

## Water Chestnut Graphing Activity

**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 understand the impacts of water chestnut on the Hudson River and be able to explain their answers based on a graph.

### Lesson Outline:

1. Students discuss possible impacts of water chestnut invasion
2. Students graph data on water chestnut
3. Students report and discuss results

**Materials:** Copies of the lab handout, computers with Microsoft Office Excel, photos of water chestnut (provided).

**Engagement:** Show students pictures of water chestnut and the native water celery plant. Ask: What do you know about the water chestnut invasion? View aerial photos of the water chestnut beds. Ask what they think happened to the native water celery population, and the impacts of the changes on different factors such as dissolved oxygen, fish populations, etc. Record their hypotheses on the board.

**Exploration:** If possible, each student should be able to work at his/her own computer. They should have some familiarity with Excel (use the Excel tutorial if necessary, in the Hudson River Ecosystem module). 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.

**Explanation:** Water chestnut is an annual plant that consists of floating leaves that are attached to the sediment by a long, tough stem. The plant produces an edible nut that is hard and spiny on the outside, and can remain viable for a decade or more. Water chestnut was introduced to North America in the late 19<sup>th</sup> century by a well-meaning botanist who thought the plant was beautiful and useful as potential wildlife food. The

chestnut quickly escaped the lakes where it was introduced, becoming a nuisance in the Hudson in the 1950s. It prefers slow-moving water up to 5m deep, and once established it forms dense, impenetrable stands of roots that even a kayak can't get through.

There are a few problems with the water chestnut. First, because of the thick beds that it forms, it's an obstacle for boaters and people who want to use the river recreationally. It has displaced native aquatic plants, changing the underwater habitat for fish. Because the plant's leaves cover the water surface, blocking out sunlight, oxygen levels are reduced beneath plant beds. The roots and stems remove oxygen from the water to support respiration, while the photosynthesis that takes place happens only above the water's surface. The water actually becomes anoxic (oxygen-free) during low tide, becoming replenished only when the tides change.

There may also be some positive aspects related to the water chestnut, although many of these are still being investigated. It may provide a good habitat for invertebrates, some studies show higher fish diversity in the water chestnut, and it removes nutrients from the water. There have been attempts to eradicate the plant, but, it is now more abundant than it has ever been.

**Extend:** If students have extra time, they can graph other variables or do research to try and explain the reason behind the changes.

**Evaluate:** Students will submit their graphs and answer the related questions.

**Comments:**