Pollution and the Long Island Sound Food Chain

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INTRODUCTION:

The challenge for me was to have students inquire about the Long Island Sound (LIS) ecosystem and to "bring the Sound to them" in an exciting and engaging way. The State Standard 6.4 - *Water moving across and through earth materials carries with it the products of human activities*, gives us the opportunity to investigate the Long Island Sound, the organisms that live there, and how pollutants affect the organisms which eventually affect humans as they eat the organisms from LIS. We decided to use the pollutant MERCURY as a focus for this study, and to work with faculty in the Department of Biological and Environmental Sciences at WestConn, who are involved in research in this area. At WestConn, we have access to the laboratory facilities and training, and instrumentation that make this approach possible.

LEARNING GOALS:

1 Students will learn that MERCURY is a pollutant that accumulates in the food chain of LIS.
2 Students will understand the levels of the LIS food chain and how pollutants such as mercury accumulate in the ecosystem.
3 Students will improve their ability to think critically and quantitatively and use the scientific method of inquiry.

LEARNING STRATEGIES:

1 Students will conduct a "hands-on" investigation of mercury pollution in the organisms of LIS.
2 Students will develop and test hypotheses to explain how pollutants move through the Long Island Sound's food chain.
3 Students will collect data on the mercury levels of the organisms from the LIS.
4 Students will analyze the results of the data and come to conclusions about the safety of the organisms in LIS as food for human consumption.

METHODS:

Day 1: On out first day we started with a quote from Terry Becker, from The Soundkeeper, to **Engage** the students in the inquiry process.
"Fishable and swimable, that's what our waters should be. That is what our birthright is: a healthy useable aquatic environment and what the law requires it to be."
After discussing the quote with particular emphasis on mercury as a pollutant, we observed samples collected from LIS, discussing the role of each and its place in the food chain. These organisms were collected during the summer of 2006 (stored frozen) to be used in the classroom during the school year. Students in groups of 3-4 planned a scientific investigation to find out if mercury had accumulated in the food chain. Hypotheses were developed, a list of available materials was presented, and a procedure to follow for the following day was put into place. *Safety:* gloves were used during the investigation.

Day 2: Students came in ready **Explore** the organisms by measuring organism samples (less than one gram) to be dried and measured for testing in the mercury analyzer at WestConn. Teachers had prepared and analyzed samples at WestConn beforehand, so that the data would be immediately available for students to evaluate.

STUDENT ANALYSIS:

The mercury levels did increase through the food chain as most students predicted except for the red algae. The red algae had a larger amount of mercury than the largest fish sample. This was confusing for the students and we came up with some ideas on why it happened. The students thought that a follow up experiment should be to test for mercury in red algae in different areas of LIS to see if mercury was consistently high in all red algae or in just the sample we had.

Day 3: The next time we met we began to **Explain** about mercury in fish and Connecticut's concerns about it and other contaminants. The students became concerned when they heard about mercury in tuna and the advisory of only one to two meals of tuna per week. Many of them knew students who have eaten tuna every day at lunch. They decided to **Elaborate** on this information by making posters for the cafeteria to let the students know these facts. The posters were made and displayed.

DID THE PROJECT MEET MY GOALS?

•The project not only met my learning goals but far exceeded them. The students did plan an experiment to analyze the mercury in the organisms in LIS and they came up with some good conclusions. When the red algae did not fit into the concentrations of mercury in the food chain they came up with a good follow up experiment for finding out why.
•As we discussed Connecticut's advisory on eating fish from LIS and other areas the students saw connections to their own lives. Making posters to warn others of the mercury in tuna moved this project to a new level.
•We also have the opportunity to continue our collaboration with WestConn. For example, students may choose to pose questions about levels of mercury in other types of foods or in different brands and types of tune. Or, they may wish to further investigate food chain effects in the ecosystem.

SAMPLES OF STUDENT WORK:

Student hypotheses were varied. Some thought the small fish had the most mercury or the sludge, but most of the students thought it would be the large fish or the crabs because they were higher on the food chain.
The student's conclusions resulted in confusion about the red algae because of its high mercury levels and a need for a follow up experiment to see why the red algae had such a high level of mercury. When they removed the red algae from the list they could see the mercury levels rising in the organisms from the sea lettuce to the large fish which proved that the mercury levels did increase through the food chain.

REFERENCES:

Fish Toxins Initiative (www.soundkeeper.org)

State of Connecticut Dept. of Public Health, "If I Catch It, Can I Eat It?" (www.state.ct.us/dph)

Long Island Sound, Watershed Profile (www.epa.gov)

WestConn Institute for Science Teacher Research home page, (www.wcsu.edu/biology.wistr_home.html)

Great science begins with great science teachers!
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