

Long-Term Monitoring of the Hudson River

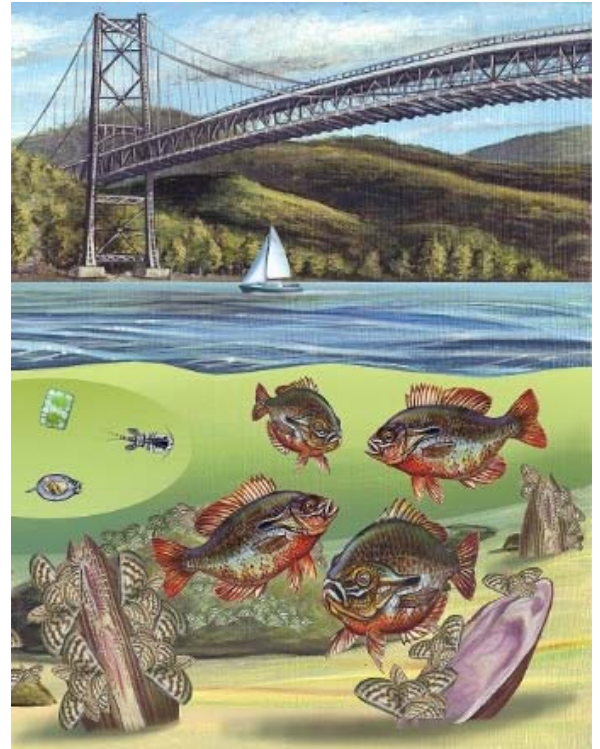
This article is provided courtesy of the American Museum of Natural History.

A puzzling reversal

In 2005, 14 years after the first sighting of zebra mussels in the Hudson River, Cary Institute scientists noticed an unexpected change in the river: zooplankton had returned to the same levels as before the invasion. Why weren't the zebra mussels eating as much zooplankton?

Then the scientists observed a change in the zebra mussels they were collecting from the river. Zebra mussels are grouped into three sizes: small (less than 10 mm), medium (10–20 mm), and large (more than 20 mm). While there were still many zebra mussels in the Hudson River, the overall number of zebra mussels was slightly declining, and they were on average much smaller. Populations of the largest — or oldest mussels — were declining greatly. Zebra mussels can live six or seven years, but now it seemed that most were dying after only one or two years. Adult zebra mussels had less than one percent chance of surviving a given year. The impact of the zebra mussel invasion was changing.

If there were fewer large zebra mussels, it made sense that there was more zooplankton. That's because large zebra mussels feed on bigger food particles like zooplankton. Smaller zebra mussels can eat only smaller particles like phytoplankton and bacteria.



WHAT HAPPENS NEXT?

What's the future of the Hudson River ecosystem now that zebra mussels have arrived? Only time and observation will tell.



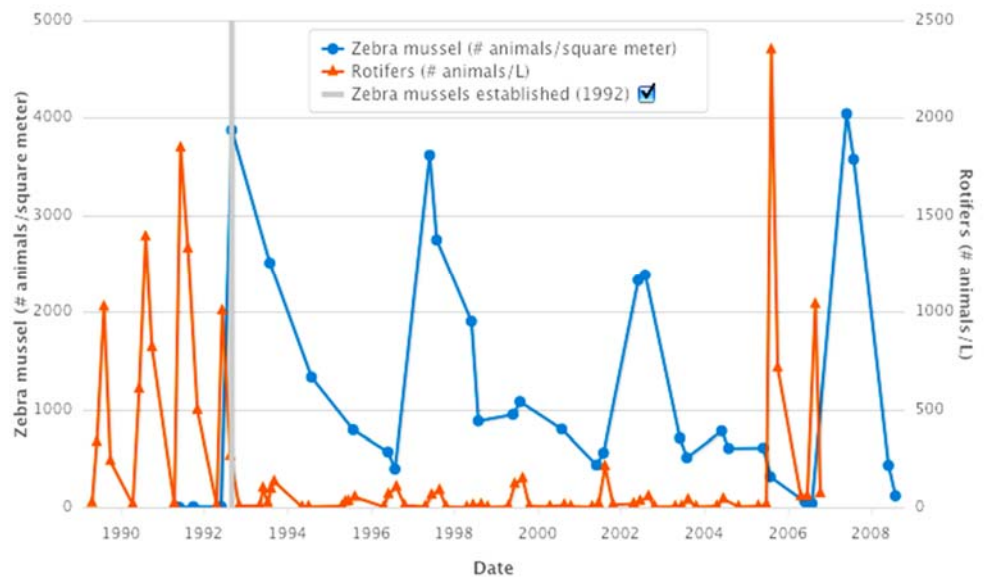
ZEBRA MUSSEL AVERAGE SIZES

These new effects rippled through the food web. As zooplankton rebounded, so did native mussels and clams. Scientists anticipate some fish species will rebound too as their food supply increases. Scientists don't know exactly what caused the decline in large zebra mussels, but they do know blue crabs were eating some of them.

More time, more data, more answers... and more questions

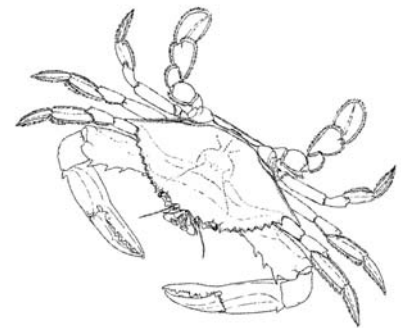
By monitoring several aspects of the Hudson River over many years, Cary Institute scientists are beginning to answer their original question: How might a zebra mussel invasion affect the Hudson River ecosystem? Early on during the invasion, zebra mussels survived, thrived, and had a huge impact on the ecosystem's food web — just as scientists had predicted.

Almost 20 years later, the number of zebra mussels has declined overall. And parts of the ecosystem, such as the number of zooplankton, native mussels, and clams, have started to increase. But is this the end of the story? Or have we just seen the first two stages of an invasion that might have three or four stages, or more?



ANALYZE THIS

This graph shows the amounts of rotifers (or zooplankton, shown with an orange line and triangles) and zebra mussels (shown with a blue line and circles) in the Hudson River over 20 years. Look at what happens in the last five years of the graphed data: what do you think is happening to the ecosystem?



Blue crabs are a bottom-dwelling predator and a chief consumer of bivalves and other crustaceans, including zebra mussels.

As their data grows, the scientists are able to track changes in the river — whether from pollution, weather, sea level rise, invasive species, or human activity – and to pose new questions. This broad approach also puts Cary scientists in a unique position to investigate future changes to the Hudson River ecosystem.

Name: _____ Date: _____

1. What unexpected change did scientists notice in the Hudson River in 2005?
 - A Zooplankton had returned to the same levels as before the zebra mussel invasion.
 - B The total number of zebra mussels in the Hudson River had returned to almost zero.
 - C The zebra mussels in the Hudson River had stopped eating all types of plankton.
 - D The average size of the plankton in the Hudson River was decreasing.

2. What caused the number of zooplankton in the Hudson River to increase?
 - A the decline in the number of phytoplankton
 - B the decline in the number of native mussels and clams
 - C the decline in the number of small zebra mussels
 - D the decline in the number of large zebra mussels

3. Read these sentences from the text.

“As zooplankton rebounded, so did native mussels and clams. Scientists anticipate some fish species will rebound too as their food supply increases.”

What conclusion can you draw about zooplankton based on this evidence?

 - A Zooplankton eat native mussels, clams, and some fish species.
 - B Zooplankton are similar organisms to certain mussels and clams.
 - C Zooplankton are an important food source for native mussels, clams, and fish.
 - D Zooplankton are a more important food source for most species than phytoplankton.

4. What relationship could scientists track in order to see whether or not blue crabs were the main reason that large zebra mussels have declined?
 - A the relationship between the size of zebra mussels and the size of blue crabs over one year
 - B the relationship between the average numbers of large zebra mussels and blue crabs over time
 - C the relationship between the average numbers of blue crabs and phytoplankton over time
 - D the relationship between the size of blue crabs and the size of zooplankton over one year

5. What is the main idea of this text?

- A The number of zooplankton in the Hudson River has unexpectedly gone up in recent years, so scientists expect the number of zebra mussels to increase as well.
- B The number of small zebra mussels in the Hudson River has unexpectedly gone down in recent years, so scientists have decided to change the focus of their studies on the Hudson River.
- C The number of large zebra mussels in the Hudson River has unexpectedly gone down in recent years, but scientists will continue to study the river to understand the invasion's changing impact.
- D The number of large zebra mussels in the Hudson River has gone down in recent years, but scientists predicted that change and are not surprised by it.

6. Read these sentences from the text.

"These new effects **rippled through the food web**. As zooplankton rebounded, so did native mussels and clams. Scientists anticipate some fish species will rebound too as their food supply increases."

What does the author mean by the phrase "**rippled through the food web**"?

- A completely changed the relationships in the food web
- B caused harm to other species in the food web
- C did not impact other parts of the food web
- D had effects on other parts of the food web

7. Choose the answer that best completes the sentence.

_____ zebra mussels can live six or seven years, now it seemed that most were dying after only one or two years.

- A For example
- B Since
- C Because
- D Although

8. What happened to different living things in the Hudson River ecosystem almost 20 years after the zebra mussel invasion? Make sure to mention the changes in at least three populations in your answer.

9. What does the number of zooplankton in the Hudson River show about the large zebra mussels in the river? Use evidence from the text to support your answer.

10. One question that scientists have not yet answered is what caused the number of large zebra mussels to decline. How might tracking different parts of the ecosystem over a long time help scientists to answer this question?
