The Short-Term Impact of the Zebra Mussel Invasion

Lexile 1060
9th - 12th

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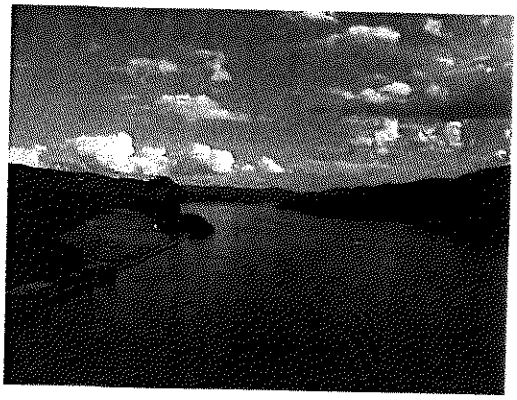
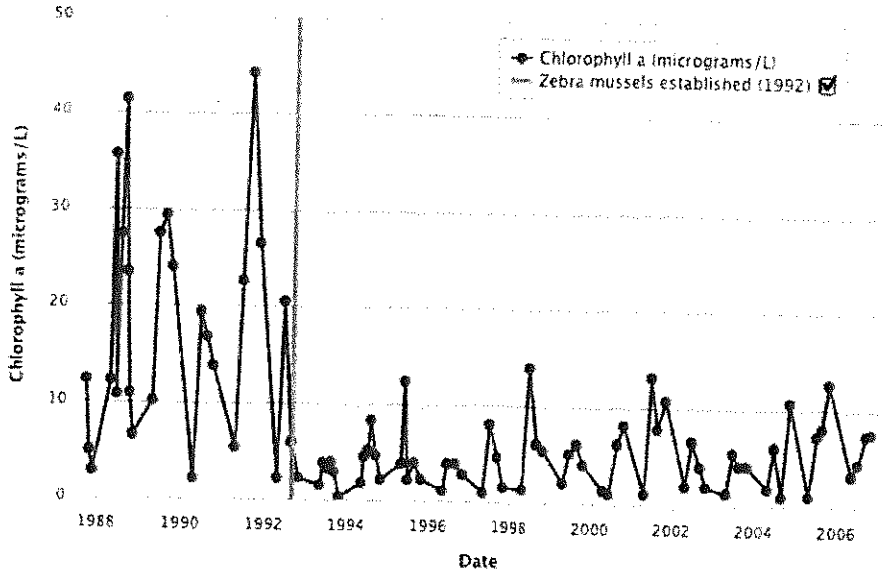
Zebra mussels first appeared in the Hudson River in May 1991. Within a year, scientists estimated their numbers had reached 500 billion, an enormous amount! In fact, if you had a huge balance and put zebra mussels on one side, they would outweigh all the other consumers in the ecosystem combined: all the fish, zooplankton, worms, shellfish, and bacteria.



An estuary is a dynamic body of water where freshwater and saltwater meet. The Hudson River is more than a river: it's a tidal estuary, where the saltwater from the Atlantic Ocean meets the freshwater running off the land.

Phytoplankton and zooplankton populations drop sharply

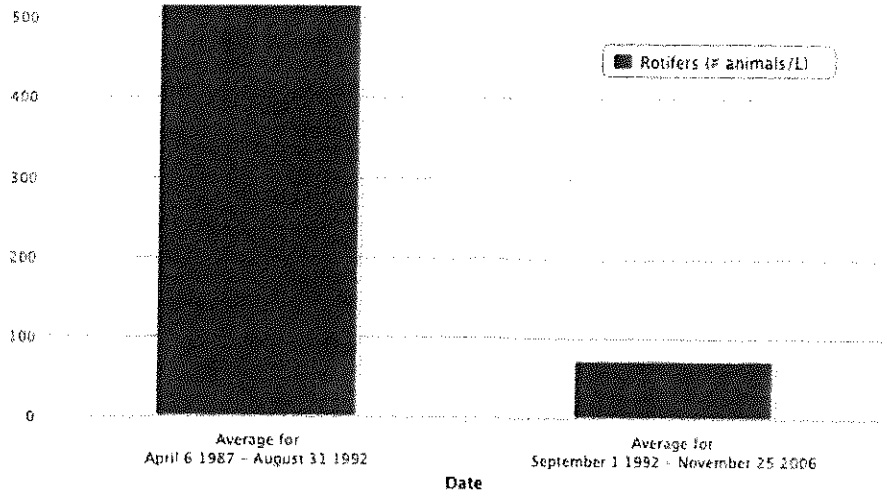
Before the invasion, scientists developed computer models to predict the effect of the zebra mussels. But they were still surprised by what happened. By 1992, there were so many zebra mussels, scientists estimate they were filtering a volume of water equal to all of the water in the estuary every 1–4 days during the summer. In the years right after the invasion, phytoplankton fell by 80 percent. Zooplankton (which eat phytoplankton) declined by half. And the smallest zooplankton (called micro-zooplankton), fell by about 90 percent.



WATCH WHAT HAPPENS

This graph shows the change in the amount of phytoplankton (represented by the blue line) over 18 years in the Hudson River. (The amount of phytoplankton is measured by the amount of chlorophyll they contain.) Look at the gray line above: there's a big change in the blue line when the zebra mussels first arrived in the river. What do you think happened?

By 1994, scientists hypothesized that zebra mussels were responsible for these changes. The mussels were filtering huge amounts of phytoplankton from the water. Less phytoplankton meant less food for zooplankton, so their numbers were shrinking too. Competition was taking place and the zebra mussels seemed to be winning.



A BIG CHANGE
This bar graph shows the change in the average number of rotifers (a type of zooplankton) in the Hudson River before and after the zebra mussels became established in 1992.

The food web changes

In the next few years, the data supported their hypothesis. Scientists made other findings too. They observed that the decrease in phytoplankton and zooplankton had effects that rippled throughout the food web. With less food available, there were fewer — and smaller — fish in the open river. The population of native mussels, which also eat plankton, shrank from more than one billion to almost none.

ALONG THE RIVER
The Hudson River flows 315 miles (507 km) through New York with over 1,000 cubic feet of water passing by every second (or 600 cubic meters per second). Scientists want to understand how the river changes over time and space.

But some populations increased — likely due to the change in the river's turbidity, or cloudiness. With far less phytoplankton, the water got clearer. During the summertime, visibility went from 3–4 to 4–8 feet. Since sunlight reached deeper into the water, rooted aquatic plants such as water celery increased by up to 40 percent. Populations of fish living in these shallow weeds increased. Another surprising result was that dissolved oxygen in the river fell by about 15 percent. The drop wasn't enough to endanger any

aquatic animals, but it was still a huge amount of oxygen. Scientists think the enormous zebra mussel populations were consuming a lot of oxygen very quickly. At the same time, the mussels were removing the phytoplankton that produce oxygen.

Questions about the long-term impact

What happens once an invasive species becomes established in an ecosystem? The invader's population might evolve to adapt to its new home. Or native species might evolve to better tolerate or even feed on the invader. Or other species might arrive that are more resistant to the effects of the invasion. Once scientists had a clear picture of the invasion's immediate impact, they started to wonder about long-term consequences like these.

Name: _____ Date: _____

1. How many zebra mussels were there in the Hudson River within a year of their first appearance?

A 500 billion
B 500 million
C 500 thousand
D 500

2. This text explains a cause-and-effect pattern in the Hudson River ecosystem that began with the zebra mussel invasion. What effect did the zebra mussels have on the phytoplankton in the Hudson River?

A The number of phytoplankton in the river rose by a little.
B The number of phytoplankton in the river fell by a little.
C The number of phytoplankton in the river rose by a lot.
D The number of phytoplankton in the river fell by a lot.

3. Phytoplankton are one of the most important parts of the food web in the Hudson River. What evidence supports this conclusion?

A The population of phytoplankton dropped sharply soon after zebra mussels invaded the river.
B The decrease in phytoplankton caused a decrease in the river's zooplankton, fish, and native mussel populations.
C The decrease in phytoplankton meant that the river's turbidity, or cloudiness, decreased.
D Zebra mussels caused oxygen levels in the river to drop, partly by removing the phytoplankton that produce oxygen.

4. Which population was helped by the invasion of the zebra mussels?

A phytoplankton
B zooplankton
C water celery
D native mussels

5. What is the main idea of this text?

A In the years right after the invasion, zebra mussels evolved and adapted to the Hudson River ecosystem.
B In the years right after the invasion, zebra mussels caused a number of changes in the Hudson River ecosystem and food web.
C In the years right after the invasion, zebra mussels did not have a major impact on the Hudson River ecosystem or food web.
D At first, zebra mussels did not have any impact on the Hudson River ecosystem, but their impact increased over time.

6. Read these sentences from the text.

"In the years right after the invasion, phytoplankton fell by 80 percent. Zooplankton (which eat phytoplankton) **declined** by half. And the smallest zooplankton (called micro-zooplankton), fell by about 90 percent."

Based on these sentences, what does the word "**decline**" most nearly mean?

A to drop in number
B to fall over
C to increase
D to stay the same

7. Choose the answer that best completes the sentence.

With far less phytoplankton, the water got clearer. _____, rooted aquatic plants such as water celery increased by up to 40 percent.

A In contrast
B However
C As a result
D Similarly

8. What are two populations that decreased as an immediate result of the zebra mussel invasion?

_____

_____

_____

_____

9. One direct effect of the zebra mussel invasion was a decrease in the cloudiness of the water. How did this affect species in the Hudson River ecosystem?

10. Once scientists understood the short-term impact of the zebra mussel invasion, they started to wonder about the invasion's long-term impact on the ecosystem. Why might the Hudson River ecosystem look different many years after the zebra mussel invasion than it did just a few years after the invasion? Use evidence from the text to support your answer.