Graphing Zebra Mussel Data

Time: One 2-hour lab period.
National Benchmarks: Benchmarks 5A: Diversity of Life; 5D Interdependence of Life; 5E: Flow of Matter and Energy; 9B:Symbolic Relationships; 9D:Uncertainty; 12B:Computation and Estimation; 12D:Communication Skills; 12E:Critical-Response Skills.
National Science Content Standards: *Science as Inquiry: A*; *Life Science: C*: Biological Evolution; The Interdependence of Organisms; Matter, Energy, and Organization in Living Systems; *Science and Technology: E:* Abilities of Technological Design; Understandings about Science and Technology; *Science in Personal and Social Perspectives: F:* Population Growth; Natural Resources: Environmental Quality; Natural and Human-induced Hazards; Science and Technology in Local, National, and Global Challenges
New York State Standards: 1, 2, 3, 4, 5, 6, 7

Objective: Students will know how the zebra mussel changed the Hudson River, and be able to explain their answer based on a graph.

Lesson Outline:
1. Students will discuss the possible impacts of zebra mussels on the Hudson river
2. Students will graph zebra mussel data
3. Students report results and discuss

Materials:
-Copies of the lab handout
-computers with Microsoft Office Excel or graphing paper

Engagement: Show students pictures of zebra mussels and the native unionid mussels. Ask: What do you know about the zebra mussel invasion? Remind students of the date of the invasion, which was in 1991 in the Hudson River. If students haven't done the introduction to the invasive species lesson, use images from that powerpoint to pique interest. Ask what they think happened to the native mussel population, and the population of plankton. Record their hypotheses on the board.
Exploration: If possible, each student should be able to work at his/her own computer. If no computers are available, or you'd like the students to graph by hand, another version of the worksheet is available with the data. They should have familiarity with Excel (use the Excel tutorial if necessary). A third option is available which has the pre-made graphs embedded in the worksheet. Explain the objectives of the lab and provide them with a copy of the instructions, making sure they have been able to find their way to Excel. Encourage the students to ask for help when they get stuck and to show you their results and graphs during the exercise. One common mistake occurs when they are asked to highlight the second set of data points that they want to graph. Many students include the title, when only the data points should be highlighted. They should also be shown how to name and save their graphs.

Students will make two sets of graphs, after reading about how scientists have collected the data in the Hudson River. The first set of graphs will show students how phytoplankton and

zooplankton populations have changed in response to the zebra mussel invasion, and the second set of graphs will look at water chemistry and transparency.

Explanation: Zebra mussels were first detected in the Hudson in 1991, and by 1992 they had spread throughout the freshwater and slightly brackish parts of the estuary. By this time, they had a biomass greater than the combined biomass of all other consumers (fish, zooplankton, zoobenthos, bacteria) in the river. The mussels filter the water about once every four days (all the water in the Hudson!). Native mussels, one of the most rapidly declining animal groups in the U.S., are the largest group of federally listed endangered or threatened invertebrates. Of nearly 300 species of mussels in North America, 13 are considered extinct and 57 are designated federally endangered or threatened species. In the Hudson, their major competitor is the zebra mussel. Populations of phytoplankton and small zooplankton fell drastically, which extends up the food web: diatoms have decreased, open water fish species suffered, while those living in the shallows have prospered. Cladocerans and copepods have not decreased, because they are too large for zebra mussels to eat. Water clarity and dissolved nutrient levels have increased. However, it is difficult to see the increase in water quality without looking at freshwater flow. Students should be encouraged to think about how other factors may regulate the changes in the river, besides the zebra mussels. Dissolved oxygen levels have decreased as well. Besides the ecological impacts, zebra mussels have also caused economic damage in the Hudson. They attach to water intakes, boat hulls, and other submerged objects. Estimates for zebra mussel damage in the Hudson ranges from $100,000 to $1million per year.

Extension: Students can research the possible causes of the fluxes in the zebra mussel population, or the impact of the reduced zooplankton numbers of the rest of the food web. Students could also make additional graphs using the other data provided.

Evaluation: Evaluate students' graphs, and their answers to the questions.

Comments: