ESTIMATING THE POPULATION OF PENCILS AT YOUR SCHOOL

OVERVIEW

Students will use a random *quadrat* technique to estimate the number of pencils in their school. The technique is identical to the one used by scientists to estimate the population of plants and animals in a given area. The students will count the number of pencils within random one meter square sections of the classroom, and then extrapolate their findings to the entire school.

CONCEPTS

- Scientific inquiry includes observing, questioning, planning, and conducting investigations.
- Scientists can take a small sample to estimate the large population. This sampling technique can be applied to a variety of populations, including fish, kelp, urchins, flowers, trees, insects and pencils.

MATERIALS

For each group:
- 1 Posterboard
- Stapler and staples
- 1 Data sheet
- 1 Pencil

PREPARATION

Make, or have the students make, a square quadrat using the posterboard and the stapler. A quadrat is a one meter square that is used to monitor biological populations. From the posterboard, the teacher or the students can cut four strips, each one meter (39 in) long and approximately 5 cm (2 in) wide. Then, staple the strips into a square. Optionally, a sturdier quadrat can be made using four pieces of PVC pipe and four elbow joints to connect them.

Make copies of the data sheet for each group, and divide the class into research teams of five.

PROCEDURE

Engagement

It would be impossible for a biologist to count the exact number of sea urchins, for example, in and around a particular kelp forest. Using quadrats to estimate the population of a species of plants or animals is an important scientific technique. Quadrat sampling involves counting the number of items in a series of 1 meter squares. In this activity you'll count pencils as a simulation of counting sea urchins in a kelp forest.

Activity

1. Your team should randomly choose five locations to place your quadrat within your classroom.
2. At every randomly chosen location, each group should set your quadrat down, and count the number of pencils within your square. Make sure that you accurately record all of your data on
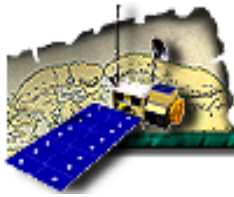
your data sheet. Remember that scientists face additional difficulties when they are counting animals: some animals have the tendency to move!
3. After all of your quadrat counts have been entered, complete the rest of the data sheet to estimate the number of pencils (sea urchins) in your school.
4. Discuss with your classmates the different information that you might gain by repeating this experiment each week throughout the year. At what times might you find fewer pencils in your quadrats? Are there any times during which you would not find any? If so, when? Are pencils an item that accurately reflects the "health" of your classroom "ecosystem"?

Explanation

To monitor seasonal and annual changes in population of different areas in an *ecosystem*, scientists establish and monitor sites that represent the range of *biogeographical* and *ecological* conditions found in an area. Selected sites should: 1) represent different aspects of geology, currents, wave action, etc; 2) have good access for researchers to monitor the site with relative ease; 3) represent the resources for that particular area; and 4) represent coverage of the zones to be monitored.

To monitor the health of a particular area in the ocean, there are a number of different methods that may be used. Population counts can be accomplished easily by using the quadrats. Quadrat sampling involves counting the number of items in a series of 1 meter squares, or sites. The number of plants or animals in each quadrat can be averaged to come up with idea of the overall population of the ecosystem. It is also possible to periodically monitor individual sites within the ecosystem to track changes over time.

EXTENSION

Take your students into the field to practice the quadrat sampling technique. You can locate a tidal area, a stream area, or even the playground. For example, you can test the playground concrete for overall "health" by estimating the population of cracks. Alternatively, you can expand your experiment and count the students on the playground.

Before sampling, make sure that the students research the type of ecosystem. This will give them a standard against which to measure their area. They should know the type and amount of plants or animals that is normally found in such an area.

LINKS TO RELATED CD ACTIVITIES, IMAGES, AND MOVIES

Activity *Describing Classroom Communities*
Activity *Dichotomous Keys*

VOCABULARY

biogeography   *ecology*   *ecosystem*
quadrat

SOURCE

Adapted from Long, Jennifer. *Science Television Student Curriculum.* Orange County Marine Institute. Dana Point, CA. 1993.

Name:_____   Date:_____

QUADRATS DATA SHEET

QUADRATS				
#1	#2	#3	#4	#5

Answer the following questions to estimate the number of pencils (sea urchins) at your school.

1. What is the average number of pencils per square meter sampled?   _____

2. How many square meters are there in your classroom?   _____

3. Estimate the number of pencils in your classroom.   _____

4. How many rooms are there in your school?   _____

5. Estimate the number of pencils in your school.   _____