PROJECT O*CEANOLOGY*

Introduction to Oceanography: NGSS Alignment

Overview

This 2.5 hour boat program is one of our most popular and versatile offerings. Students will literally and figuratively get their hands wet as they investigate the living and non-living components of Long Island Sound! Your students will study living organisms in the stern of the boat by hauling a trawl net, doing a plankton tow, pulling a lobster pot, and (on some trips) sorting through a mud grab. In the bow of the boat, they'll learn how to use a wide range of oceanographic equipment as they investigate physical and chemical aspects of the water column and the bottom. We'll save their data as part of our flagship environmental monitoring program. Project Oceanology students have been collecting data on the living and non-living components of ecosystems in Long Island Sound and Fishers Island Sound for more than thirty years, and our data are used by scientists at the University of Connecticut and elsewhere to understand long-term environmental trends.

To maximize the educational benefit for students, we strongly recommend following up with our Data Analysis activity, freely available to all teachers that bring a group for the Introduction to Oceanography trip. The Data Analysis activity can take place in the Project Oceanology computer lab immediately before or after the trip, or in the regular classroom after students have returned home.

Performance Expectations

HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Students will pull a lobster pot, and discuss how and why the lobster population in Long Island Sound has changed over recent decades. Students will gather empirical evidence about the environmental conditions in Long Island Sound, and identify how those conditions change along an environmental gradient (depth). They will also capture organisms from different depths. Students will discuss the potential for long-term and short-term environmental change, and how different organisms are adapted for different environmental conditions associated with depth.

HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Students will gather empirical evidence about the physical and biological components of Long Island Sound, and discuss how these components are related.

Science and Engineering Practices

Developing and using models

Students will work collaboratively to use their own data to construct a vertical profile of the water column, showing how each variable changes with depth.

Analyze and interpret data

Students will share their findings with the group, and then work together to analyze the results and make an assessment of whether the ecosystem is healthy.

Using math/computational thinking

Students will use simple geometry and algebraic thinking to calculate the depth of sea floor based on the amount of line they let out for trawling. They will also read scientific instruments and then perform calculations to characterize the physical environment.

Engaging in argument from evidence

Students will gather empirical data on the physical and biological aspects of Long Island Sound, use this information to make an assessment about the health of the ecosystem, and then defend their assessment using the evidence that they gathered.

Crosscutting Concepts

Patterns

Students will examine organisms from Long Island Sound and identify similarities and differences based on physical appearance and behavior. We will discuss how these morphological and behavioral patterns relate to how the organisms are adapted to their environments. Students will also look for patterns across environmental gradients (particularly depth) in the physical data they collect.

Cause and Effect: Mechanism and Explanation

Students will pull a lobster pot and learn about the decrease that has been observed in the Long Island Sound lobster population over the last few decades. They will propose potential explanations for this change, and discuss potential mechanisms. Students will also discuss the population biology of other organisms captured during the trip (varies by trip). Students will collect empirical evidence showing how several physical variables vary with depth of the water column, and then discuss why this occurs.

Scale, proportion, and quantity

Students will use calipers and/or rulers to measure organisms captured, and also discuss life in the ocean at different size scales (plankton vs. fish). Students will collect data using a variety of oceanographic equipment, and then use correct units, calculations, and conversions.

Stability and change

Students will collect empirical data on the physical characteristics of the water column, and investigate which variables remain constant with depth and which change. They will also discuss how populations of organisms in Long Island Sound have remained stable or changed over time.

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Disciplinary Core Ideas

LS2.A: Interdependent relationships in ecosystems. Organisms and populations are dependent on their environmental interactions both with other living things and with nonliving factors.

Students will gather empirical data on the living and non-living components of Long Island Sound, and discuss how they are connected.

LS2.C: Ecosystem dynamics, functioning, and resilience. Ecosystems are dynamic in nature; their characteristics vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

Students will gather empirical data on the living and non-living components of Long Island Sound, discuss how they are connected, and discuss how and why they may have changed over time.

Nature of Science

Scientific knowledge is based on empirical evidence

Students will gather empirical data on the living and non-living components of Long Island Sound, then use their information to assess the health of Long Island Sound.