In this activity, you will compare data collected by scientists in the years before and after the arrival of the zebra mussels. From the data, you will begin to build a picture of how the ecosystem has changed.

GUIDING QUESTION

What do the scientific data tell you about how the Hudson River changed after the introduction of the zebra mussel?

MATERIALS

For each pair of students

1 computer with Internet access

PROCEDURE

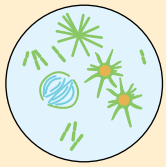
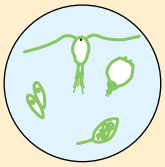
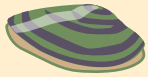
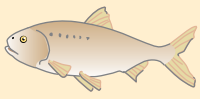
1. Visit the *SEPUP Third Edition* Ecology page of the SEPUP website at *www.sepuplhs.org/middle/third-edition* for the Effects of an Introduced Species activity. Watch the video clips, *The Problem* and *Observation*.

Collecting Data

To study the Hudson River ecosystem, scientists collected data on abiotic factors, such as the water's temperature, cloudiness, pH, and oxygen levels. The scientists also collected data on biotic factors, including measuring the populations of microscopic organisms, fish, and aquatic plants. To study the whole river, they chose six key locations where they measured several variables. They also used the transect method to collect water samples every 2–4 km along a 170-km stretch of the river between the six key locations. At that time, no zebra mussels lived in the river.

In May 1991, a few years after zebra mussels were first found in the Great Lakes, the mussels appeared in the Hudson River. Based on what scientists already knew about the Hudson's water chemistry, its river bottom, and other conditions, they predicted that zebra mussels would invade the river. Within a year, scientists estimated that the zebra mussel population had reached 500 billion! If you had a huge balance scale and put the Hudson River zebra mussels on one side, they would outweigh all the other consumers in the ecosystem combined—fish, zooplankton, worms, shellfish, and bacteria.

3. Your task is to help scientists figure out how the zebra mussels have affected the river ecosystem. Use the following table to choose three factors to investigate. Be sure to choose factors that you think zebra mussels might affect.

Biotic factors		***Abiotic factors***
	**Phytoplankton:** *These tiny drifting organisms use photosynthesis to make food. Scientists filter plankton from the water and measure the amount of chlorophyll they contain to estimate the amount of phytoplankton.* **Graph parameter:** *Chlorophyll a*	**Water temperature:** *Temperature affects an organism's metabolism—the internal chemical reactions that affect its health and growth.* **Graph parameter:** *Temperature*
	**Zooplankton:** *These tiny animals drift in open water, feeding on phytoplankton. Scientists measure their abundance by filtering river water through mesh nets.* **Graph parameters:** *Rotifers, copepods,* Cladocera	**Dissolved oxygen:** *Oxygen dissolves in water. Both producers and consumers (like zebra mussels) take up oxygen during respiration. Producers also give off oxygen.* **Graph parameter:** *Dissolved oxygen*
	**Freshwater mollusks:** *Mollusks, such as clams, mussels, and oysters, feed by filtering food. Native mollusks in the Hudson River include Unionidae and Sphaeriidae, which eat bacteria and phytoplankton.* **Graph parameters:** Unionidae, Sphaeriidae	**Water clarity:** *Scientists use a Secchi disk to measure how clear water is. They lower the disk into the water until they can no longer see the pattern on the disk's surface. The clearer the water, the greater the depth at which scientists can see the pattern.* **Graph parameter:** *Secchi depth*
	**Watershed nutrients from organic matter:** *Organic particles from soil, dead leaves, and other materials wash into the river from the watershed (the land around the river). This organic matter feeds many organisms, especially bacteria.* **Graph parameters:** *Bacterial abundance, bacterial production*	**Suspended solids:** *The solid particles suspended in water affect its clarity and quality. These particles can be both biotic (like phytoplankton) and abiotic (like silt and clay). Zebra mussels consume huge amounts of biotic suspended solids, clearing large bodies of water.* **Graph parameter:** *Total suspended solids*
	**Fish:** *Fish eat zooplankton, invertebrates, or other fish.* **Graph parameters:** *Alosa (pelagic fish),* Centrarchidae *(littoral fish)*	

4. Develop a testable question and a prediction for how each factor you selected will change after the zebra mussels' arrival in the river. Write down why you chose these factors and your prediction for each factor.
5. Go to the link on the Ecology page of the SEPUP website. Select "Graph the Data."
6. You will examine data from the Kingston location. Select "Over Time," and use the map to choose the Kingston location.
7. Set the first parameter to "Zebra mussel," and set the second parameter to one of the factors you chose in Procedure Step 3.
8. Examine the graph prior to the arrival of the zebra mussel in 1991 and afterward, and record your findings.
9. Repeat this process for each of the other two factors you chose.

ANALYSIS

1. For each factor you examined, do the data show stability or change in the Hudson River ecosystem? Support your claim with evidence and reasoning.
2. In Procedure Step 4, you made predictions about how each of the three factors would be affected by the introduction of the zebra mussel. Describe whether the data supported your predictions.
3. How did the introduction of the zebra mussel change the Hudson River ecosystem?
4. Your observations covered data that spanned from a few years before to over 20 years after the zebra mussel arrived in the Hudson River. Predict what the data might show in the next 20 years. Explain the reasons for your prediction.