

MATERIAL TO XEROX



**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
 2. _____ byssal threads
 3. _____ exotic species
 4. _____ food chain
 5. _____ indigenous species
 6. _____ phytoplankton
 7. _____ veliger
 8. _____ 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 MUSSEL POST-TEST CONT

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 CON'T

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 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? _____

MUSSEL TO MUSSEL STORY 4.1

MR. BOEPPLE'S SHELLS

Hundreds of years ago, the American Indians and the Pilgrims lived off the land. They ate freshwater mussels. Sometimes they would find a treasure inside one of the mussels—a pearl that they could use to make jewelry. The mussels were easy to find, but they almost never had a pearl inside. Because the pearls were so rare, they became very valuable. The biggest pearls were worth the most money. People began to find pearls inside the mussels in the Mississippi River Valley during the 1850's. The pearl hunters became very rich. People began to race to find as many pearls as possible. This caused the disappearance of most of the freshwater mussels in the Mississippi River Valley.

In 1888, John Boepple came from Germany to hunt for freshwater mussel. John was not looking for pearls. Instead, he wanted to make buttons out of the shells. It would have been too expensive to bring the shells to Germany, so he decided to make the buttons in America. One day he was bathing in the Illinois River when he cut his foot on a sharp object. He had cut his foot on one of the freshwater mussel shells that he had been searching.

During the next few years he struggled to learn English; and he collected as many shells as he could. Then in 1891, using the shells he had spent years collecting, Boepple set up his first button making business in Muscatine, Iowa. Two local businessmen helped him get started. They had the money to run the business, and Boepple had the skill to make the buttons. The men soon began to argue. The investors wanted to make as many buttons as quickly and cheaply as they could. John Boepple wanted to make a quality product, but he needed the businessmen's money. Eventually, the dispute caused Boepple to look for new partners. (The first two partners tried to run their own button making business. They failed without Boepple because they knew nothing about making buttons.)

Boepple did not take long to find new partners that were very wealthy. They let him run his company as he wanted it run. The business flourished. The only problem was that Boepple had to collect the mussel shells by hand. This was a very slow process. Help was soon on the way because people began to discover pearls in the shells. Just like 40 years earlier, word began to spread about how rich a person could become by finding pearls. Soon farmers, shopkeepers, and businessmen began wading into the shallow rivers and streams hoping to get rich. Boepple was now able to buy the shells he needed to make his buttons.

In 1897, someone invented a new tool called a brail. The tool allowed mussel hunters to harvest mussels in deeper water from boats instead of wading into shallow waters. People crowded the rivers to find the mussels. Soon violence broke out. Pearl hunters robbed each other and fought over hunting space. Even though hunters rarely found pearls, they knew they could make a profit by selling the mussel shells to the button makers. As more people hunted for shells, more shells became available to make buttons.

MR. BOEPPLE'S SHELLS (continued)

The new button makers were not as concerned about quality as John Boepple. Everyone thought there would be an endless supply of shells. Button makers became more wasteful and used the shells more foolishly. Factories were springing up everywhere. New machines made buttons faster and cheaper. Boepple became very worried about the poor quality of the buttons being made. There were many arguments, and again, the person who knew more about making buttons than anyone else in the country was forced out of business. Boepple was left with nothing.

Seventeen years had passed since John Boepple first started making buttons. Again, shell collectors and button manufacturers became concerned about the natural supply of shells. History had repeated itself. In 1908, the mussels again became very difficult to find. The few that were found were too small to be useful for button-making. Finally, in 1911 the United States government asked John Boepple to help find ways to increase the mussel population.

Boepple traveled to Indiana in search of new ways to replenish the mussel supply. He waded in Indiana's rivers looking for mussels. Just as he had done so long ago on the Mississippi River, he cut his foot on a shell on the river bottom. This time the ending was not a happy one. After several months, John Boepple died from blood poisoning from he cut. This German-American immigrant had valued the freshwater mussel more than any person in the world. Ironically, he became victim of the very thing that had given him his life's work.

Written by Cherie Van Camp * Adapted from: The Founding and Early History of the Pearl Button Industry by Michael G. O'Hara, Muscatine Community College, Muscatine, Iowa



**ZEBRA
MUSSELS**

**MUSSEL TO MUSSEL: SHELL IDENTIFICATION SHEET
TEACHER'S KEY 4.4**

Zebra Mussel Watchers' Names:

Identification for Native Mussel Shell Collection:

1. Blue Mussel
2. Asiatic Clam
3. Washboard Clam
4. Maple Leaf Clam
5. Zebra Mussel
6. Pimpleback Clam
7. Silty Hornsnail
8. Pink Heelsplitter Clam
9. Yellow Sand Shell
10. Three-horned Wartyback
11. Ponderous Campeloma
12. Three-ridge Clam
13. Ebony Shell



ZEBRA MUSSELS

MUSSEL TO MUSSEL: FRESHWATER AND ZEBRA MUSSEL LIFE CYCLES OBSERVATION SHEET 4.6

Zebra Mussel Watchers' Names:

Compare zebra and freshwater mussels

Contrast
Zebra mussels

Freshwater

HOW BIG ARE YOUR MUSSELS?
 ZEBRA MUSSEL LENGTH-FREQUENCY CHART
 DATA SHEET 5.1

Zebra Mussel Watchers' Names:

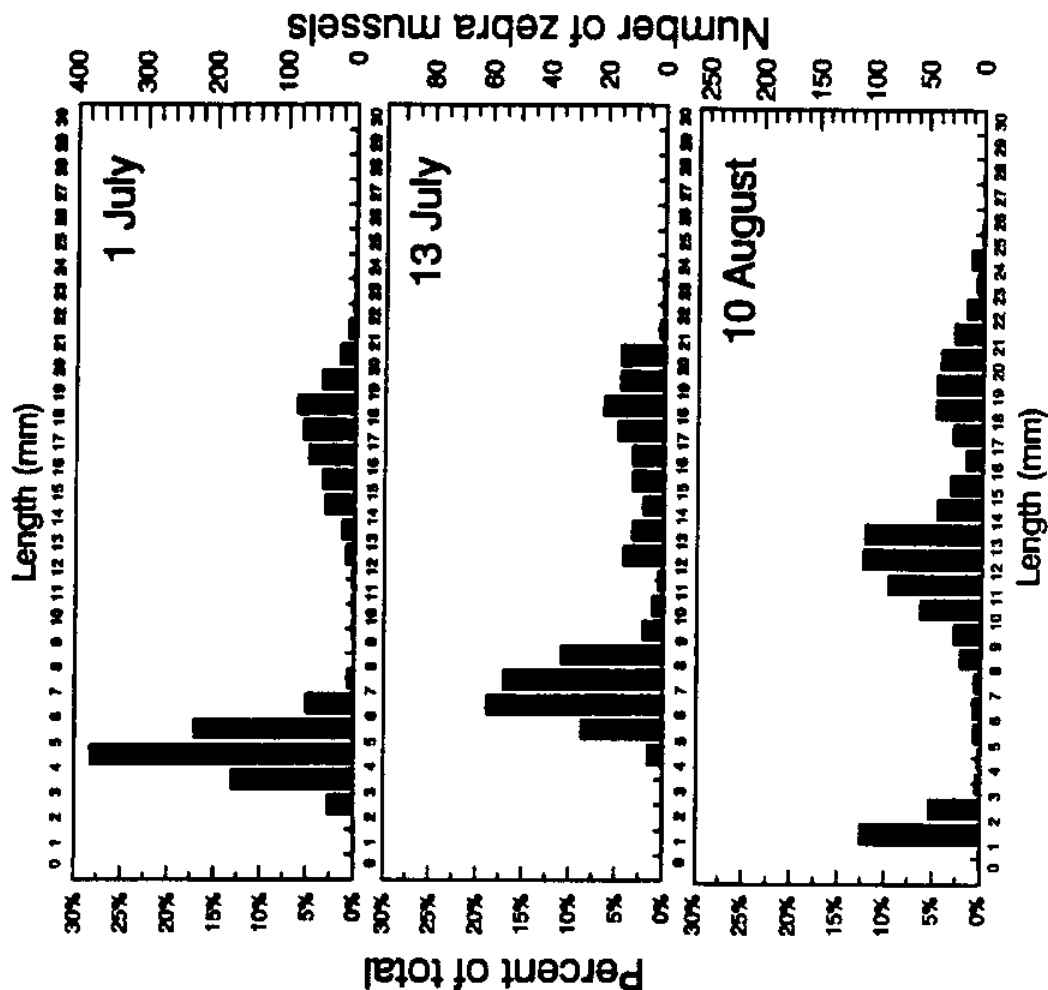
Length	Number	Total	Percentage
1 mm			
2 mm			
3 mm			
4 mm			
5 mm			
6 mm			
7 mm			
8 mm			
9 mm			
10 mm			
11 mm			
12 mm			
13 mm			
14 mm			
15 mm			
16 mm			
17 mm			
18 mm			
19 mm			
20 mm			
21 mm			
22 mm			
23 mm			
24 mm			
25 mm			
26 mm			
27 mm			
28 mm			
29 mm			
30 mm			

maximum length _____ minimum length ⁵² _____ Total shells _____

HOW BIG ARE YOUR MUSSELS?
 ZEBRA MUSSEL LENGTH FREQUENCY
 BAR GRAPH 5.2

Researchers from the Illinois Natural History Survey made random collections of zebra mussels from the Illinois River near Peoria, IL on three dates in 1993. The samples were returned to the laboratory where the length of each shell was determined. These length data were sorted into 1-mm length intervals. Numbers of zebra mussels from each collection in each interval were tabulated, and the percentages of shells in each interval were calculated (see the table below). Percentages were then used to construct the three length frequency distribution graphs below.

Length Interval (mm)	1 July 1993		13 July 1993		10 August 1993	
	Number	Percent	Number	Percent	Number	Percent
0 - 1	0	0.0%	0	0.0%	1	0.1%
1 - 2	1	0.1%	0	0.0%	108	12.6%
2 - 3	37	2.8%	0	0.0%	47	5.4%
3 - 4	175	13.1%	0	0.0%	4	0.5%
4 - 5	377	28.3%	5	1.8%	3	0.3%
5 - 6	229	17.2%	28	8.7%	6	0.7%
6 - 7	68	5.1%	81	18.9%	7	0.8%
7 - 8	9	0.7%	88	17.1%	5	0.6%
8 - 9	0	0.0%	36	10.8%	16	2.1%
9 - 10	2	0.2%	7	2.2%	24	2.8%
10 - 11	3	0.2%	4	1.2%	55	6.3%
11 - 12	3	0.2%	2	0.6%	84	9.7%
12 - 13	12	0.9%	14	4.3%	108	12.4%
13 - 14	17	1.3%	11	3.4%	106	12.2%
14 - 15	42	3.2%	7	2.2%	41	4.7%
15 - 16	46	3.5%	11	3.4%	28	3.2%
16 - 17	67	5.0%	11	3.4%	15	1.7%
17 - 18	75	5.6%	16	5.0%	26	3.0%
18 - 19	82	6.2%	21	6.9%	42	4.8%
19 - 20	46	3.6%	15	4.7%	42	4.8%
20 - 21	22	1.7%	15	4.7%	37	4.3%
21 - 22	11	0.8%	2	0.6%	26	3.0%
22 - 23	2	0.2%	1	0.3%	15	1.7%
23 - 24	2	0.2%	1	0.3%	6	0.7%
24 - 25	1	0.1%	0	0.0%	10	1.2%
25 - 26	1	0.1%	0	0.0%	2	0.2%
26 - 27	0	0.0%	0	0.0%	0	0.0%
27 - 28	0	0.0%	0	0.0%	1	0.1%
28 - 29	0	0.0%	0	0.0%	0	0.0%
29 - 30	0	0.0%	0	0.0%	0	0.0%
Total	1332	100%	322	100%	669	100%



FILTERING FOOLS DATA SHEET 6.1

Zebra Mussel Watchers' Names:

	Unfiltered water ● cottonball	100 ml filtered with 2 cottonballs	100 ml filtered with 4 cottonballs	100 ml filtered with 6 cottonballs
Describe the water.				
	0 zebra mussels	2 zebra mussels	4 zebra mussels	6 zebra mussels
Describe how zebra mussels affect water, based on cottonballs above.				

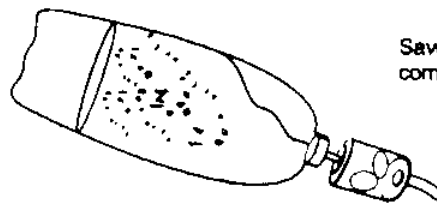


2 cottonballs



Screw the zebra mussel filter model on bottle

Add the dirty water to a clean 2-liter bottle



Save filtered water for comparison.



Repeat steps using 4 then 6 cottonballs.

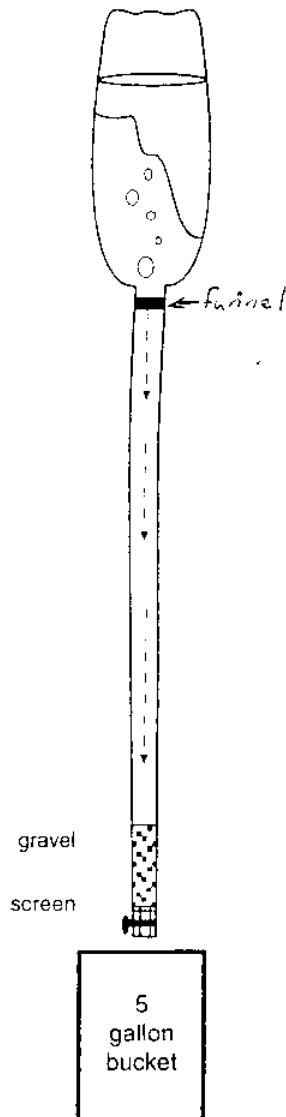


ALL CLOGGED UP! DATA SHEET 7.1

Zebra Mussel Watchers' Names:

Rate of Flow Data Table

STEPS 1-5



Amount of gravel	Rate of flow in seconds			
	Trial 1	Trial 2	Trial 3	Average
no gravel				
5 cm				
15 cm				
20 cm				

Make a prediction after plotting the data on the graph paper.

Predicted rate of flow using 10 cm of gravel _____ seconds

Predicted rate of flow using 25 cm of gravel _____ seconds



ZEBRA MUSSELS

FILTERING FOOLS OBSERVATION SHEET 6.2

Zebra Mussel Watchers' Names:

1. Compare the cottonball filters. Did the 2, 4, or 6 filters remove more material from the water?

2. How does this filtering demonstration relate to the zebra mussel?

3. Write a paragraph telling why filtering of zebra mussels has such a great impact on a body of water.

4. List at least 5 ways that filters are used by people.



ZEBRA MUSSELS

ALL CLOGGED UP! RECORD SHEET 7.2

Zebra Mussel Watchers' Names:

Questions

1. How good was your group's prediction at the 10 cm of gravel level? Why?

2. How good was your group's prediction at the 25 cm of gravel level? Why?

3. Which prediction (10 or 25 cm of gravel) should have been more accurate? Why was one prediction more accurate than the other?

4. How does this demonstration relate to zebra mussels?

5. Describe how the zebra mussel might affect pipes in water or power plant systems.

FAMILY REUNION! DATA SHEET 8.1

Zebra Mussel Watchers' Names:

1. Area of pan _____ cm² Area of carton _____ cm² (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)



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

WORDS OF WISDOM ACTIVITY 4: MUSSEL TO MUSSEL

CLASSIFICATION: systematic arrangement in groups or categories according to established criteria

DIVERSITY: variety

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

MOTHER OF PEARL: the hard, pearly internal layer of certain bivalve shells, such as abalone and the three ridge mussel

ORGANIC DETRITUS: dead animal or plant materials or debris

PARASITIZE: to obtain benefit from another organism at that organism's expense

SEDENTARY: remaining or fixed in one spot

SEDIMENTS: soil, sand, and minerals that settle at the bottom of a body of water

NATIVE SPECIES: species that naturally occur or live in a particular area or region

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

INTRODUCED SPECIES: a population placed into a particular area or region that the species is not native to

COMMON NAME: the familiar name used by everyday people to refer to any species

SCIENTIFIC NAME: the Latin name used by scientists to describe species

MOLLUSK (SHELL SPECIES): members of the phylum of invertebrates that include bivalves, snails, and squids



ZEBRA MUSSELS

WORDS OF WISDOM

ACTIVITY 5: HOW BIG ARE YOUR MUSSELS?

CENTIMETER (cm): a metric unit of measure equal to 1/100 meter (about the width of your finger)

DATA: facts, figures, or information from which conclusions can be drawn

MAXIMUM: the greatest number, degree, or quantity

MILLIMETER (mm): a metric unit of measure equal to 1/1000 of a meter; 10 mm equals 1cm

MINIMUM: the smallest number, degree, or quantity

PERCENTAGE: a given part or amount in every hundred

VENTRAL LINE: a longitudinal line along the lower side of a zebra mussel





ZEBRA MUSSELS

WORDS OF WISDOM ACTIVITY 6: FILTERING FOOLS

FILTRATION: a treatment process for removing solid matter from water by passing the water through sand or man-made filter

LITER (L): a metric unit of liquid measurement; it is equal to 1.06 quarts

NUTRIENT: any substance assimilated by living things that promotes growth

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

SUBMERGE: to completely immerse in water





ZEBRA MUSSELS

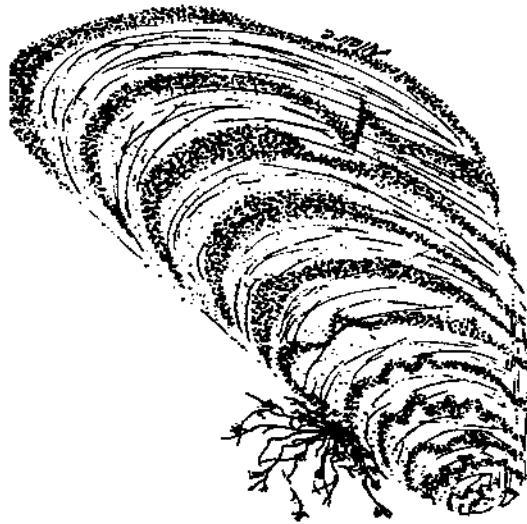
WORDS OF WISDOM ACTIVITY 7: ALL CLOGGED UP

CONGREGATE: a gathering or assemblage of people or things

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

INTAKE LINES: the place fluid is taken into a pipe, e.g., intakes for water treatment plants and power industries

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





ZEBRA MUSSELS

WORDS OF WISDOM ACTIVITY 8: FAMILY REUNION

AREA: the measure of the surface of a solid; a part of any surface; a particular zone

ESTIMATE: to judge or determine generally, but carefully, the size, value, or cost of an item

EXTRAPOLATE: to arrive at a conclusion or result by hypothesizing from known facts or observations

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

PREDICT: to determine in advance what will happen

QUANTIFY: to determine or express the amount of something; to measure

SAMPLING: the process of taking a small amount of an item or object for testing or analysis





ZEBRA MUSSELS

WORDS OF WISDOM ACTIVITY 9: WEB OF LIFE GAME

BIOLOGICAL DIVERSITY: variety of life

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

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

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

HABITAT: the place where a population lives and its surroundings, both living and non-living

LARVAL FISH: an immature, free-swimming stage of a fish

NATIVE SPECIES: species that naturally occur or live in a particular area or region

ORGANIC MATTER: carbon-based waste compounds produced by living plants or animals

ZOOPLANKTON: microscopic aquatic animals eaten by larger aquatic animals

VELIGER: a zebra mussel larvae



