NOAA Teacher AT Sea Fisheries Lesson Plan
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Activity Title: Investigating the Health of Fisheries in Long Island Sound

Subject (Focus/topic): Environmental Science/Ecosystems

Grade Level: 6th – 8th

Average Learning Time: 3 weeks

Lesson Summary (Overview/Purpose): Students will collect and analyze data about the physical parameters of Long Island Sound and the population of different species of fish that live there to determine the overall health of the fisheries in the Sound. Students will experiment with different abiotic and biotic factors that can affect the quality of water. Students will research how human activity affects the organisms of Long Island Sound and what can be done to protect this ecosystem.

Overall Concept (Big Idea/Essential Question): How does the physical environment affect the growth of organisms?

Specific Concepts (Key concepts)

1. Long Island Sound is an estuary which has a high level of biodiversity.
2. Different factors such as temperature, ph, salinity, sunlight, amount of nutrients and dissolved O2 affect the growth of marine organisms.
3. Human activities on land affect the quality of water in Long Island Sound.

Focus Questions (Specific Questions):

1. What type of fish live in Long Island Sound?
2. What other types of organisms live in Long Island Sound?
3. What do fish and other organisms in the Sound need to survive?
4. What conditions do fish need to be healthy?
5. How have fish adapted to live in Long Island Sound?
6. How has the water quality of Long Island Sound changed?
7. How does human development and activities along the shore of Long Island Sound affect the organisms that live there?
8. How do human development and activities inland affect life in the waters of Long Island Sound?

Objectives/Learning Goals:

1. Students will research the fish and other types of organisms that live in Long Island Sound and their requirements for growth.
2. Students will design experiments testing the effect of different substances on the amount of dissolved oxygen in water and relate this information to the effects of human activities on ocean water.

3. Given a list of websites, students will be able to obtain and analyze relevant data on the populations of fish and on physical parameters of Long Island Sound over a period of time.
4. Students will be able to determine trends in the health of a fishery over a period of time and write a report.
5. Students will research ways to help protect the Long Island Sound ecosystem and develop a Presentation.

Background Information: Students need to have a general knowledge of ecosystems and food webs. Students also need to understand that many aquatic organisms are able to get oxygen out of water.

Common Misconceptions/Preconceptions:

1. What people do away from the ocean has no effect on the ocean.
2. Only commercial fish have any importance to humans
3. Estuaries are not valuable areas, only breeding places for mosquitoes and other bugs

Materials:
A variety of aquaria or large glass jars or beakers
Water quality testing kit, including tests for dissolved O2, salinity, pH, N, and temperature
Instant Ocean or a variety of salts
A variety of fertilizers
Acids – lemon juice, vinegar
Water plants
Fish or other small aquatic animals
Different light sources
Potting soil
Gravel
Sand
Straws (to blow CO2 into water)

Technical Requirements: Computers with internet access, smart board or projector

Teacher Preparation:

1. Teacher must be familiar with the common organisms of Long Island Sound. The teacher must also be familiar with standard water quality testing. There must be ample space to store the water quality experiments for 2 weeks.

Key words:
Estuary
Hypoxia
Biodiversity
Biotic
Abiotic

Pre-Assessment Strategy/Anticipatory Set: Students will create a chart with three columns. One column will be titled Vertebrate Animals, the second column Invertebrate Animals and the third column Plants. Students will then list all of the organisms that they are familiar with that live in Long Island Sound. They will then put an asterisk next to those they have personally seen.

Lesson Procedure:

Day 1 (80 minutes): What is the Long Island Sound (LIS) ecosystem like?

1. In their journals, students create charts of organisms of Long Island Sound as described in the Pre-Assessment strategy.
2. Whole class discussion of lists. If there is disagreement about whether an organism should be included, a question mark will be placed next to its name.
3. Students watch the power point presentation "Living Treasures: The Plants and Animals of Long Island Sound" by Nancy Balcom, Connecticut Sea Grant for Long Island Sound Study in their groups. Students will add to the chart all of the organisms that live in Long Island Sound.
4. Students count the number of different species that live in Long Island Sound and write a short paragraph describing the level of biodiversity of the Sound.

Day 2 (80 minutes and ongoing research for 2 weeks): How do scientists monitor water quality?

1. Discuss factors that all these organisms need to survive (appropriate temperature range, pH range, salinity, and amount of dissolved O2).
2. Introduce the term hypoxia and then have the students read the article from CT DEP on Water Quality Monitoring in Long island Sound: http://www.ct.gov/dep/cwp/view.asp?a=2719&q=325534&depNav_GID=1654
3. Students answer questions on associated worksheet.
4. Go over information together.
5. Student groups begin real time data project on water quality of Long Island Sound. Students will collect data on water quality from the University of Connecticut's MYSound website: http://mysound.uconn.edu/index.html on at different stations in Long Island Sound for 2 weeks. Student groups will then graph, analyze and compare data from the different stations to determine the overall water quality of Long Island Sound within that 2 week period.
6. Students groups will write up a conclusion from their data.

Day 3 & 4 (80 Minutes each day): What affects the amount of dissolved O2 in water?

1. Student groups create a variable wheel of factors that affect the amount of dissolved O2 in water.
2. Teacher demonstrates how to test for dissolved oxygen.
3. Student groups choose one variable with which to experiment.
4. Students design experiments. Teacher approves.
5. Students conduct experiments and gather data.
6. Students write up results in a lab report.

Day 5 (80 minutes): How healthy are the Fisheries in LIS?

1. Students will work in groups of 6 to research 6 important fisheries species in LIS; Bluefish, Striped bass, Summer Flounder, Winter Flounder, Tautog, and Scup. Five of these species: Bluefish, Striped Bass, Scup, Summer Flounder, and Tautog comprised about 90% of the estimated total and creeled catch of recreational fishermen in 2008. They will use information from the following website to graph the change in the catch amounts of these six fish from 1981to 2008:
   "A study in Marine Recreational Fisheries" by the State of Connecticut Department of Environmental Protection
   http://www.ct.gov/dep/lib/dep/fishing/general_information/f54r2008report.pdf

2. Students will then compare graphs of the 6 species and write a report on the trends that they see.
3. Student groups will share their findings with the class.

Day 6 & 7: (80 minutes): What can we do to protect Long Island Sound?

1. Students go to the Long Island Sound Study website: http://longislandsoundstudy.net/get-involved/what-you-can-do/ to learn about what students can do to help protect the Sound.
2. Student teams pick one aspect of protecting the sound to research and create a presentation. Students choose from: Around your home, Around your backyard, Around the Sound, Around your school, Curbing polluted stormwater runoff, or volunteer opportunities
   a. Students will have their choice of format – poster, power point, wiki, book, pamphlet, song, skit, etc.
   b. Presentation must include the problem affecting Long Island Sound and the different actions people can take to remedy it.
3. Students present to 4th graders (Fourth grade also studies the ocean)

Assessment and Evaluation:

Day 1 – Informal – chart of organisms that live in LIS, paragraph about LIS biodiversity
Day 4 – Graded laboratory report on dissolved oxygen experiment
Day 5 - Graded Graphs and report on the population trends for fisheries in LIS
Day 7 – Graded Presentations
Day 7 – Graded report on water quality in LIS over 2 weeks period

Standards:
National Science Education Standards Addressed:

All students should develop abilities necessary to do scientific inquiry

- Identify questions that can be answered through scientific investigations
- Design and conduct a scientific investigation
- Use appropriate tools and techniques to gather, analyze, and interpret data
- Communicate scientific procedures and explanations
- Use mathematics in all aspects of scientific inquiry

All students should develop understandings about scientific inquiry

- Different kinds of questions suggest different kinds of scientific investigations. Some investigations involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.
- Mathematics is important in all aspects of scientific inquiry.
- Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations

Populations and Ecosystems

- A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.
- The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Populations, Resources, and Environments

- When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.
- Causes of environmental degradation and resource depletion vary from region to region and from country to country.

Ocean Literacy Principles Addressed:

1e. Most of Earth's water (97%) is in the ocean. Seawater has unique properties: it is saline, its freezing point is slightly lower than fresh water, its density is slightly higher, its electrical conductivity is much higher, and it is slightly basic. The salt in seawater comes from eroding land, volcanic emissions, reactions at the seafloor, and atmospheric deposition.

1g. The ocean is connected to major lakes, watersheds and waterways because all major watersheds on Earth drain to the ocean. Rivers and streams transport nutrients, salts, sediments and pollutants from watersheds to estuaries and to the ocean.

2c. Erosion – the wearing away of rock, soil and other biotic and abiotic earth materials – occurs in coastal areas as wind, waves, and currents in rivers and the ocean move sediments.

5a. Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.

5d. Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.

5f. Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, pressure, substrate and circulation,

ocean life is not evenly distributed temporally or spatially, i.e., it is “patchy”. Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is considered a desert.

5i. Estuaries provide important and productive nursery areas for many marine and aquatic species.

6d. Much of the world’s population lives in coastal areas.

6e. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, non-point source, and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

6g. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

Connecticut State Standards Addressed:

6.2 An ecosystem is composed of all the populations that are living in a certain space and the physical factors with which they interact.

6.4 Water moving across and through earth materials carries with it the products of human activities.

Grades 6-8 Core Scientific Inquiry, Literacy and Numeracy - *How is scientific knowledge created and communicated?*

Scientific Inquiry

- Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena.
- Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.
- Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists.

Scientific Literacy

- Scientific literacy includes speaking, listening, presenting, interpreting, reading and writing about science.
- Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media.

Scientific Numeracy

- Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

Additional Resources:

1. CT DEP on Water Quality Monitoring in Long island Sound http://www.ct.gov/dep/cwp/view.asp?a=2719&q=325534&depNav_GID=1654
2. University of Connecticut's MYSound website: http://mysound.uconn.edu/index.htmlon
3. "A study in Marine Recreational Fisheries" by the State of Connecticut Department of Environmental Protection **http://www.ct.gov/dep/lib/dep/fishing/general_information/f54r2008report.pdf**
4. Long Island Sound Study website: http://longislandsoundstudy.net/get-involved/what-you-can-do/

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