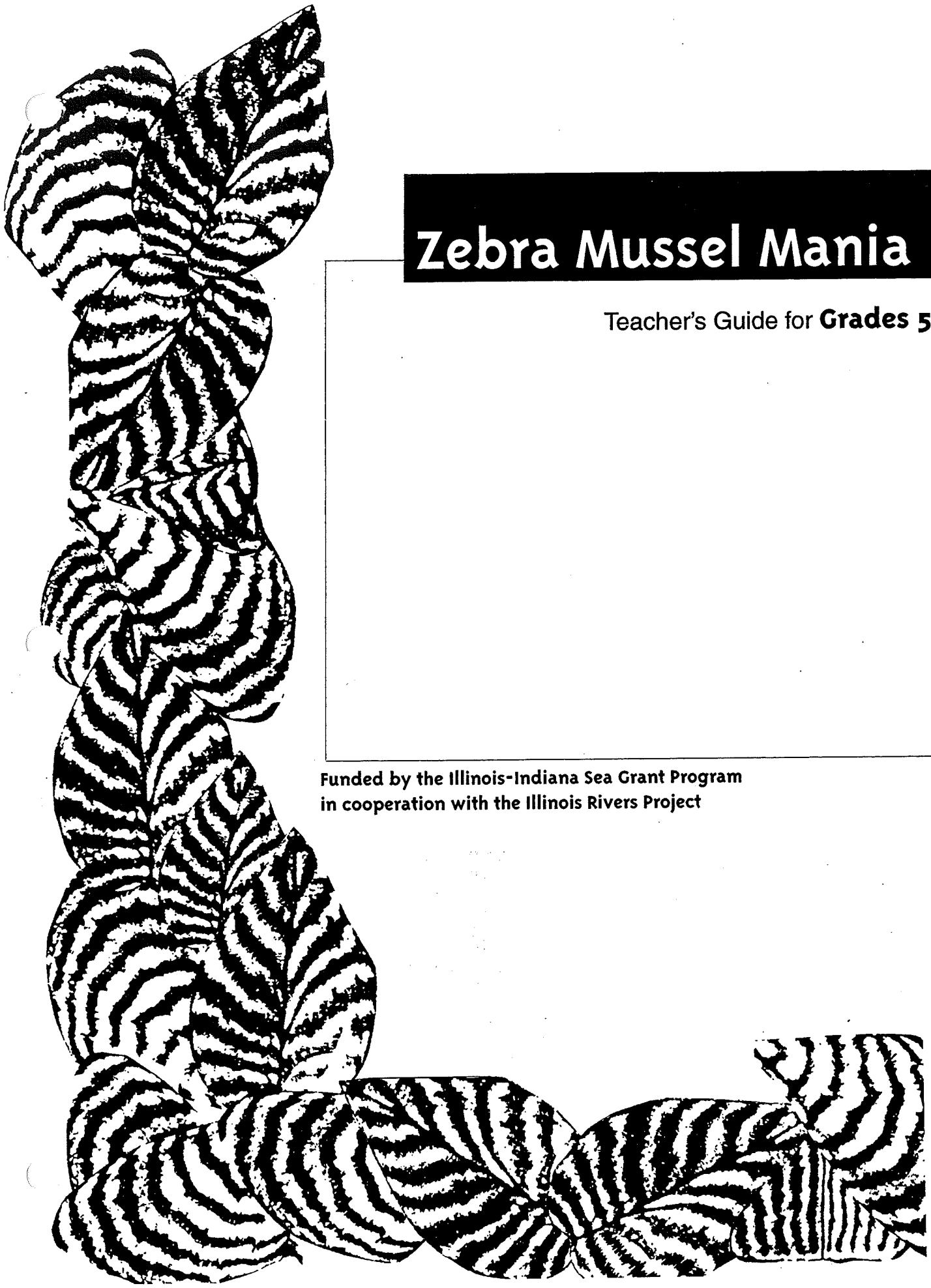


Zebra Mussel Mania

Teacher's Guide for **Grades 5 and 6**

**Funded by the Illinois-Indiana Sea Grant Program
in cooperation with the Illinois Rivers Project**

Zebra Mussel Mania

Teacher's Guide for **Grades 5 and 6**

Developed by:

John Barger, Marjorie Burgett, Jane Greenberg,
Marla Hostetler, Becky Keim, and Katy Scukanec

Funded by:

Illinois-Indiana Sea Grant Program
National Sea Grant College Program

Illinois-Indiana Sea Grant Project Coordinator

Robin G. Goettel
Illinois-Indiana Sea Grant Program
University of Illinois
65 Mumford Hall
1301 W. Gregory Drive
Urbana, IL 61801

Illinois Rivers Project Coordinator

Dr. Robert A. Williams
Illinois Rivers Project
Box 2222
Southern Illinois University
Edwardsville, IL 62026

For additional information or to order copies of *Zebra Mussel Mania* curriculum guide (IL-IN-SG-95-2), contact Robin Goettel (listed above).

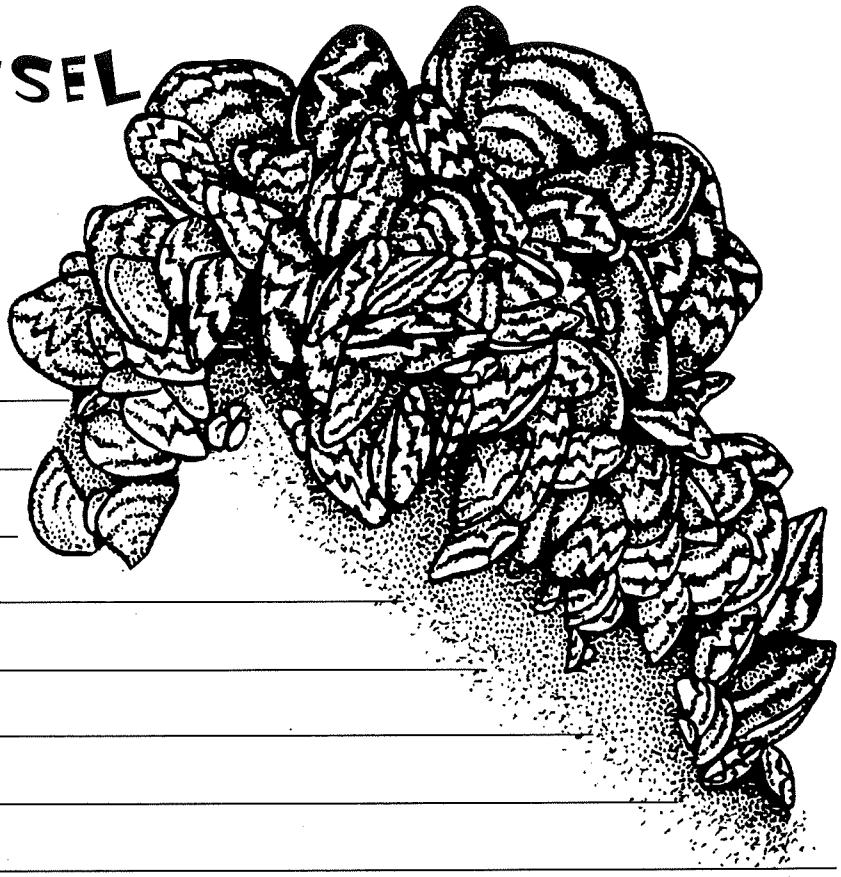
Editors: Robin G. Goettel and Agnes E. Dillon
Designers: Ann Bergeron, Larry Ecker, Thai Nguyen, Lori Dzielak, and Christen Coomer

The Zebra Mussel Traveling Trunk was modeled after the Math and Science Hands-on (M.A.S.H. kit) concept developed at Educational Service Center #16, Belleville, Illinois, and Southern Illinois University at Edwardsville.

TABLE OF CONTENTS

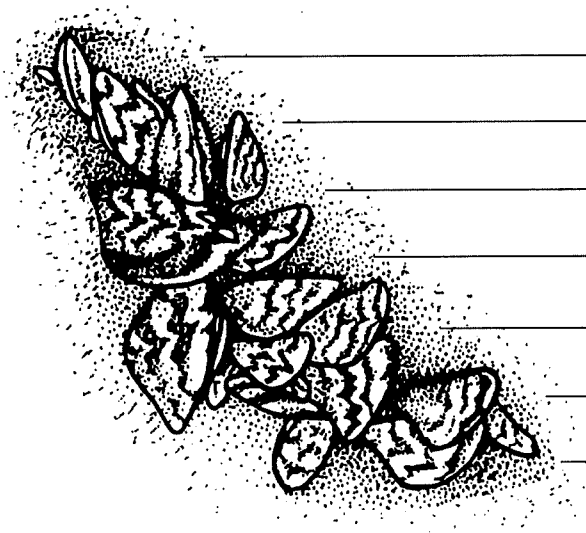
ACTIVITIES

Zebra Mussel Journal



Name: _____

Date: _____



ACTIVITY THREE	DON'T HAVE A CLUE
TIME:	(1) 45-minute lesson
SCIENCE PROCESS SKILL:	Inferring
SCIENCE CONCEPT:	Zebra mussels have an impact on the environment.
BENCHMARKS:	Students should: Know that, in making decisions, it helps to take time to consider the benefits and drawbacks of alternatives. Understand that, for any particular environment, some plants and animals survive well, some survive less well, and some cannot survive at all. Know that organisms interact with one another invarious ways in addition to providing food.
OBJECTIVE:	Students will make inferences based on facts about zebra mussels.

WHAT YOU OUGHT TO KNOW

Zebra mussels may have negative impacts that upset the ecological balance of the Great Lakes and inland waterways. The sport fisheries in the Great Lakes are changing because of improved water clarity. The zebra mussel's amazing water-filtering capacity is partly responsible for improved water clarity; but other factors such as tougher pollution laws and better technology are helping to keep the water clean. Research is being conducted to examine effects of the zebra mussel invasion on native mussel populations.

Although this activity's story, "What Happened to Lake Michigan," is fictional, the facts and basic story line are scientifically based. This is an interactive lesson in which students must work together to understand the problem. The fact cards provide information and background knowledge. No single fact card is sufficient to answer the questions.

WHAT'S THE CONNECTION??

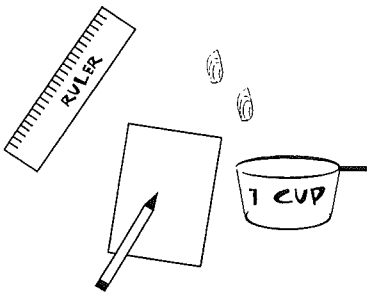
TO LANGUAGE:
Write and play an original clue game.

TO ART:
Use the story to create and illustrate a comic book.

TO MUSIC:
Write a rap using alliteration.

WORDS OF WISDOM

Aquatic vegetation, smallmouth bass, water clarity
(see also glossary on page 7)



RESOURCES AT THE READY

FOR EACH GROUP–
Two copies of the story 3.1, "What Happened to Lake Michigan"
Fact card sheet master 3.2
Observation Sheet with story questions 3.3
Laminated fact cards
Paper and pencils
Zebra mussel journals

GETTING YOUR ACT TOGETHER

Hand out the zebra mussel journals so that students can refer to their previously gathered information. Provide eight fact cards for each working group. Provide other zebra mussel literature as needed by the group.

TIME TO EXPERIENCE ZEBRA MUSSEL MANIA!!

1. Divide students into cooperative learning groups. Each group will carry out the entire activity.
2. Give each group two copies of Story 3.1, "What Happened to Lake Michigan," and the related questions from Observation Sheet 3.3.
3. Distribute two to three fact cards per group member in every group, and request that they do not read them yet.
4. Teacher will read the story, "What Happened to Lake Michigan." At the end of the story, students in each group will take turns reading the questions found on Observation Sheet 3.3.
5. Students are to silently read their fact cards and, when needed, share the information on the fact cards with their group members.
6. Record the answers to the questions on Observation Sheet 3.3 using all available information. Any answer that can be substantiated with the fact cards and other outside knowledge should be accepted.
7. When the groups are finished, conduct a class discussion on each question and allow each group to contribute its collective answers. Come to a class consensus when determining answers to each question.
8. Have each child record the answers to each question (reached by class consensus) in his/her journal. This information will be useful in later activities.

WHAT DID YOU LEARN??

Each group should present its answers in a class discussion of the questions. The answers should indicate that students have gained experience in finding and summarizing the information requested. Were proper inferences made?

WAIT, THERE'S MORE. . .

- Can the students adapt/modify the game by creating more information (fact) cards?
- Can they rewrite or change the story and make fact cards more locally based?
- Suggest that the modified game be used next year, or have the students teach their adaptation to another class.

"DON'T HAVE A CLUE" GAME

DIRECTIONS FOR STUDENTS

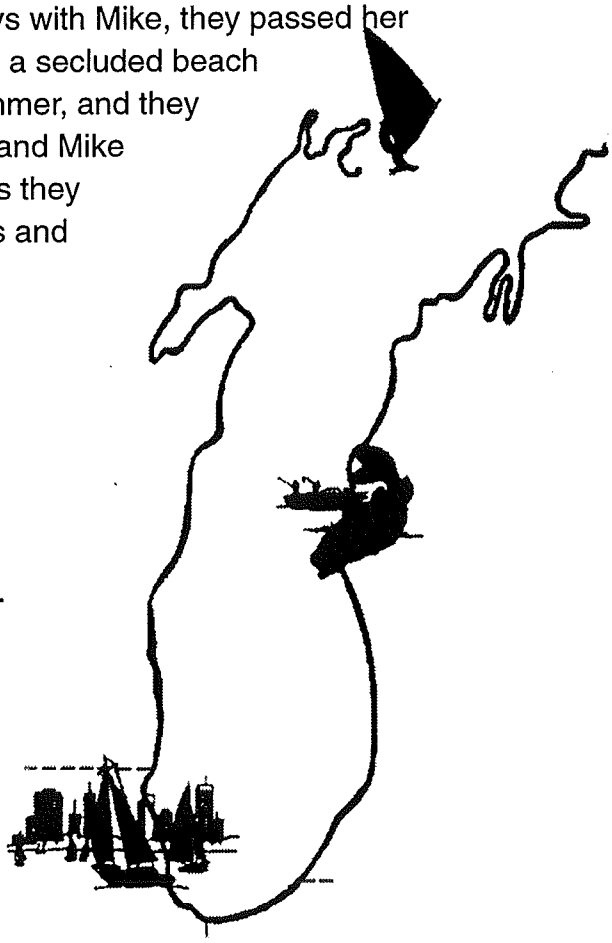
1. Each person in the group will receive several (two or more) fact cards concerning the story.
2. Listen to the story of Lake Michigan as it is read.
3. Using the facts, help your group answer the questions found on Observation Sheet 3.3. The group can take any approach to solving the problem. However, do not pass the fact cards to anyone (not even in your group) until the activity has ended. One student will read a question then refer to his/her fact cards for an answer. If that student does not have the answer, another student with the correct fact card gives the answer. The next student reads the second question, and so on until all the questions are answered.

Don't Have a Clue Story 3.1
Read by Teacher

WHAT HAPPENED TO LAKE MICHIGAN?

Melanie had grown up near Chicago, and she had spent most of her summers sailing, swimming, and fishing in Lake Michigan. Melanie moved away from Chicago in 1980. In 1993, she and her husband, Mike, moved back to her home town, where they moved into a condominium high above Lake Michigan's impressive shoreline. Melanie noticed that the water in the harbor was much clearer than when she was a child. She was surprised to see a lot of plant life in the water that she had never observed before.

One day while they were sailing, Melanie told Mike that, when she was in high school, she remembered boats coming in and out of the harbor filled with walleye and smallmouth bass. As Melanie was remembering the good old days with Mike, they passed her family's favorite vacation spot, a secluded beach where they camped every summer, and they noticed a nasty odor. Melanie and Mike also noticed that the only boats they saw on the lake were sailboats and yachts— no fishing boats.



On their return trip home they stopped at Fred's Fresh Fish Shop to purchase, what else, fresh fish. Melanie was disappointed to learn from Fred, a local fisherman, that he didn't have any walleye left.

He informed her that the local fishing industry had gone through many changes. At this time, the only fresh fish he had was fish shipped in from elsewhere.

Fact Card 3.2

An adult zebra mussel filters approximately one liter of water per day.

Don't Have a Clue

Fact Card 3.2

During dusk and dawn, the water is full of shadows. In this environment, walleye can hide and attack their prey. Many people no longer fish for walleye during the day.

Don't Have a Clue

Fact Card 3.2

Due to increased water clarity, sunlight penetrates the water causing increased growth in vegetation.

Don't Have a Clue

Fact Card 3.2

When zebra mussels die, they wash up on the shoreline and begin to decay.

Don't Have a Clue

Fact Card 3.2

A zebra mussel was found in Lake St. Clair in 1988. They reproduce rapidly. One female mussel can produce 30,000 to 100,000 eggs per year.

Don't Have a Clue

Fact Card 3.2

Because they find their prey by sight and chase them down, smallmouth bass like clear water.

Don't Have a Clue

Fact Card 3.2

Walleye generally are found in murky water where they can hide and attack their prey.

Don't Have a Clue

Fact Card 3.2

Walleye, who have eaten more small fish than were being produced, have diminished their current food source.

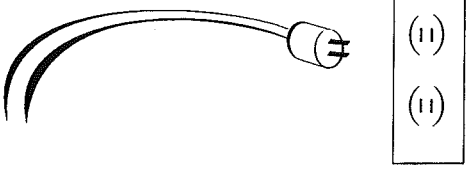
Don't Have a Clue

ACTIVITY EIGHT:	**FAMILY REUNION**
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 investiga tions 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.

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:
Write directions for using sampling to determine the number of zebra mussels in a lake or river.

TO MATHEMATICS:
Determine the number of zebra mussels it would take to cover the gym floor, cafeteria wall, classroom floor, or playground area.

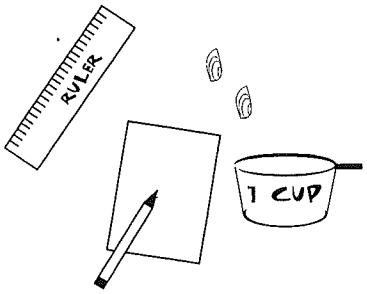
TO ART:
Construct a zebra mussel colony using macaroni shells (two sizes) to represent the sample.

TO SOCIAL STUDIES:
Brainstorm ways in which sampling can be used by business, industry, and the government to control the zebra mussel population.

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 pan 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 pebbles 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, mass can be used to determine the number of pebbles in any future sample.

FAMILY REUNION!
DATA SHEET 8.1

Zebra Mussel Watchers' Names:

_____

_____

1. Area of pan_____cm^2 Area of carton_____cm^2 (length x width = _____)
2. Estimate cartons per pan_____
3. Actual cartons per pan_____ (determined by area of pan x area of carton)

Average number of pieces of gravel per carton_____

Number of cartons sampled_____

Number of Pebbles Collected

River site	Student sampling group				Average
	A	B	C	D	
1					
2					
3					
4					

Total population density of: site 1_____ site 2_____ site 3_____ site 4_____
(determined by taking the sample average x actual number of cartons that fit into pan)

Total population density of all sites_____
(add population densities of all sites and divide by 4)