

STOP ZEBRA MUSSELS EQUIPMENT BOX AT A GLANCE

NOTE: Alabama teachers should contact their county Extension office to check out an Equipment Box.

INTRODUCTION

The Stop Zebra Mussels Equipment Box was modeled and modified from the Illinois-Indiana Traveling Trunk. This section is written to provide you with a quick overview of the major curriculum elements around which the Illinois-Indiana Traveling Trunks were designed. In cooperation with the Illinois Rivers Project, the Minnesota Sea Grant College Program, and the University of Minnesota Bell Museum of Natural History, the Illinois-Indiana Sea Grant developed this educational resource kit. The Zebra Mussel Traveling Trunk and accompanying curriculum guide, Zebra Mussel Mania, were specifically created to provide teachers, environmental educators, natural resource agencies, and Cooperative Extension Service youth educators with a set of tools to teach 5th and 6th grade students about zebra mussels and the array of problems commonly associated with these and other exotic species. The Trunks were modeled after the **Math And Science Hands-on (M.A.S.H.)** kit concept developed by Educational Service Center #16 in Belleville, Illinois, and Southern Illinois University at Edwardsville.

SCOPE AND SEQUENCE

Both the Alabama Cooperative Extension System's Stop Zebra Mussels Equipment Box and the Illinois-Indiana Sea Grant Program's Traveling Trunk were developed around fundamental themes in science that can be matched to concepts covered in most textbooks. Students explore these central themes as they complete seven developmentally appropriate, process-based activities.

BENCHMARKS

The Alabama Cooperative Extension System's personnel were impressed with the Traveling Trunk from Illinois-Indiana Sea Grant Program and with permission developed their own using the Traveling Trunk as a template. The Stop Zebra Mussels Equipment Box contains seven activities that are slightly modified from the original ten activities in the Traveling Trunk. The Traveling Trunk was developed by Illinois, Indiana, and Minnesota educators primarily to assist classroom teachers in meeting the educational needs of their students. As a result, each investigation's instructional guide-lines focus on information in Benchmarks for Science Literacy, Project 2061 (American Association for the Advancement of Science). These guidelines include the basic concepts and fundamental skills across the curriculum: science, mathematics, social studies, language arts, fine arts, health and physical education. The trunk activities were carefully selected to prepare students to meet or exceed these benchmarks. Each of the ten activities is prefaced with specific goals and objectives to be met upon completion of the exercises that comprise the activity.

SCIENCE PROCESS SKILLS

The activities in the boxes address the science process skills necessary for students to utilize when learning science: observation, measurement, classification, inference, prediction, communication, formulation of hypotheses, experimentation, and interpretation of data.

COOPERATIVE LEARNING

The instructional approach utilized in this curriculum allows students to work in cooperative groups. It is recommended that the size of your cooperative groups not exceed four students. Many educational benefits occur when students work together in groups to investigate and solve problems. Cooperative learning more closely resembles the way individuals work together to solve problems in the real world. Another important reason for the use of cooperative groups is to make the acquisition, costs, and management of materials reasonable for the classroom teacher.

LANGUAGE ARTS

Students read about, talk about, and write about the exciting science activities they are doing. This additional use of language along with the science investigation reinforces students' understanding of the scientific principles being explored. The trunk includes its own science-related publications and an additional list of resources.

MATHEMATICS

Many of the science investigations result in an opportunity for the students to apply mathematics skills in a variety of ways. Students are encouraged to quantify their observations with metric measurements and to record and report those observations with charts, tables, and graphs. Often times students will need to apply mathematical operations to solve problems or answer questions.

ALTERNATIVES IN ASSESSMENT

The activity assessment provided in this guide can be used to determine students' understanding of the major concepts dealt with in the trunk. Unit tests utilize a variety of different question formats such as fill in the blank, short answer, etc. The lesson assessment may be given in a pre-post type format in order to:

- (1) determine the increase of students' understanding as a result of this unit, and
- (2) clarify students' prior skill and knowledge of the direction instructions should take. The trunks also include a performance-based assessment that gives the teacher the opportunity to observe what students actually can do with the science concepts and skills they have learned.

COOPERATIVE LEARNING: CLASSROOM MANAGEMENT TECHNIQUES

- 1 In order for your students to complete the activities successfully, it is essential that they know, and follow, the ten rules for group work:
 - * move into groups quietly, without bothering others
 - * use quiet voices
 - * stay with your group
 - * everyone shares the work
 - * no one is bossy
 - * everyone shares materials
 - * everyone shares ideas
 - * take turns talking
 - * care about other's feelings
- 2 Initially avoid competition between groups. This can be accomplished by carefully selecting groups in a variety of manners--randomly (i.e., by birthdays), by students' abilities, or by allowing students to choose the groups for themselves. It is important to note, however, that if the final technique is used to form groups, the students must be made aware that, if their group does not perform adequately or productively, alternative selection methods will be employed (i.e., TEACHER selection).
- 3 Clearly define the task to be done.
- 4 Be sure a "product" is connected with the group activity.
- 5 In setting time limits, allow TOO LITTLE TIME rather than TOO MUCH TIME for the group to finish.
- 6 Each person in the team should play an active role. Regular rotation of roles should occur to give each student the opportunity to play a different role. Roles students can have are:

PRINCIPAL INVESTIGATOR: This person keeps the group members on task and makes sure the activity is understood by all and is completed. Any questions will be immediately clarified with the teacher.

MATERIALS MANAGER: This person obtains all supplies the group needs. If the group is large enough, a second Materials Manager can be assigned to be responsible for returning materials to the supply area and having the group clean up its work area.

RECORDER/EVALUATOR: This person writes down responses that team members have formulated. This student notes how well group members perform their responsibilities, contributing to the overall performance and outcome of the group.

REPORTER: This person writes down the group's conclusions and reports to the class. The reporter may also need to record the group's data on a class graph or chart. If the group is large enough, two Reporters can be assigned--one to record conclusions and chart data, the other to present their findings to the class.

- 7 Follow the Five C's of group work in order to have a safe and FUN science activity:

CAUTION: Laboratory group work requires caution in every part. Safety instructions should be followed and a safety checklist should be implemented before each activity

COOPERATE: To ensure successful group work, each member must cooperate with the other members of the group.

CONTRIBUTE: Each member must make an effort to contribute to the group.

CONTROL: Group work requires control over our body movements, voices, and actions. To avoid chaos in the classroom, control must be practiced by each member of the group.

CLEAN UP: Each group member must do his or her part to clean up after the activity. Students must make sure the work area is clean and all materials are put away.

- 8 The culmination of a group activity should be a time of sharing and evaluating how well members worked together as well as examining each group's end results or products.

QUICK REFERENCE GLOSSARY

Definitions in this Glossary are intended for teacher use and quick reference.

- * **action project**--taking what is learned and making a plan for bringing the issue to the attention of the local community and society in general
- * **aquatic vegetation**--the plant life that exists in a freshwater environment
- * **area**--the measure of the surface of a solid; a part of any surface; a particular zone
- * **ballast water**--the water carried in a boat or ship to give stability
- * **biological diversity**--variety of life
- * **bivalve**--any mollusks, including mussels and clams, having a shell consisting of two valves hinged together
- * **brainstorm**--the unrestrained offering of ideas or suggestions by all members of a group seeking a solution to a problem
- * **byssal threads**--a tuft of filaments, chemically similar to silk, secreted by various bivalves, especially mussels, used to attach the mollusk to the substratum
- * **centimeter (cm)**--a metric unit of measure equal to 1/100 meter (about the width of your finger)
- * **common name**--the familiar name used by everyday people to refer to any species
- * **community**--a group or unit that lives together
- * **congregate**--a gathering or assemblage of people or things
- * **data**--facts, figures, or information from which conclusions can be drawn
- * **degradation**--sedimentation in aquatic areas that affects the quality of the water; the lowering of land surfaces by erosion
- * **dispersal**--to break up and scatter in various directions
- * **dissolved oxygen**--the oxygen freely available in water; vital to fish and aquatic life for respiration; dissolved oxygen has been accepted as the single most important indicator of the ability of a body of water to support aquatic life

- * **diversity**--variety
- * **documentary**--a motion picture, television program, or other presentation that shows or analyzes news events or social conditions with little or no fictionalization
- * **ecosystem**--the interacting system of a biological community and its non-living environmental surroundings
- * **estimate**--to judge or determine generally, but carefully, the size, value, or cost of an item
- * **exotic species**--the organisms that are foreign, not native, to a particular location
- * **extrapolate**--to arrive at a conclusion or result by hypothesizing from known facts or observations
- * **filtration**--a treatment process for removing solid matter from water by passing the water through sand or a man-made filter
- * **flow restriction**--anything that restricts or slows water flow; for example, zebra mussels restrict flow in a water pipe, and weeds restrict flow in a canal
- * **food chain**--a sequence of organisms, each of which uses the next lower member of the sequence as a food source
- * **food web**--all the individual food chains in a community
- * **glochidia**--the parasitic larval stage of freshwater mussels that infests the gills of many fish
- * **habitat**--the place where a population lives and its surroundings, both living and non-living
- * **indigenous species**--organisms that are native to a particular area or region
- * **infestation**--to overrun or inhabit in large numbers, as to be parasitic in or on a host
- * **intake**--the place fluid is taken into a pipe, e.g., intakes for water treatment plants and power industries
- * **introduced species**--a population placed into a particular area or region the species is not native to
- * **larval fish**--immature, free-swimming stage of a fish
- * **life cycle**-- the series of changes in form undergone by an organism in development from its earliest stage to the recurrence of the same stage in the next generation

- * **liter (L)**-- a metric unit of liquid measurement; it is equal to 1.06 quarts
- * **maximum**-- the greatest number, degree, or quantity
- * **millimeter (mm)** -- a metric unit of measure equal to one thousandth of a meter; 10 mm equals 1 cm
- * **minimum**-- the smallest number, degree, or quantity
- * **mollusk**-- the members of the phylum of invertebrates that include bivalves, snails, and squids
- * **molluscicide** -- a chemical substance that poisons mollusks
- * **mother of pearl** -- the hard, pearly internal layer of certain bivalve shells, such as abalone and the three ridge mussel
- * **native species** -- species that naturally occur or live in a particular area or region
- * **nonindigenous species** -- species that are not native to a particular area or region
- * **nutrient** -- any substance assimilated by living things that promotes growth
- * **organic detritus** -- dead animal or plant materials or debris
- * **organic matter** -- carbon-based waste compounds produced by living plants or animals
- * **parasitize** -- to obtain benefit from another organism at that organism's expense
- * **percentage** -- a given part or amount in every hundred
- * **phytoplankton** -- microscopic plants that float in the water and are eaten by aquatic animals
- * **population** -- a group of interbreeding organisms of the same kind occupying a particular space
- * **population density** -- the quantity or number of a species per unit, as of an area
- * **predator** -- an animal or organism that lives by feeding on other animals
- * **predict** -- to determine in advance what will happen
- * **prey** -- an animal used for food by another animal
- * **public information** -- knowledge or information that is open to and for the use and benefit of all people

- * **public involvement** -- action taken by members of a community in response or conjunction with a particular issue or project
- * **quantify** -- to determine or express the amount of something; to measure
- * **questionnaire** -- a written or printed form used in gathering information about a subject; it consists of a set of questions to be answered then submitted to a group or organization
- * **salinity** -- a condition in which salt is part of a solution; the amount of salt in water
- * **sampling** -- the process of taking a small amount of an item or object for testing or analysis
- * **sedentary** -- remaining or fixed in one spot
- * **sediments** -- soil, sand, and minerals that settle at the bottom of a body of water
- * **siphon** -- an opening through which water enters and leaves an object, such as a mussel; some species can use this activity as a means of propulsion; also a means by which a liquid is transferred from one object to another, such as to siphon water into a bottle
- * **smallmouth bass** -- a North American fish found in cool, clear, fresh waters
- * **submerge** -- to completely immerse in water
- * **substrate** -- the ground or other solid material on which an animal moves or is fastened
- * **turbidity** -- when the amount of material such as silt or organic matter in the water reduces its clarity
- * **univalve** -- a mollusk possessing only one shell, such as a snail
- * **veliger** -- a zebra mussel larvae
- * **ventral line** -- a longitudinal line along the lower side of a zebra mussel
- * **water clarity** -- a condition in which the water is unclouded
- * **zooplankton** -- microscopic aquatic animals eaten by larger aquatic animals

ORGANIZATIONS AND OFFICIALS

Staff members from the following organizations can be contacted to speak to your class about problems faced by the organization that relate to the activities in this guide. Representatives also may be able to discuss how they are solving problems caused by zebra mussels and other nonindigenous species. For addresses and or phone numbers, consult your local phone directory or contact your local or school library.

- * **State Sea Grant Program**
- * **State Natural History Survey**
- * **State Water Survey**
- * **State Department of Conservation/Natural Resources**
- * **U.S. Army Corps of Engineers**
- * **Natural Resource Conservation Service**
- * **State Department of Transportation**
- * **Power Company**
- * **Municipal Water Treatment Facility**
- * **Biology Department of a University or College**
- * **Museum**
- * **Extension Service**
- * **Power Squadron**
- * **National Estuary Program**
- * **Estuarine Research Reserve**



GOALS AND OBJECTIVES

Goals

- * To provide scientifically based education about zebra mussels for fifth and sixth grade students.
- * To provide teachers with an interactive teaching tool and curriculum on zebra mussels.
- * To build students' critical thinking and scientific literacy.

Objectives

After completing *Stop Zebra Mussels*, students will be able to:

- * Record observations of zebra mussel characteristics and be able to describe concerns about their arrival in North America.
- * Demonstrate the ability to differentiate between freshwater mussels and zebra mussels.
- * Measure and graph the length of the ventral side of a sample of zebra mussels.
- * Construct a model to simulate how zebra mussels filter large quantities of water.
- * Use a model to predict the rate of flow of water in a pipeline.
- * Calculate the number of zebra mussels in a given area.
- * Demonstrate critical changes in a native river ecosystem due to the introduction of zebra mussels.

SETTING THE STAGE FOR LEARNING

- 1. Cooperative Learning Groups** -- All work in this unit is meant to be done in groups of two to four students. The importance of helping each other and sharing must be stressed. It is helpful if both individual and group goals are set by the teacher and students.
- 2. Inquiry-Discovery Method** -- Very little of this material should be TOLD to the students. They should learn by completing the activities in the unit. This provides students with valuable experiences and skills along with learning the content in the unit.
- 3. Play Time** -- Allow time for students to appreciate Zebra Mussel Mania materials in a nonstructured, informal environment before, during, and after the activity.
- 4. Material Storage** -- Allow zebra mussels and other materials to dry out before returning to packages and to the trunk. This will avoid a mold problem.
- 5. Unit Introduction** -- To find out students' prior knowledge about zebra mussels, let the children brainstorm. First, place the words zebra mussel on chart paper or butcher paper. List all the words the students give you. Remember, when brainstorming, all words are accepted. Then, form a semantic map by putting the words under different categories. Words that have nothing to do with zebra mussels will naturally be discarded. Finally have the students write their own definition of a zebra mussel.
- 6. Zebra Mussel Journal** -- Students will keep a daily journal of their research about zebra mussels. This journal can also include usage of the unit vocabulary words as well as any questions they may have. Use pocket folders or construction paper to create journals, and have students decorate the journal by drawing zebra mussels. You can reproduce pictures from the guide for a journal cover. Use the journal master page provided to make appropriate number of copies for each student.
- 7. Creative Writing** -- The zebra mussel journal sheet decorated with a zebra mussel border can be used for creative writing activities, including reports, letters, brainstorming ideas, poetry, essays, etc. Use this with any language arts activity.
- 8. Reference Materials** -- At the end of the notebook is a section containing material discussing zebra mussels.
- 9. Expanding Bulletin Board** - Use materials in the kit to prepare bulletin boards. Other material can be obtained by contacting the previously mentioned organizations.

10. Learning Strategies - You are encouraged to use the following strategy(s) to introduce any lesson in this unit.

* **KWL** strategy suggests that you ask each student to identify "what you know about the topic" (**K**), "what you want to know about the topic" (**W**), and after the lesson, "what you learned" (**L**). A section on the KWL sheet can be used to indicate what the student is still confused about. Students fill out the first two columns before the activity and the last two after completing each activity. See Student KWL, page 13.

* **Mapping** is a technique for visually organizing material. Place a concept word in the middle of the board or butcher paper and let the children give you category words and phrases that fit with your word.

11. Attitude Survey - The attitude survey is optional. See page 14.

12. Safety - Go through the safety rules found on page 16. Other safety rules may pertain if you go on a field trip.





**ZEBERA
MUSSELS**

STUDENT KWL STRATEGY

*** Activity**

*** Student Name**

*** What I know**

*** What I want to know**

*** What I learned**

*** What I am confused about**



**ZEBRA
MUSSELS**

STUDENT ATTITUDE SURVEY

Name:

Date:

Directions: Please read each of the following statements carefully. Put a check mark by each statement that you agree with.

- _____ 1. I would rather study science than any other subject.
- _____ 2. Science is of great value.
- _____ 3. I really enjoy science.
- _____ 4. Science is boring.
- _____ 5. I love to study science.
- _____ 6. Science is a waste of time.
- _____ 7. Science will benefit only the smart kids.
- _____ 8. I have no desire to learn about science
- _____ 9. Science classes are profitable to everyone who takes them.
- _____ 10. Science is practical.
- _____ 11. I like science experiments.
- _____ 12. Science experiments are dumb.
- _____ 13. Science teaches me to think.
- _____ 14. Science is of benefit to me.
- _____ 15. I hate science.

You may write any additional comments about science that you feel are important on the back.

SAFETY RULES

These safety rules may be discussed and posted during science activities, or the teacher may have the class generate a list of safety procedures to follow.

- 1. Listen to your teacher's instructions.**
- 2. Don't touch or pick up any materials unless your teacher tells you to.**
- 3. Follow directions.**
- 4. Ask your teacher for help if you need it.**
- 5. Cooperate with a partner or with your group.**
- 6. Never put anything in or near your eyes or mouth, and wash your hands when you have finished.**
- 7. Clean up work area and return all materials to their proper places.**
- 8. Always walk in the science area.**
- 9. Talk quietly in groups.**
- 10. Tell your teacher immediately in case of accidents.**
- 11. Be Careful !!!**



ZEBRA MUSSEL POST-TEST

NAME: _____

MATCHING

- | | |
|-----------------------------|--|
| 1. _____ ballast water | a. The organisms that are foreign, not native to a particular location |
| 2. _____ byssal threads | b. a zebra mussel larvae |
| 3. _____ exotic species | c. the water carried in a boat or ship to give stability |
| 4. _____ food chain | d. microscopic aquatic animals eaten by larger aquatic animals |
| 5. _____ indigenous species | e. a tuft of filaments used to attach the mollusk to the substratum |
| 6. _____ phytoplankton | f. the organisms that are native to a particular area |
| 7. _____ veliger | g. the microscopic plants eaten by larger aquatic animals |
| 8. _____ zooplankton | h. a sequence of organisms, each of which uses the lower member of the sequence as a food source |



ZEBRA MUSSEL POST-TEST CON'T

TRUE OR FALSE

9. _____ Zebra mussels have only positive effects on freshwater mussels.
10. _____ Classification of shells is done using color, size, texture, and other methods involving the senses.
11. _____ There is no way to tell the difference between a shell button and a plastic button.
12. _____ The Great Lakes have been affected by zebra mussels.
13. _____ Zebra mussels traveled to North America in the ballast water of ships.
14. _____ Zebra mussels live well in water that is very salty and very cold.
15. _____ People are the main transporters of zebra mussels.
16. _____ Zebra mussels filter up to 1 liter of water a day.
17. _____ Zebra mussels help the food web of a lake.

FILL IN THE BLANK

1. Mussels and clams which have two shells are _____ mollusks.
2. Taking a small part or quantity of something to determine population density is called _____.
3. Through _____, zebra mussels improve water clarity.
4. The variety of life in an ecosystem is called _____.



ZEBRA MUSSEL POST-TEST CONT

SHORT ESSAYS

How do zebra mussels affect the food chain?

Name two negative effects of zebra mussels.

Draw a zebra mussel

Name two ways that zebra mussels spread.

What are barriers to the spread of zebra mussels?



ZEBRA MUSSEL POST-TEST TEACHER'S KEY

NAME:

MATCHING

1. C ballast water
 2. E byssal threads
 3. A exotic species
 4. H food chain
 5. F indigenous species
 6. G phytoplankton
 7. B veliger
 8. D zooplankton
- a. the organisms that are foreign, not native to a particular location
 - b. a zebra mussel larvae
 - c. the water carried in a boat or ship to give stability
 - d. microscopic aquatic animals eaten by larger aquatic animals
 - e. a tuft of filaments used to attach the mollusk to the substratum
 - f. the organisms that are native to a particular area
 - g. the microscopic plants eaten by larger aquatic animals
 - h. a sequence of organisms, each of which uses the lower member of the sequence as a food source



ZEBRA MUSSELS POST-TEST TEACHER'S KEY

TRUE OR FALSE

9. F Zebra mussels have only positive effects on freshwater mussels.
10. T Classification of shells is done using color, size, texture, and other methods involving the senses.
11. F There is no way to tell the difference between a shell button and a plastic button.
12. T The Great Lakes have been affected by zebra mussels.
13. T Zebra mussels traveled to North America in the ballast water of ships.
14. F Zebra mussels live well in water that is very salty and very cold.
15. T People are the main transporters of zebra mussels.
16. T Zebra mussels filter up to 1 liter of water a day.
17. F Zebra mussels help the food web of a lake.

FILL IN THE BLANK

1. Mussels and clams which have two shells are BIVALVE mollusks.
2. Taking a small part or quantity of something to determine population density is called SAMPLING.
3. Through FILTERING, zebra mussels improve water clarity.
4. The variety of life in an ecosystem is called BIODIVERSITY.



ZEBRA MUSSEL POST-TEST (Teacher's Key)

SHORT ESSAY

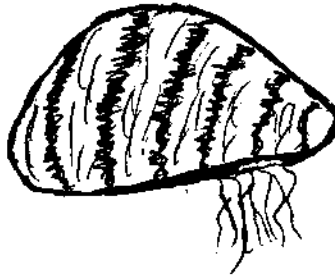
How do zebra mussels affect the food chain?

Zebra mussels compete with other aquatic organisms for food in river, lakes, and streams. Because there are so many zebra mussels competing for food with other animals at their level in the food web, less food is available for other animals. These other animals can die for lack of food.

Name two negative effects of zebra mussels.

Zebra mussels clog intake pipes at water treatment and industry plants, causing great expense for removal and cleanup. They can also clog and damage the engines on boats. Zebra mussels may reduce populations or even eliminate native mussels from rivers and lakes by competing with native mussels for food, space, and oxygen.

Draw a zebra mussel



Name two ways that zebra mussels spread.

They attach to boats. The juvenile form is free floating and can be carried in water currents. Zebra mussels can attach to animals or birds such as diving ducks which move from one location to another.

What are barriers to the spread of zebra mussels?

Chlorine has been used to control zebra mussels. Boaters should clean their boats with hot water before leaving an area. This will help prevent further spread of zebra mussels.

ACTIVITY TWO: LOOKING AT THE ZEBRA MUSSEL MENACE

TIME: (2) 45-minute lessons

SCIENCE PROCESS SKILL: Observing, measuring, and communicating

SCIENCE CONCEPTS: Zebra mussels have identifiable and observable characteristics.
Zebra mussel history and concerns can be identified from a video.

BENCHMARKS: Students should: Know that changes in an organism's habitat are sometimes beneficial to it and sometimes harmful.

Judge whether measurements and computations of quantities such as length, area, volume, weight, or time are reasonable in a familiar context by comparing them to typical values.

OBJECTIVE: Students will record observations of the zebra mussel. Students will be able to describe concerns about the zebra mussel's arrival in North America.

WHAT YOU OUGHT TO KNOW

A zebra mussel is a bivalve mollusk. It is a fingernail-sized clam with yellowish or brownish shells marked in wavy bands. Female zebra mussels can produce 30,000 to 1,000,000 eggs per year. These eggs develop into free-swimming larvae (called veligers) that quickly begin to form shells. After approximately three weeks, zebra mussels attach to hard surfaces called substrates. These are surfaces such as rocks, gravel, metal, crayfish, native mussels and, each other. They attach to these surfaces by using their byssal threads. Byssal threads have a strong adhesive that will dry under water and even adhere to Teflon.

ASK QUESTIONS



Zebra mussels filter plankton from the water. Adult mussels can filter up to one liter of water per day. Diving ducks and freshwater drum eat zebra mussels. However, zebra mussels reproduce at such a rapid rate they cannot be controlled by this method alone.

The activities in Day 1 allow students to observe the characteristics of the zebra mussel. Observations are made by using the five senses. Some observations are: shiny inside, two shells per mussel, and 2 cm in length. Caution students not to make inferences, such as meat is inside the shell, unless they can see it. During Day 2 students will identify some of the environmental, recreational, and industrial problems caused by zebra mussels.

WHAT'S THE CONNECTION??



TO LANGUAGE:

Write letters to request information about zebra mussels from organizations listed on the Organizations and Officials sheet, page 9. Write a physical description of the zebra mussel in the journal.

TO MATHEMATICS:

Estimate the number of zebra mussels that will occupy a 100 ml space.

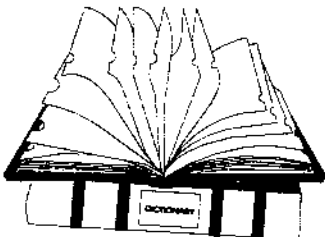
TO ART:

Construct a mosaic of the zebra mussel by using construction paper.

TO SOCIAL STUDIES:

Using a world map, trace the spread of zebra mussels over time.

WORDS OF WISDOM



LOOK IT UP

Ballast, byssal threads, bivalve, ecosystem, exotic, molluscicides, salinity, substrate, veliger (see also glossary on page 5). Students should put these in their zebra mussel journal.

RESOURCES AT THE READY

Material:	In Kit	In Notebook	Teacher Provides
	Video	ZM Journal	Newsprint Sheets
	Metric Rulers	Sheet 2.1	Group Folders
	Measuring Cups	Sheet 2.2	Scale (optional)

Video contains (combined onto one tape):

“The Invasion of the Zebra Mussel” (10:00)

“Luck Isn’t Enough” (13:30)

Note: “Luck Isn’t Enough” is not about zebra mussel, but is a good video on water quality.

For each working group:

(1) Metric ruler

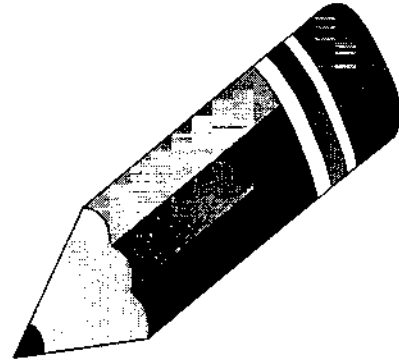
(100 ml) Zebra mussel shells

(1 or 2) Measuring cups

Zebra Mussel Observation Sheet 2.1

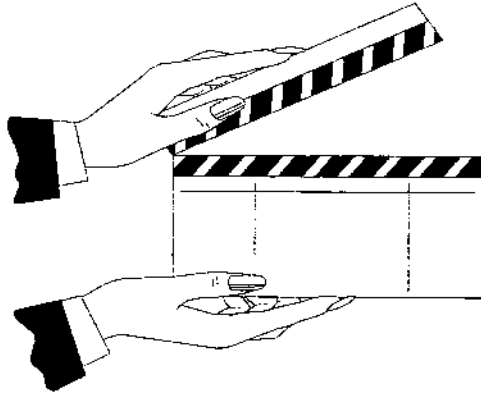
Zebra Mussel Menace Record Sheet 2.2

Group folder

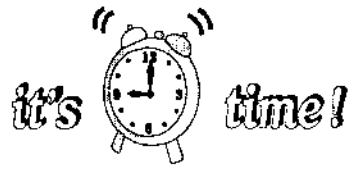


GETTING YOUR ACT TOGETHER

Prepare the materials in a folder for each cooperative group. On newsprint, make up a summary sheet for each of the day’s activities. The summary sheets should be titled “Stop Zebra Mussels.” Preview the first video described in the resources section.



TIME TO EXPERIENCE ZEBRA MUSSEL MANIA!!!



DAY 1

1. Show the video "The Invasion of the Zebra Mussel." The other video can be shown on this day or at a later time in the curriculum.
2. Provide the Words of Wisdom either as a handout or have the students copy them into their journal.
3. Divide students into cooperative learning groups.
4. Have each group measure 100 ml of zebra mussels. (If necessary, you could have these measured out in advance.) Before the shells are observed by the groups, have them estimate the number of mussels in the sample. Record this on the Zebra Mussel Observation Sheet 2.1.
5. Observe mussels and record observations on the Zebra Mussel Observation Sheet 2.1. You will want to support the students' observations by offering clues to the groups as needed. Some suggestions are:

What are the color variations?

Ask questions about shell symmetry and bivalve construction.

One side will feel sharp, another smooth.

How is feel related to a particular surface that is touched?

How many actual mussels were counted? (Record this on the data sheet.)

Sound is not easy to observe. In order to observe sound, something must be done to the mussels.

An obvious smell is present. Does it change when the mussels are wet?

6. Record each group's data on your newsprint sheets. Are differences apparent? Discuss the data.

DAY 2

7. Hand out Stop Zebra Mussel Record Sheet 2.2 to each student.
8. View video again so students may complete the sheet.
9. Have the reporters summarize the data on a class chart.
10. Write group-generated answers for each question on newsprint charts.
11. Discuss and summarize the results. Each student should copy this summarized data in his/her journal.

WHAT DID YOU LEARN???

Use the group charts to generate discussion based on observations made. The students' senses should have been used to observe zebra mussel characteristics. Taking measurements of length, width, and mass also should have helped students to identify physical aspects of zebra mussels. While watching the video, did each student make notes and contribute to the total information produced by their group? Each group member should be able to answer questions based on physical observations of zebra mussels and information gained from the video. Can they answer your questions?

WAIT, THERE'S MORE...

Use information from the chart to have the class draw conclusions from the following questions:

1. Why are zebra mussels considered a menace?
2. How do zebra mussels affect you?
3. How did zebra mussels travel from Europe to North America?
4. How are zebra mussels transported throughout the United States?
5. What are some ways to prevent the zebra mussel spread?





ZEBRA MUSSELS

WORDS OF WISDOM

ACTIVITY 2: LOOKING AT THE ZEBRA MUSSEL MENACE

BALLAST WATER: the water carried in a boat or ship to give stability

BYSSAL TREADS: a tuft of filaments, chemically similar to silk, secreted by various bivalves, especially mussels, used to attach the mollusk to the substratum

BIVALVE: any mollusks, including mussels and clams, having a shell consisting of two valves hinged together

ECOSYSTEM: the interacting system of a biological community and its non-living environmental surroundings

EXOTIC SPECIES: the organisms that are foreign, not native, to a particular location

MOLLUSCICIDES: a chemical substance that poisons mollusks

SALINITY: a condition in which salt is part of a solution; the amount of salt in water

SUBSTRATE: the ground or other solid material on which an animal moves or is fastened

VELIGER: a zebra mussel larvae





ZEBRA MUSSELS

STOP ZEBRA MUSSELS OBSERVATION SHEET 2.1

Zebra Mussel Watchers' Names:

Predict the number of zebra mussels in 100 ml _____

Count the zebra mussels in 100 ml _____

Directions: Record your observations of zebra mussels. Remember that you have a ruler and scale!

Sight (visual) _____

Smell (olfactory) _____

Touch (tactile) _____

Sound (auditory) _____

Size (quantitative) _____

Draw a zebra mussel



ZEBRA MUSSELS

STOP ZEBRA MUSSELS RECORD SHEET 2.2

Zebra Mussel Watchers' Names:

Directions: Answer as many questions as you can while viewing the video.

1. Why are zebra mussels a concern? _____

2. Where did zebra mussels come from? _____

3. How did zebra mussels get to North America? _____

4. Describe the zebra mussel. _____

5. Who or what do zebra mussels affect? _____

6. List some of the rivers and lakes that have been affected by zebra mussels? _____

7. What can be done to decrease the spread of zebra mussels? _____



ZEBRA MUSSELS

STOP ZEBRA MUSSELS OBSERVATION SHEET 2.1

Zebra Mussel Watchers' Names:

TEACHER'S KEY

Predict the number of zebra mussels in 100 ml _____ will vary _____

Count the zebra mussels in 100 ml _____ will vary _____

Directions: Record your observations of zebra mussels. Remember that you have a ruler and scale!

Sight (visual) _____ length, has stripes, bottom is flat, two halves, etc. _____

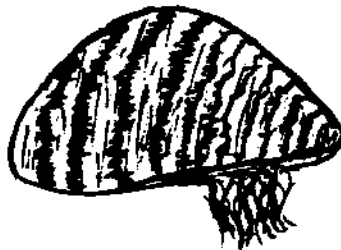
Smell (olfactory) _____ stinks, smells bad, etc. _____

Touch (tactile) _____ edge is sharp, surface is smooth, etc. _____

Sound (auditory) _____ clinks together _____

Size (quantitative) _____ will vary (small, tiny, big) _____

Draw a zebra mussel





ZEBRA MUSSELS

STOP ZEBRA MUSSELS RECORD SHEET 2.2

Zebra Mussel Watchers' Names:

TEACHER'S KEY

Directions: Answer as many questions as you can while viewing the video.

1. Why are zebra mussels a concern? Causes some of us hard earned money, changes the way we use our lakes and rivers, undesirable environmental changes, etc.
2. Where did zebra mussels come from? Europe
3. How did zebra mussels get to North America? Surviving in the ballast water of ocean going ships, ships dumped water into Great Lakes.
4. Describe the zebra mussel. Small, bivalve mollusks, has byssal threads, prolific, has larvae called veligers.
5. Who or what do zebra mussels affect? Intake pipes, industries, boats, docks, people walking on the beach, native clams, disrupt the food chain for larger fish.
6. List some of the rivers and lakes that have been affected by zebra mussels? Mississippi, Tennessee, Tom-Bigbee.
7. What can be done to decrease the spread of zebra mussels? Drain all water and let your equipment dry, Spray boat with Hot water, Scrape off visible mussels, Don't transport bait to another body of water, Use molluscicides.

