

**TIME:** (1) 45-minute lesson

**SCIENCE PROCESS SKILL:** Predicting and inferring

**SCIENCE CONCEPT:** Population density can be determined by sampling.

**BENCHMARKS:**

Students should:  
 Know that, usually, there is no one right way to solve a mathematical problem; different methods have different advantages and disadvantages.

Know that results of similar scientific investigations seldom turn out exactly the same. Sometimes this is because of unexpected differences in the things being investigated, sometimes because of unrealized differences in the methods used or in the circumstances in which the investigation is carried out, and sometimes just because of uncertainties in observation. It is not always easy to determine the cause for different results.

Keep records of their investigations and observations and not change the records later.

**OBJECTIVE:** Students will calculate the number of zebra mussels in a given area.

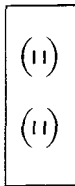
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### WHAT YOU OUGHT TO KNOW



Zebra mussels attach to hard surfaces in lakes and rivers. They attach to rocks, docks, boats, and even to each other. This activity will engage the students in a sampling technique currently being used by scientists to estimate the number of zebra mussels in rivers and lakes. The students will engage in similar sampling techniques by taking samples of gravel (zebra mussels) from a cookie sheet (lake/river bottom), and then using this information to calculate the number of pebbles in the entire pan.

When sampling zebra mussel populations in rivers such as the Illinois River, Illinois Natural History Survey divers take large metal square frames to the bottom of the river. In the dark water, they push the heavy metal square very carefully into the river bottom. Then they carefully remove everything from inside the dimensions of the metal square and place the samples in collecting bags before bringing them to the surface. At the surface or in the laboratory, the scientists count the organisms. Several more samples are taken; the surface area of the entire location is measured; and the population for that large area is determined.



### WHAT'S THE CONNECTION??

#### TO LANGUAGE:

The students can write directions for using sampling to determine the number of zebra mussels in a lake or river.

#### TO MATHEMATICS:

The students can determine the number of zebra mussels it would take to cover the gym floor, cafeteria wall, classroom floor, or playground area.

#### TO ART

Students can construct a zebra mussel colony using macaroni shells (2 sizes) to represent their sample.

#### TO SOCIAL STUDIES:

The students will brainstorm ways in which sampling can be used by business, industry, and the government to control the zebra mussel population.

"SAMPLING"  
"ESTIMATE"



## WORDS OF WISDOM

Area, estimate, extrapolate, population, population density, predict, quantify-sampling (see also glossary on page 7)

## RESOURCES AT THE READY

Set up four lab stations. Each group of students will rotate from station to station.

Each group will need:

Cookie pans or other flat container  
(4 total in trunk)

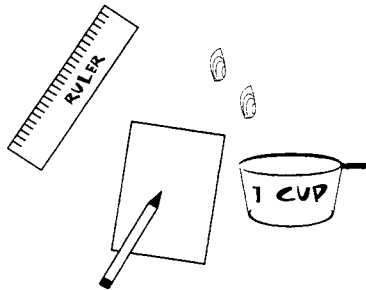
Lightweight gravel

Spoons for moving and counting the gravel

Teacher-collected cardboard drink  
(milk or juice) cartons (4)

Family Reunion Data Sheet 8.1

Zebra mussel journals

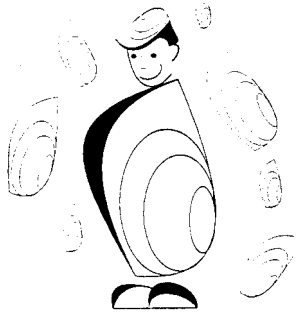


## GETTING YOUR ACT TOGETHER

Collect, rinse, and clean drink cartons, one for each lab station. Cut out the carton's top and bottom so you have an open-ended square box. The carton box should be at least 5 cm deep. Fill four pans with 2 cm of gravel and move some of the gravel to make the surface uneven, thus more natural. Tell the class that the pans represent four sites on the river bottom. Assign groups to survey each site, just as they would if four boats were needed. The sites represent typical populations of zebra mussels for an area.



## TIME TO EXPERIENCE ZEBRA MUSSEL MANIA!!



1. Discuss the problem of counting an entire population of anything. This is what zebra mussel experts come across when they deal with an entire river or lake to determine a population. Pretend that the gravel covering the pans are zebra mussels. Ask the students if they could quickly count all the pebbles (zebra mussels) in the pan. The correct response is, "Not easily." But students can learn to take samples and use those samples to extrapolate or predict a larger population.
2. Use the Data Sheet 8.1 to record the area of the pan and area of the carton.
3. Have the students estimate the number of cartons needed to cover the pan. They should record their predictions.
4. The students should then calculate the actual number of cartons needed to cover the pan and record this information. Determine the number of cartons needed by dividing the area of the pan by the area of the carton.
5. Take an actual sample from the pan by using the carton. Students should push the carton down, open ended, through the gravel until the carton rests on the bottom of the pan.
6. The students will remove their sample from the inside of the carton by using a spoon. Quantify the sample by counting. Record the sample counts in the journals and on Data Sheet 8.1.
7. After each group has completed the four samplings, have them share their results with the entire class. Place the numbers on the class chart. Show the class how to do an average. Have the students write the procedure for collecting samples in their zebra mussel journals.
8. Explain to the students that, by taking the average number of pebbles and multiplying that by the number of cartons needed to cover the pan, they will arrive at the population density of zebra mussels in the entire pan.

## WHAT DID YOU LEARN??

Can the students tell you the procedure for collecting a sample and determining the density of a population? You can determine the validity of the mathematical calculations by checking the students' data sheets. Do their sampling procedures reflect concern for developing accurate data?

## WAIT, THERE'S MORE. . .

You also can quantify the sample by another sampling technique. To do this, use a balance to find the mass of a known sample, say 100 pebbles chosen randomly. If 100 has a mass of X grams, any future mass can be used to determine the number of pebbles.