Partnerships for Reform through Investigative Science and Mathematics

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Hawaii's Rocky Shore

Concepts
Organisms are adapted to the environment in which they live.

HCPS III Benchmarks
SC.1.1.1
SC.1.1.2
SC.1.5.2
MA.1.1.2

Duration
1 hour

Source Material
MARE Rocky Seashores

Vocabulary
Burrows
Crustacean
Echinoderms
Environment
Mollusk
Predator
Shelter
Substrate
Wave shock

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Hidden Animals

Summary

Students observe the effects of wave shock on animals living in three different seashore substrates: sand, gravel, and rocks. They will predict which substrate is safest for the hidden animals (i.e. offers the most protection). Students will collect and record data from this experiment. In the extended activity, they will make pie charts and interpret their results.

Objectives

- Students will make predictions (i.e. hypotheses) on which substrate provides the most protection based on its property.
- Students will test their predictions through experimentation.
- Students will learn basic data-collection skills using data sheets and data management by creation of simple pie charts.

Materials (per group of 4 students)

Enough substrate to fill a bin half-way (the three substrates are sand, gravel, and rocks)
3 bins (rectangular, 5 quart-size) for each type of substrate
One 5-gallon bucket(s) for water
10-12 plastic or rubber animals
1 Hidden Animals worksheet per student

Making Connections

Animals protect themselves against environmental hazards in different ways. Some demonstrate adaptation through behavior, such as seeking shelters when exposed to danger. Students may recall times at the rocky shore when they tried to remove an 'opihi from a rock and the animal in turn used its strong suction and muscular foot to adhere to the rock.

Teacher Prep for Activity

Purchase plastic or rubber animals for the experiment (alternately, you may opt to have students make their own seashore animals using recycled materials that will not fall apart when wet). Collect substrates from nearby beaches or purchase the substrates. Find an area outside of the classroom to run the experiment. Fill bins with substrates and bucket(s) with water. Also, be sure to photocopy worksheets.

Background

Animals utilize sand, gravel and rocks for shelter within their habitat. Among the three types of **substrates** we use in this lesson, in the natural **environment**, sand and rocks provide most protection, while gravel provides the least. Hence, the wave should have the least impact

on the animals that are hidden in the sand and larger rocks. In these cases, animals remain hidden and protected after the waves hit the substrates (**wave shock**). The gravel, which is neither as heavy as the rocks nor as compacted as the sand, is easily moved and dislodged by the waves.

The animals that hide in the gravel are brought to the surface, where they are exposed to further waves and predators. **Mollusks** such as snails, limpets ('opihi), clams, oysters and mussels have hard shells to protect themselves; therefore, they can live on the rocks where they are more exposed to waves and **predators**. **Crustaceans** such as crabs are more mobile, and they can be found hiding in the cracks between rocks or digging **burrows** in the sand. **Echinoderms**, such as sea urchins have tentacles with suction ends so they can adhere to rocks and are not easily removed from the substrate.

Procedure
1. Introduce the new vocabulary to the class. The use of props is helpful (for example, water to demonstrate wave shock, a rock to demonstrate shelter, photos of crustaceans, echinoderms, and mollusks- use www.arkive.com).
2. Present a scenario to the class: the seashore animals that students will be given need a place to hide from waves. Ask hypothetically, "which substrate will provide the most protection?"
3. Show the class 3 bins of substrates. Each bin is ¾ filled; one is filled with sand, one with gravel and the other with rocks.
4. Evenly divide the class into three groups. Each group is responsible for burying their animals in their respective substrate. Each student will be given one animal to bury.
5. Ask the class the following questions and compare the three kinds of substrates:
    ● Was it easy to dig in the bin?
    ● Can you easily see the animals hiding in the bin?
    ● Which substrate do you think will provide the most protection from crashing waves?
    Ask students to fill out the prediction part of the worksheet.
6. Bring the class and bins of substrates outside where you have the buckets of water set up. Line up the bins with enough distance from each other, and have the class gather in semicircle around the bins.
7. Dump the water directly and forcefully onto one bin. When things settled, have a volunteer to count the number of animals dislodged (now visible) by the wave. Record the number. Also note the number of the animals still safely hidden. Take the next bucket of water (or refill the same bucket) and repeat for the second bin, and then the third bin.
8. Return to the classroom and help students fill out the results section of the worksheet. Go through the results as a class. Ask students if the results match their hypotheses. Conduct the extended activity below in order to create pie charts.

Assessments
Worksheet completed

Math Extension Activities: Making Pie Charts
Some easy charts can be made using the data generated from this lesson. However, you may choose to cover this activity on a different day.

1. Organize data using a table. It is important to know the amount of both animals moved to the surface and safely hidden (see the following).

Example:

Substrate	Moved to the surface	Safely hidden	Total animals
Sand	2	4	6
Gravel	4	3	7
Rocks	3	4	7

2. Construct pie charts to summarize the results. This can be drawn on board or using Microsoft Excel on a computer during computer lab (if applicable). The purpose is to show students how to summarize data and read graphs. For example:

Gravel

43%

57%

- Safely hidden
- Moved to surface

Rocks

43%

57%

- Safely hidden
- Moved to surface
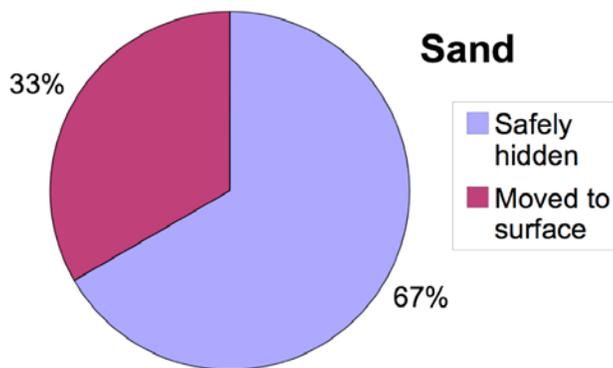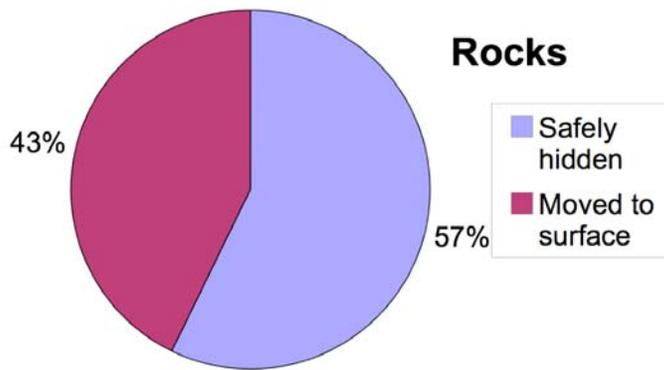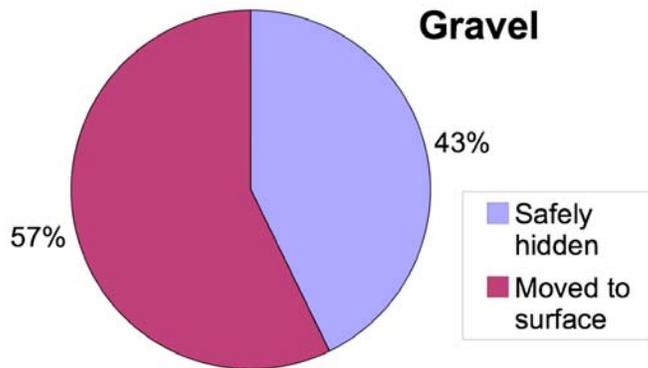
Here we summarized the proportions of dislodged animals and the animals that are safely hidden for each substrate. Gravel, for example, has more than half of its animals dislodged by the waves.

Student name: _____

Hidden Animal Worksheet

1) **Make a prediction**: which will protect best (circle your answer)?

SAND   GRAVEL   ROCKS

2) How many animals did the class hide in each bin?

SAND	GRAVEL	ROCKS

3) **What were the results?** Write down how many animals were **visible (not hidden)** after the wave.

SAND	GRAVEL	ROCKS

4) Now, which place is **the safest** for animals to hide? Why?