Title: ***Coating Deepwater Coral with Sweets***
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Background Information

Deepwater coral reefs, aptly known as cold-water coral reefs, can be formed by the carbon created when bacteria biodegrade oil from natural seeps nearby. Oil spills can be easily devastating to coral reefs, ranging from the reefs at the surface of the water, directly subsurface, and even cold-water corals. The most recent and notable offshore drilling incident was the BP Deepwater Horizon oil spill which was responsible for releasing millions of barrels of oil into the Gulf of Mexico and the surrounding coast. Researchers have noticed that the cold-water coral population has been greatly impacted by this recent incident within the deeper depths of the Gulf of Mexico. Many times, the degree to which coral can be damaged depends on the range in oil densities and the physical attributes associated with these different densities (e.g., toxicity, smothering, etc.). Lighter oils have lower amounts of metals, are more mobile, and are more poisonous. Heavier oils have higher amounts of metals, have a thicker consistency, and will "smother" an area with greater ease.

Louisiana State Standards (Grade-Level Expectations)

SI GLE: Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
Pose questions that can be answered by using students' own observations and scientific knowledge (SI-E-A1)
Generate testable questions about objects, organisms, and events that can be answered through scientific investigations (SI-M-A1)
Describe how investigations can be observation, description, literature survey, classification, or experimentation (SI-H-A2)

SI GLE: Predict and anticipate possible outcomes (SI-E-A2)
Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
Describe how investigations can be observation, description, literature survey, classification, or experimentation (SI-H-A2)

SI GLE: Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (SI-E-A5) (SI-E-B4)

Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)
Identify and explain the limitations of models used to represent the natural world (SI-M-A5)
Use evidence to make inferences and predict trends (SI-M-A5)

SI GLE: Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)

SE GLE: Explain how the use of different energy resources affects the environment and the economy (SE-M-A6)

SE GLE: Give examples and describe the effect of pollutants on selected populations (SE-H-A11)

SE GLE: Determine the interrelationships of clean water, land, and air to the success of organisms in a given population (SE-H-C1)

SE GLE: Relate environmental quality to quality of life (SE-H-C2)

LS GLE: Analyze positive and negative effects of human actions on ecosystems (LS-H-D4) (SE-H-A7)

PS GLE: Differentiate between the physical and chemical properties of selected substances (PS-M-A3)
Classify changes in matter as *physical* or *chemical* (PS-H-D1)

Ocean Literacy Principles

Principle 4a: Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean.

Principle 5c: Some major groups are found exclusively in the ocean. The diversity of major groups of organisms is much greater in the ocean than on land.

Principle 5g: There are deep ocean ecosystems that are independent of energy from sunlight and photosynthetic organisms. Hydrothermal vents, submarine hot springs, and methane cold seeps rely only on chemical energy and chemosynthetic organisms to support life.

Principle 6b: From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.

Principle 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 (such as point source, non-point source, and noise pollution) and physical modifications (such as changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

Time Requirement

This activity is very simplistic in setup and cleaning afterwards. The teacher should separate 3 'tufts' of cotton candy on plates separately. Place the different types of 'oil' beside each plate. The time limit for this experiment depends on the teacher's choice (between 5-10 min to observe the amount of dissolved cotton candy by each 'oil').

Materials

Water in a squirt bottle
Syrup- medium thickness (e.g., maple syrup)
Honey in a squeezable container
Cotton candy
Medium sized plates (3)
Timer or stopwatch or clock

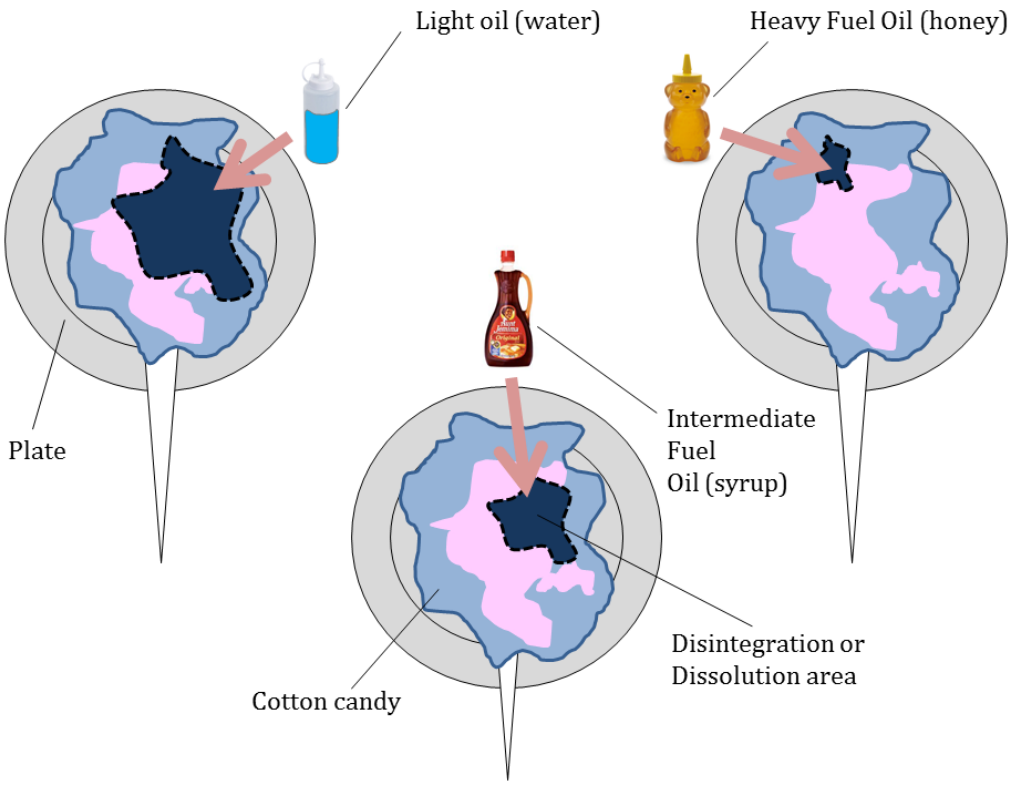
Lesson Description

Creating the Coating Deepwater Coral with Sweets experiment

1. Separate each parcel of cotton candy into three 'tufts'; one to be placed on an individual plate each.
2. Place the three 'oils' (i.e., water in a squirt bottle, medium syrup, honey in a squeezable container) beside those plates; there should be one 'oil' by each plate.
3. Allow students to squirt a gush of 'oil' on each cotton candy for 1-2 seconds; instruct them to choose three separate locations to squirt the oil. Try to keep each gush of 'oil' in a particular location on the cotton candy.
4. Time how long it takes each 'oil' to spread or disintegrate the cotton candy (e.g., 1-5 min). Ask them to estimate the amount of disintegration (e.g., ¼, 1/3, ½, 2/3, ¾, etc.) after the suggested time limit ceases and enter it on the sheet below.

Methodology

Students will be creating an oil spill on these 'cold-water corals' and observing which oil does the most damage. Water, syrup, and honey are supposed to imitate the viscosity of a light crude oil, intermediate fuel oil, and a heavy fuel oil. All are devastating to marine environments, but in different ways. Lighter oils are more toxic and expansive, while heavier oils do not spread as quickly, but are able to smother anything many things. Students should be able to determine how time may affect the rate of dissolution (of the cotton candy) and infer which 'oil' is more devastating to coral.


Light oil (water)
Heavy Fuel Oil (honey)
Plate
Intermediate
Fuel
Oil (syrup)
Disintegration or
Dissolution area
Cotton candy

Types of Oil			
Dissolution Area	Light Crude Oil (Water)	Intermediate Fuel Oil (Syrup)	Heavy Fuel Oil (honey)
1/4			
1/3			
1/2			
2/3			
3/4			
ALL			

Standard Evaluation (Student Deductions)

1. Which type of oil caused the most destruction to the cold-water coral? Why?
2. What was the relationship between the density of the oil and the size of the dissolution area?
3. Lighter oil is usually more toxic than heavier oils. Why?
4. Heavier oils have a greater 'smothering effect'. Why wouldn't lighter oils be able to 'smother' organisms?
5. If the syrup or honey were left on the cotton candy for an extended period, what do you think would happen?

The evaluation can be in the form of a test, essay, questions and answers worksheet, or any other mode of measuring retainment or comprehension of material.