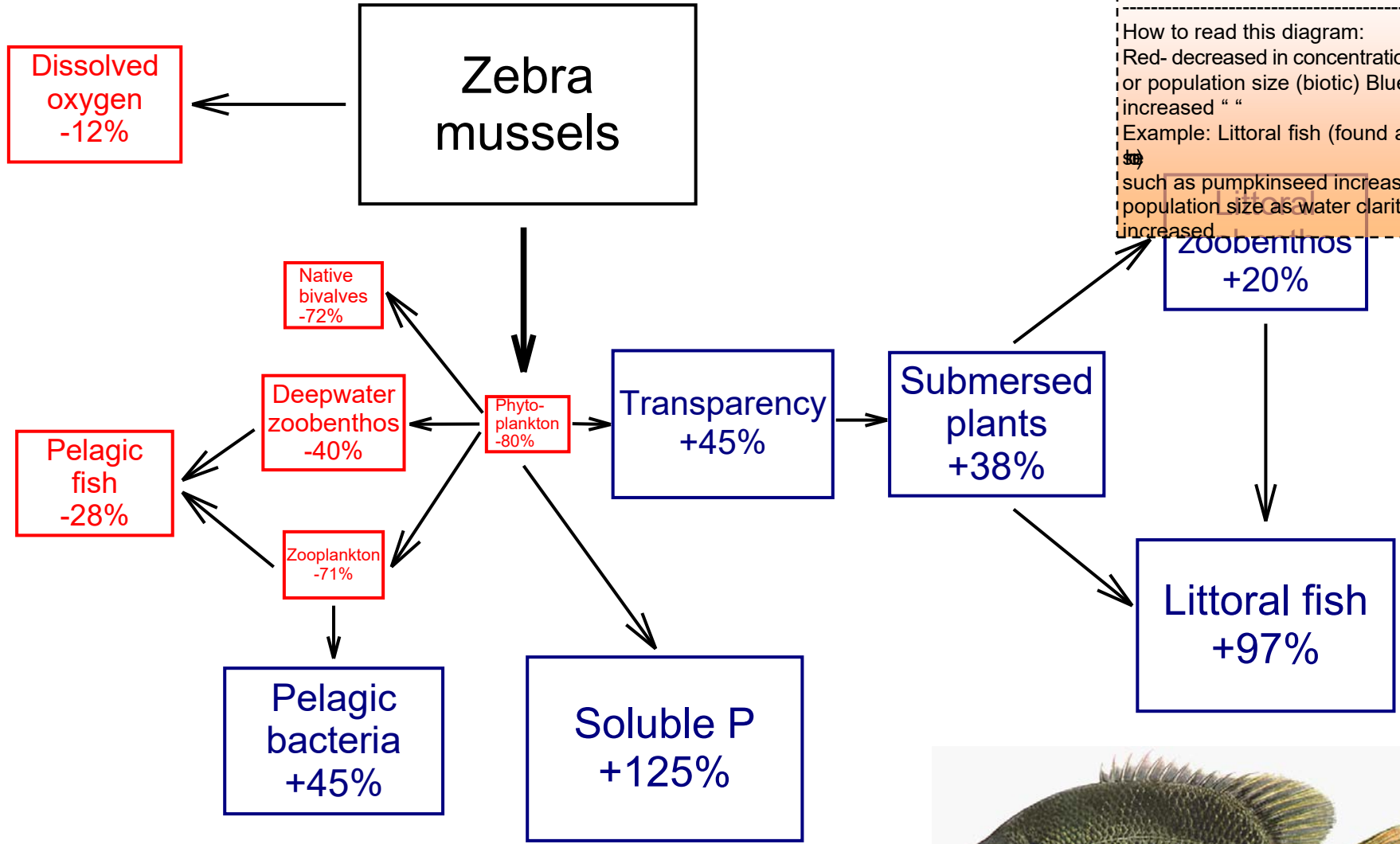
Results from Cary Institute research-early years of ZM invasion: Submerged aquatic plants grow in the shallows. Water transparency has increased due to ZM filtering large volumes of water. Aquatic plants get more sunlight so their growth has increased.



Early Invasion Years, 1993-2004

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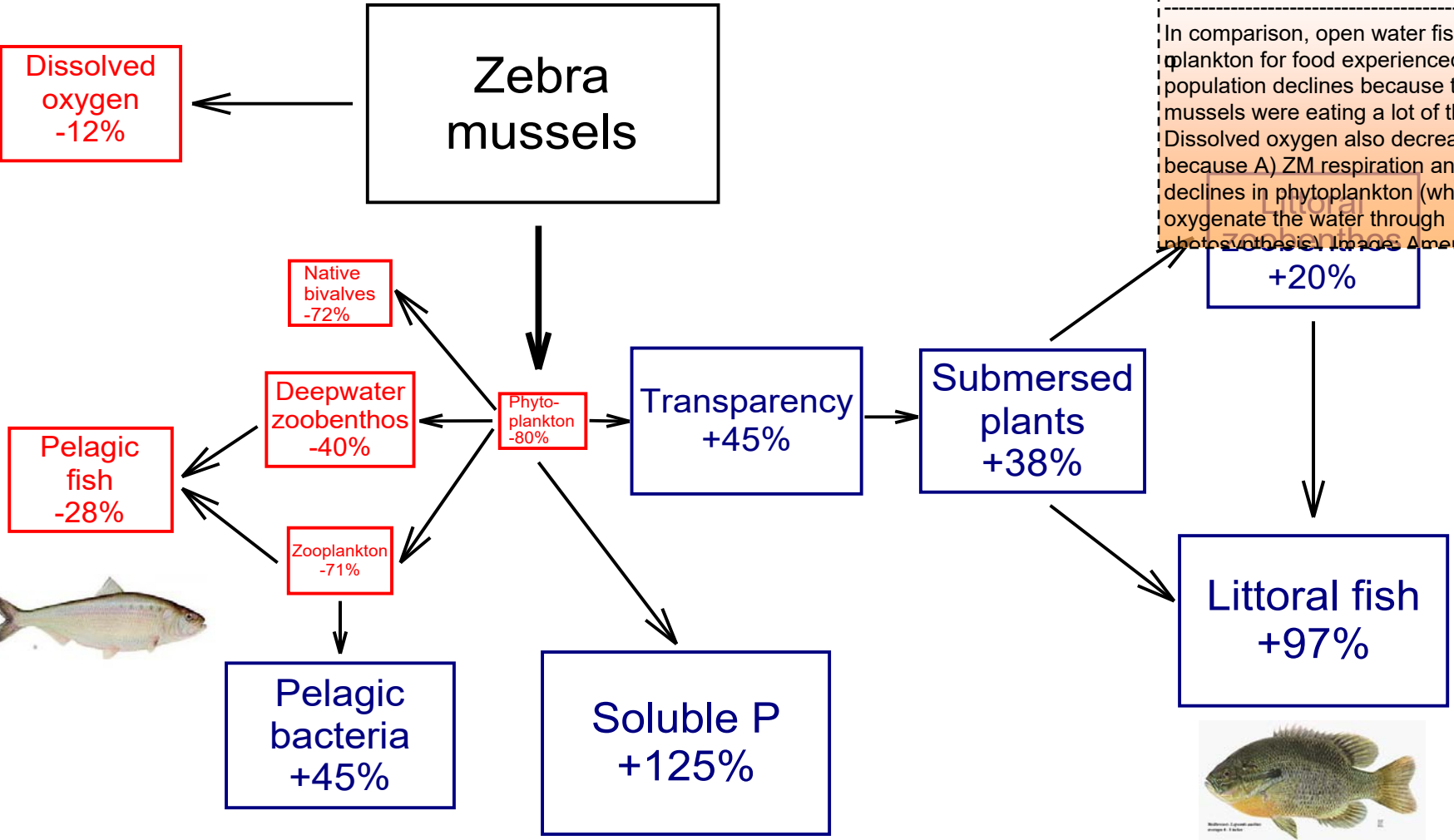
How to read this diagram:
Red- decreased in concentration (abiotic) or population size (biotic) Blue- increased “ “
Example: Littoral fish (found along the shore) such as pumpkinseed increased in population size as water clarity increased.



Early Invasion Years, 1993-2004

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In comparison, open water fish that rely on plankton for food experienced population declines because the zebra mussels were eating a lot of their food. Dissolved oxygen also decreased because A) ZM respiration and B) declines in phytoplankton (which oxygenate the water through photosynthesis). Image: American

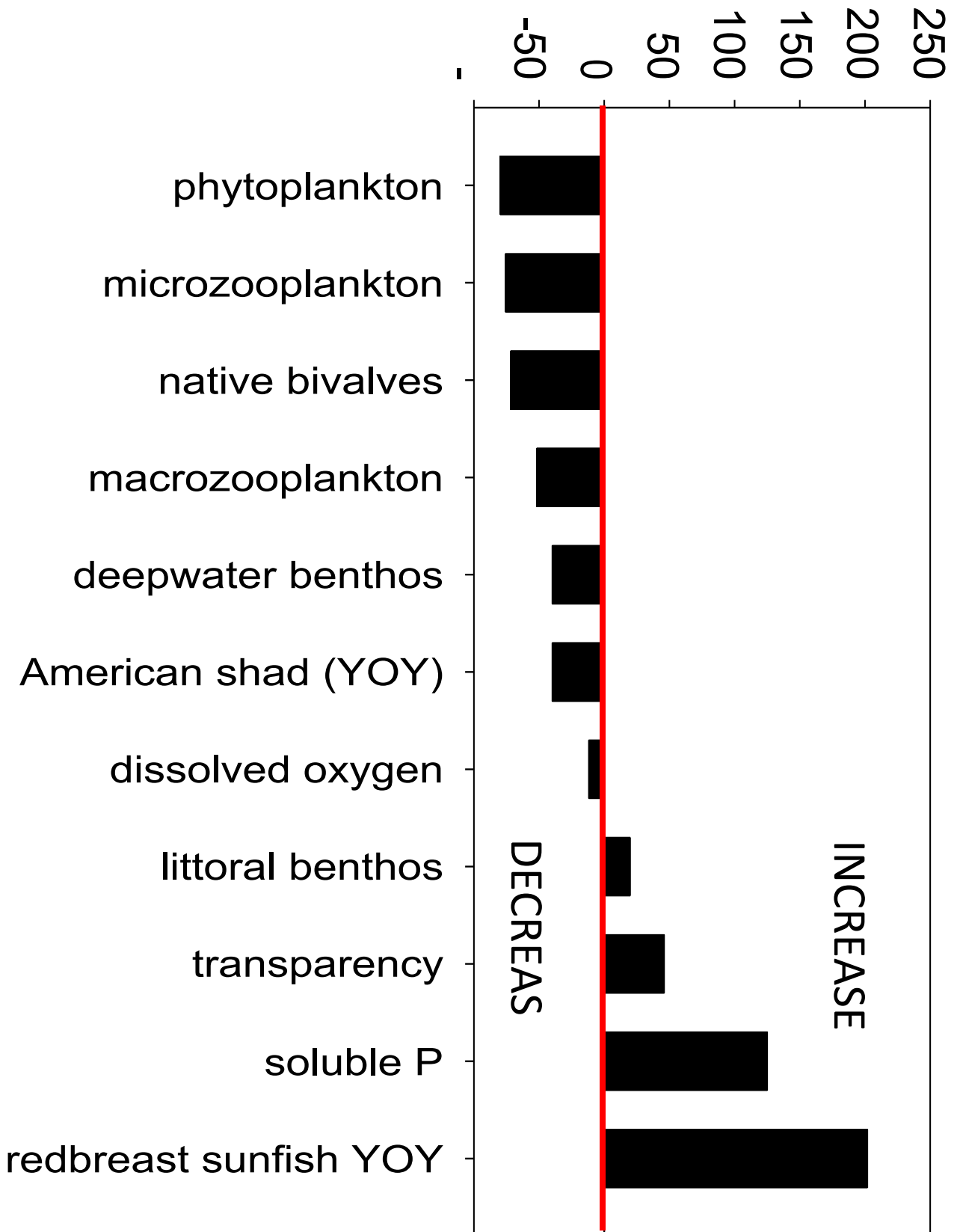


Food web in the open water

Food web in the shallows

[View: Results](#)

Change associated with zebra mussel invasion



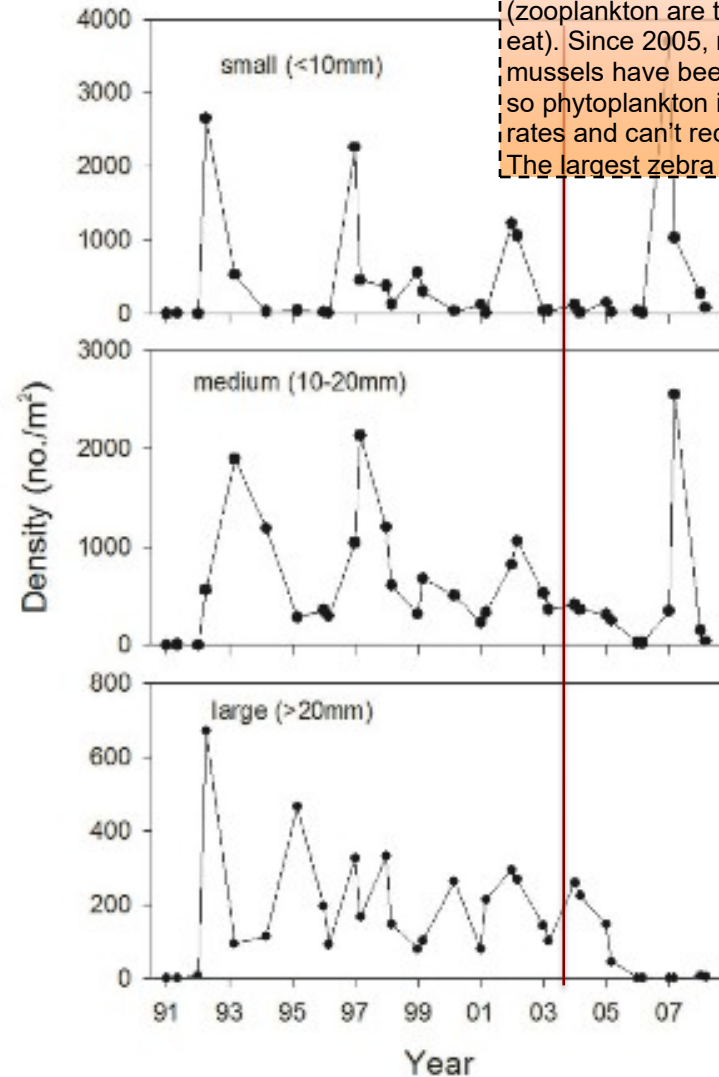
Zebra Mussels

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?

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Zebra Mussel Population Dynamics

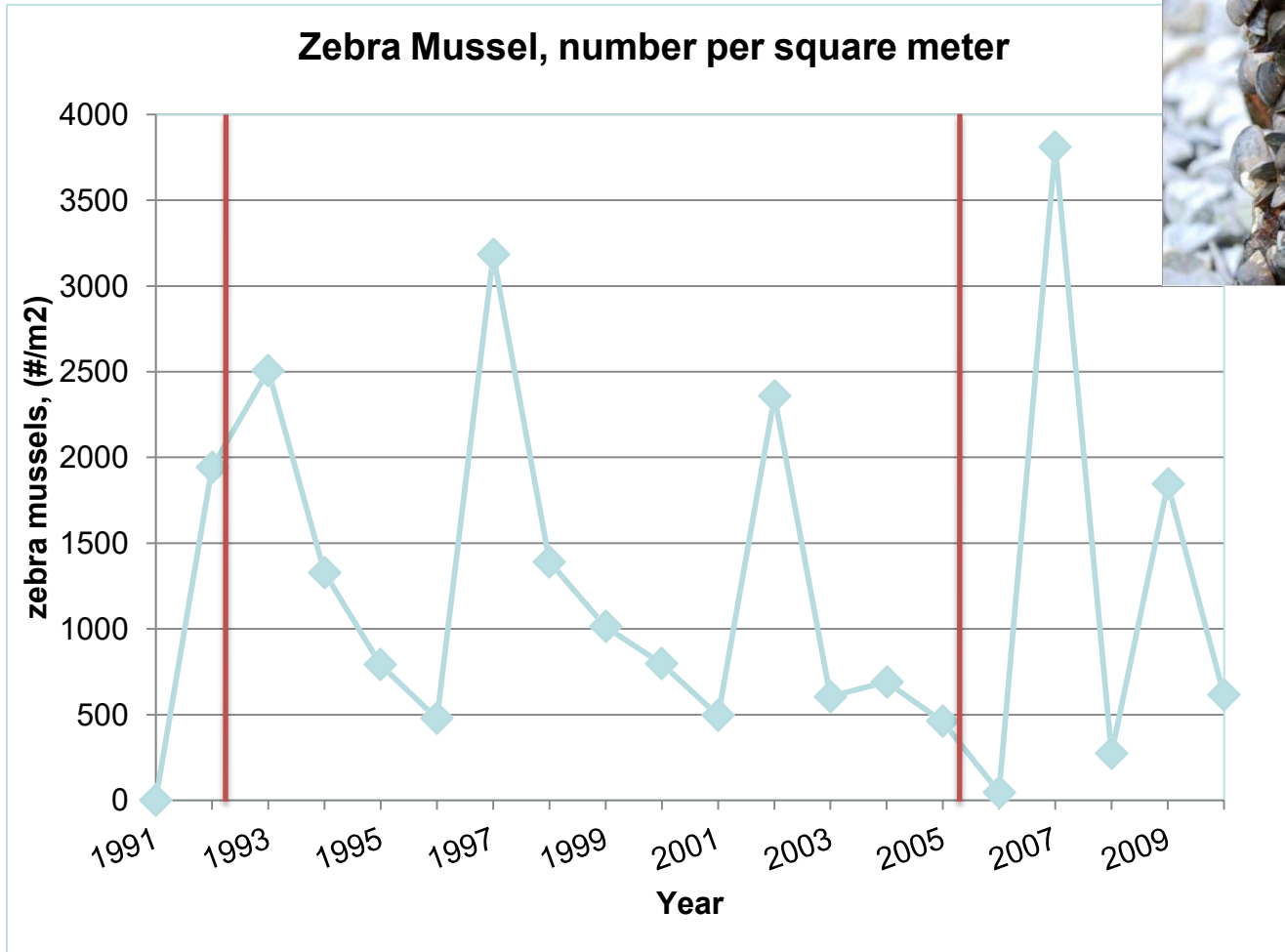


Changing trends- The smaller zebra mussels consume phytoplankton and bacteria (zooplankton are too big for them to eat). Since 2005, most of the zebra mussels have been small and medium, so phytoplankton is being eaten at high rates and can't recover. The largest zebra mussels eat

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.

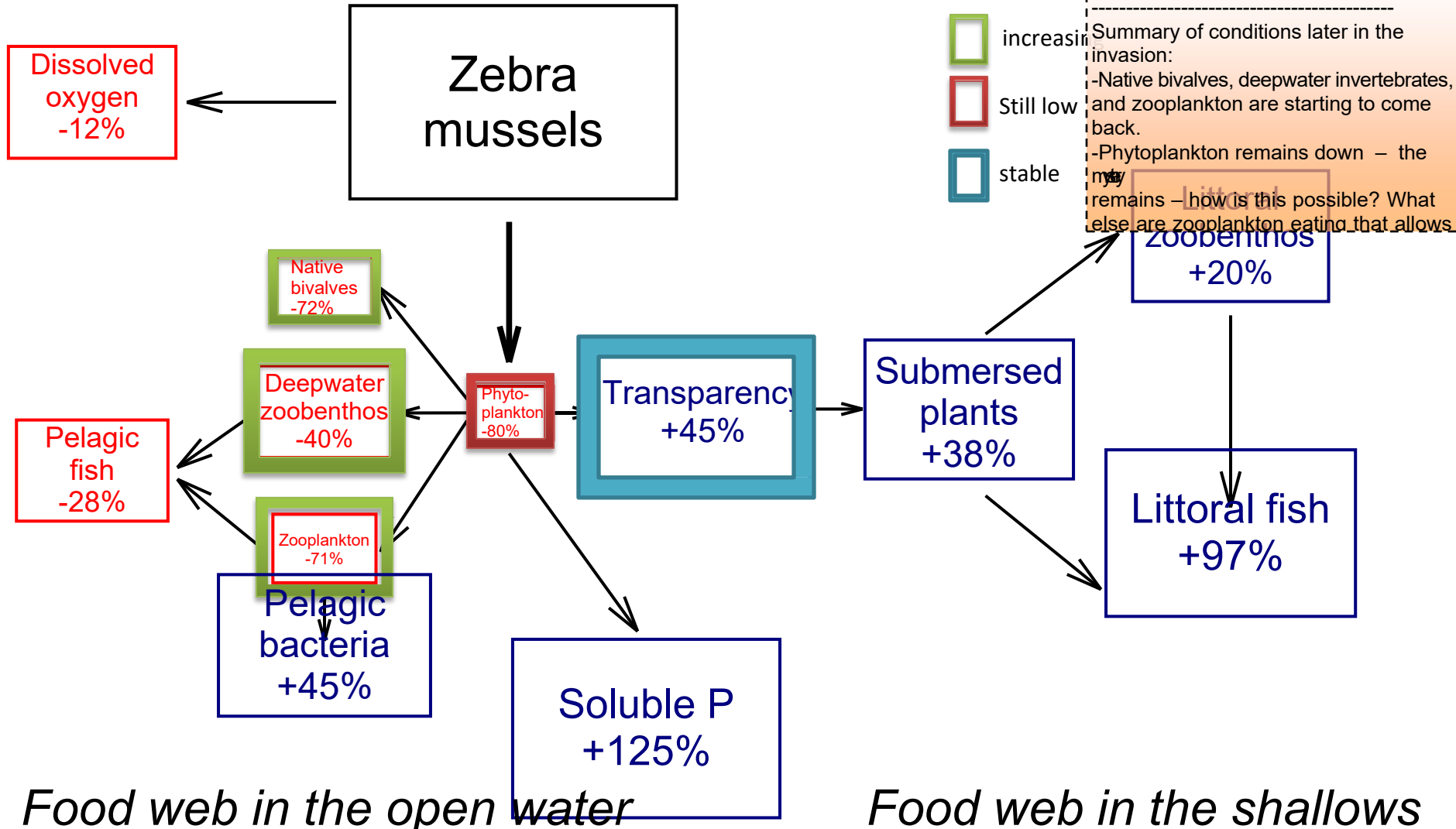
What does the population look like now?

The first full year of the invasion was 1993.
The early invasion was 1993-2004.
The later invasion, sometimes referred to as the "recovery" began in 2005.
The zebra mussel population goes up and down, being limited by light, food, and freshwater flow. In 2007, there were nearly 4,000 in a square meter!



Later Invasion Years, 2005-2009

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Adult male blue crabs migrate upriver in the late summer, and have been observed eating zebra mussels. There aren't more blue crabs in the river, however, so we might assume that they have learned how to eat the mussels over time. Another organism in the river that has

What are eating large zebra mussels?



**Blue crabs
and
pumpkin seed fish**

