

Activity: Mussel to Mussel

(Adapted from *Zebra Mussel Mania*, Illinois-Indiana Sea Grant Program)

Lesson Summary

Students compare life cycles of native freshwater mussels to non-native zebra mussels. They describe how the zebra mussel impacts native mussels, other organisms and the ecosystem. They describe the role of human activity and technology on the spread of zebra mussels and its impact on the economy and recreation.

Ohio Standards Correlations

Standard: Life Sciences

Grades 3-5 Benchmark A: Differentiate between the life cycles of different plants and animals.

Indicator(s)

Grade Three

1. Compare the life cycles of different animals including birth to adulthood, reproduction and death (e.g., egg-tadpole-frog, egg-caterpillar-chrysalis-butterfly).

Grades 3-5 Benchmark B: Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.

Indicator(s)

Grade Three

2. Relate animal structures to their specific survival functions (e.g., obtaining food, escaping or hiding from enemies).

Grades 3-5 Benchmark C: Compare changes in an organism's ecosystem/habitat that affects its survival.

Indicator(s)

Grade Five

6. Analyze how all organisms, including humans, cause changes in their ecosystems and how these changes can be beneficial, neutral or detrimental (e.g., beaver ponds, earthworm burrows, grasshoppers eating plants, people planting and cutting trees and people introducing a new species).

Grades 6-8 Benchmark C: Explain how energy entering the ecosystem as sunlight supports the life of organisms through photosynthesis and the transfer of energy through the interactions of organisms and the environment.

Indicator(s)

Grade Six

8. Describe how organisms may interact with one another.

Standard: Science and Technology

Grades 3-5 Benchmark A: Describe how technology affects human life.

Indicator(s)

Grade Three

2. Describe ways that using technology can have helpful and/or harmful results.

Grade Five

1. Investigate positive and negative impacts of human activity and technology on the environment.

Time

4 45-minute sessions

Materials

Per group

1 copy of "Freshwater Mussels: Mussel Life Cycle," taped together horizontally (Attachment A)

1 copy of "Zebra Mussels: Life Cycle of the Zebra Mussel," taped together horizontally (Attachment B)

1 copy of Comparison Chart (Attachment C)

For whole class

1 set per student of mussel vocabulary cards and sorting mat from "Building a Science Vocabulary"

1 set per student of vocabulary cards for "Mussel to Mussel"

Overhead transparencies of zebra mussel distribution map (Attachment D), zebra mussel colony on intake valve (Attachment F) and beach covered with zebra mussel shells (Attachment G).

1 copy per student of "Zebra Mussel Fun (or Not So Fun) Facts"

Attachment E) and "Zebra mussels really get around! (Attachment H)

Hard copy or pdf of *Russell the Mussel*

Background

Almost 300 different species of native mussels have been identified from streams, rivers, lakes and ponds of North America. They are important, both economically and ecologically. The zebra mussel is native to an area in the Ukraine and Russia near the Black and Caspian Seas. When canals were built, the zebra mussel spread throughout Europe. It is believed that they were first introduced into the Great Lakes in the mid 1980s. Scientists believe that zebra mussel larvae and juveniles may have traveled in ballast water in boats coming from Europe to North America. When the ballast water was pumped out, so were the zebra mussels. The habitat of the Great Lakes is well suited for the non-native zebra mussel. Zebra mussels compete with native mussels for food, space, oxygen, and other necessities. Some competition between equals may not be bad, but, because zebra mussels reproduce so quickly, they often will “out-compete” the native mussels (and other native organisms as well).

Understanding the similarities and differences between the life cycle of the zebra mussel and native freshwater mussels helps to explain one reason why zebra mussels are proliferate and may eliminate native mussels completely from many rivers and lakes. (See “Zebra Mussels in North America: The Invasion and Its Implications” for additional information <http://www.sgnis.org/publicat/snyder.htm>).

Vocabulary

Vocabulary from Session 1, “Building a Science Vocabulary”

larvae—fertilized mussel eggs develop into larvae

life cycle—the stages of growth and development from egg to adult

organic detritus—decomposing plant and animal material

plankton—microscopic plants

sedentary—settled, not moving or very slow moving

sediments—bits of rocks, soil, and remains of organisms carried by water

spawning—female releases eggs into water and male released sperm

veligers—the larvae of zebra mussels

zooplankton—microscopic animals

byssal threads—used by zebra mussels to attach to surfaces

Teacher Tips

Optional: Make the new vocabulary cards a different color to make them easier to separate for future use.

Procedures

Engage

1. Ask students to think back to the story about Russell the Mussel (pp. 4-6). Ask them what they remember about how native freshwater mussels reproduce.
2. Record the ideas where everyone can see them.

Explore



1. Pass out the vocabulary words from the "Building a Science Vocabulary" activity and have them sort the words on their sorting mat. Ask how many had more words in the left and middle columns today than the first time they sorted them.
2. Pass out the new vocabulary cards and have students sort these. Explain that they will use both sets of words in the next task and encourage them to use different strategies while reading to learn the meaning for each word (e.g., infer through context, identify word chunks, consult a dictionary or glossary).



Explain

1. Divide students into groups of three and give each group a copy of the "Freshwater Mussels: Mussel Life Cycle" (Attachment A).
2. Have them read it as a group and determine the meaning of any words they do not know.
3. Pass out the "Zebra Mussels: Life Cycle of the Zebra Mussel" and have them read it as a group and determine the meaning of any words they do not know.



Elaborate/Extend

1. Using the two life cycle charts (native freshwater mussels and zebra mussels), have each group discuss the life cycles and record the similarities and differences between these two groups of organisms. Have them record their findings on the "Mussel to Mussel Life Cycles Comparison Chart."
2. Synthesize the groups' information into a class chart by having groups take turns sharing their findings.
3. Discussion Questions:
 - Based on the life cycle, which mussel reproduces the fastest? Why? (zebra—external fertilization, grows rapidly, can reproduce by age one; native mussels—need host fish, sometimes very specific fish, grows slowly)
 - Which mussel can travel the farthest without help? How does it travel? (zebra—free swimming)



- Which mussel can travel the farthest with help? How does it travel? (zebra mussel—can detach and drift with current, can attach to boats)
- 4. Show the distribution map of zebra mussels in North America. Discuss the pattern of distribution.
- 5. Share and discuss the “Zebra Mussel Fun (or Not So Fun) Facts”
- 6. Show the pictures of a zebra mussel colony on the intake valve and zebra mussel shells on the beach. Discuss the impact of the non-native zebra mussels on the ecosystem, economy, and recreation.
- 7. Optional—Students can become super sleuths in pursuit of the zebra mussel and other aquatic invaders through this engaging Web site.
http://sgnis.org/kids/Lakes/suspects/suspect_zeke.html



Evaluate

1. Compare the life cycle of the zebra mussel and the life cycle of native freshwater mussels. Include two (2) similarities and three (3) differences.
2. Create a poster, brochure, commercial or other media educating the public on the impacts of zebra mussels and what they can do to help stop the spread of zebra mussels.
3. Complete the “Zebra mussels really get around!” matching poster (Attachment H).

References

Zebra Mussel Mania: Teacher's Guide for Grades 5 and 6, Illinois-Indiana Sea Grant Program, University of Illinois, Urbana, IL 61801.

INSERT VOCABULARY CARDS

Attachment A

Insert Native Mussel Life Cycle

Insert Native Mussel Life Cycle

Insert Native Mussel Life Cycle

Insert Native Mussel Life Cycle

Attachment B

Insert Zebra Mussel Life Cycle

Insert Zebra Mussel Life Cycle

Insert Zebra Mussel Life Cycle

Notes



Attachment C

Mussel to Mussel Life Cycles Comparison Chart



Similarities Between Zebra Mussels and Freshwater Mussels	Differences Between	
	Zebra Mussels	Freshwater Mussels



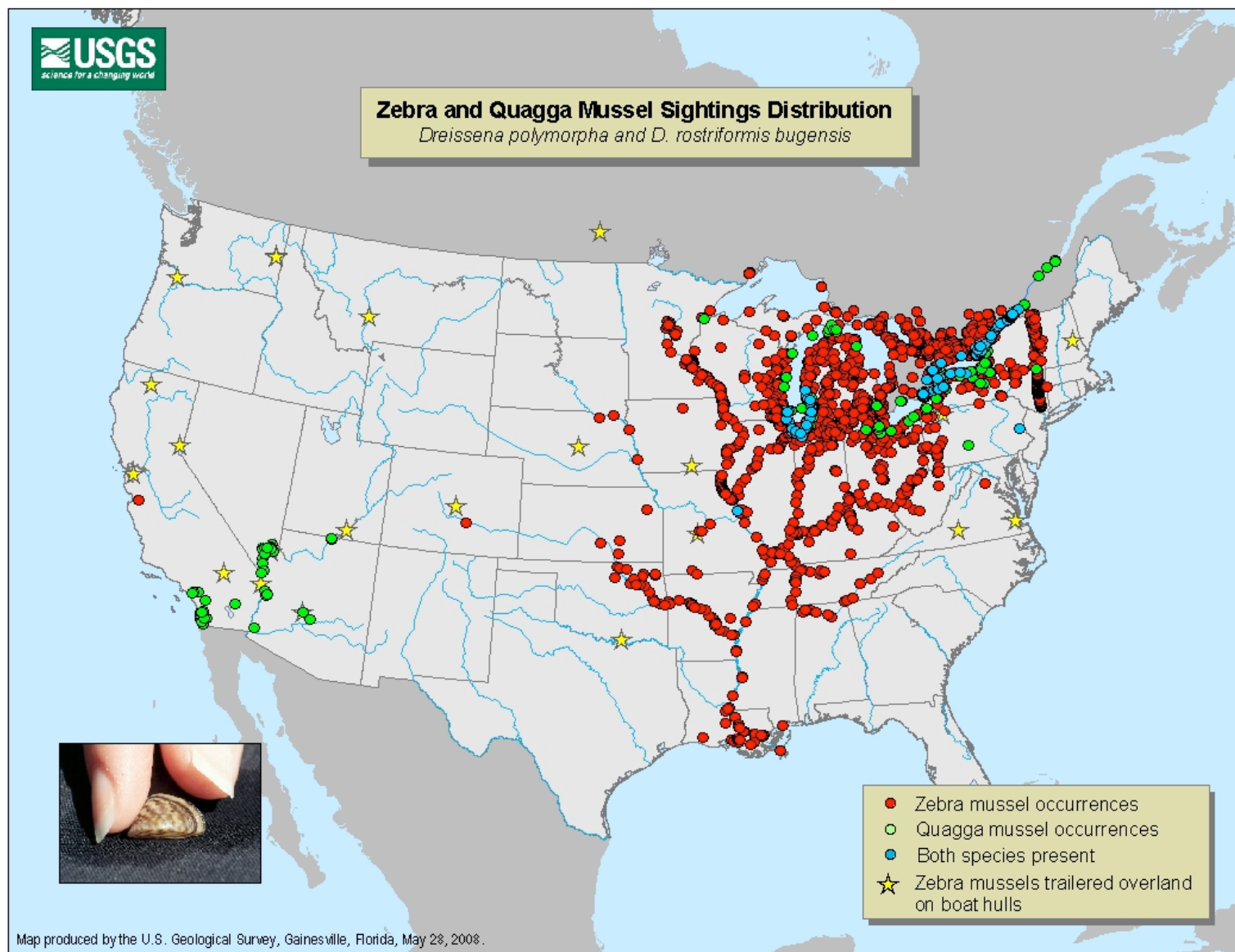
Attachment C

Mussel to Mussel Life Cycles Comparison Chart Answer Key



Similarities Between Zebra Mussels and Freshwater Mussels	Differences Between	
	Zebra Mussels	Freshwater Mussels
• Both are mollusks and have two shells (bivalve) • Both live in rivers and streams • Both are filter feeders • Both eat plankton • Both have fertilized eggs that become larvae	• Free swimming • Fertilization of eggs occurs in water (spawning) • Larvae known as veligers • Post-veligers have a settling stage • Post-veligers attach to a hard surface using byssal threads • Mussels colonize or cluster together • Juveniles detach and drift to new location • Adults attached mostly to hard surfaces • Rapid growth	• Sedentary • Fertilization of eggs occurs in the gills of the female mussel • Larvae known as glochidia • Glochidia have a parasitic stage • Glochidia attach to fish gills • Mussels live as individuals • Juveniles can move short distance by extending foot • Adults live in most substrates from sand to mud to gravel and cobbles • Slow growth

Attachment D

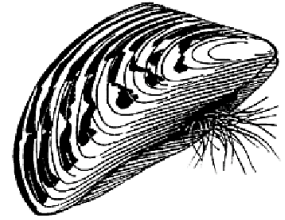


Attachment E

Zebra Mussel Fun (or Not So Fun) Facts

(Adapted from Ohio Sea Grant and New York Sea Grant Fact Sheets)

- A mature female may produce up to one million eggs per season.
- Zebra mussels are sexually mature within one year.
- In Lake Erie, they live approximately 3 years.
- They can colonize any surface that is not toxic—rock, metal, wood, glass, plastic, concrete, rubber, fiberglass, paper, plants, or other mussels. They can also colonize soft, muddy bottoms.
- In Lake Erie there can be as many as 30,000-100,000 mussels in a square meter.
- Each adult is capable of filtering 1 or more liters of water each day, which reduces the food source for zooplankton, the base of the aquatic food web. Water clarity in some areas of Lake Erie has increased from 1 to 35 feet, changing the lake ecosystem in that area.
- Veligers (larvae) can spread by water currents, bait and fish stocking activities, and in anglers' bait bucket water. Adult zebra mussels can spread by attaching to organisms such as crayfish and turtles; attaching to ship, barge, and recreational boat hulls, on or in boats pulled by trailers to another body of water; and via canals.



- Zebra mussels readily encrust native mussels, consuming their food and fouling their water. They out compete them for habitat.
- Because zebra mussels thrive in currents, they colonize water intakes, pipelines and intake canals. This in turn impacts drinking water treatment, electrical power generation and industrial facilities operations.
- Zebra mussels also impact recreation—colonies on docks, on boats, in boat engines; sharp shells on beaches
- Zebra mussels may accumulate organic pollutants and pass them up the food chain to fish and waterfowl and even to people.

Attachment F



Attachment G



Attachment H

Get Around

Get Around