

## Invading the Invaders: Impacts of Zebra and Quagga Mussels

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**Target Grade:** Grades 5-6, Science

### Lesson Overview:

Students will be able to describe how two closely related invaders of the Great Lakes, zebra mussels and quagga mussels, affect the Great Lakes and inland lakes through a process called filtration. Students will investigate how these very similar invasive species, called Zebra Mussels and Quagga Mussels, can negatively impact lakes and rivers where they live.

### Background:

Plants or animals that are introduced into an area from another part of the world are referred to as “Aliens” or “Exotic Species.” They are called this because they did not originate in the habitat like the **native species** that have lived in the environment for very long periods of time. When an exotic species spreads rapidly and has a negative impact on the environment, economic activities and/or humans, scientists refer to these organisms as “**invasive species.**” Invasive species can be any organism that can cause damage or changes to an ecosystem in which it did not originate. These non-native organisms can be plants, animals, insects, or microorganisms, such as bacteria and fungi. Zebra Mussels and Quagga Mussels arrived in the Great Lakes around the same time. Zebra Mussels initially spread faster, but Quagga Mussels can live and grow at greater depths and in colder water, and are now more common than zebra mussels in most places in the Great Lakes, and therefore are causing even more damage.

**Duration:** 50- 55 min

**Setting:** Classroom

### LEARNING OBJECTIVE:

*At the end of this lesson, students will be able to:*

- Explain how invasive mussels can harm lakes through a process called filtration.
- Define Invasive species.
- Compare and contrast invasive species to non-native species.
- Describe how mussels eat and why they are called “Filter Feeders.” • Illustrate a labeled diagram demonstrating the process of filter feeding.

### Performance Expectation:

MS-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. \*\*

**Materials:**

*Per student group:* ½

c. pebbles

¼ cup Sodium Polyacrylate (may be purchased from Carolina Biological Supply or may be obtained by cutting open a disposable baby diaper and shaking powder into bowl)

1/2 c. sand

1 clear plastic bowl or a 16 oz. clear plastic cup?

Small sieve or aquarium net

1 c. measuring cup

1 paper or plastic 8 oz. cup

Color markers

Poster size paper

Tape

*Per student:*

Science Journal

**Warm-Up**

Visit the Belle Isle Aquarium at Belle Isle State Park in Detroit to observe a demonstration of filter feeding by quagga mussels from Belle Isle or watch a short video of a filtration experiment using quagga mussels from Belle Isle, available on Belle Isle Aquarium website <http://detroitaquarium.weebly.com/educating-aboutinvasive-species.html>

**Focus Questions**

- How does filtration by Zebra Mussels and Quagga Mussels affect an aquatic ecosystem?
- How do Zebra Mussels and Quagga Mussels feed?
- When is clear water not a good thing?

**ENGAGE** (5-10 min)

The teacher will ask the following questions:

*When you hear the word invasive, what does that mean? How can something be invaded? Give an example.*

*Today we are going to learn about non-native aquatic animals in the Great Lakes called Zebra Mussels and Quagga Mussels. Zebra Mussels are known to be invasive species. What do you think an invasive species is? In your science journal, write down your response. (Teacher will walk around to monitor students working = 3 minutes)*

*Turn and talk to your neighbor and share what you wrote. You have 2 minutes each. (4 minutes)*

*Teacher will call on a few students to share with the class what they wrote for a definition of invasive species. Answer: An Invasive Species is any organism that causes damage to an ecosystem in which it did not originate.*

### **EXPLORE (10 min)**

Put 2 cups of water in a measuring cup.

In a bowl, stir 3 teaspoons of pebbles, 2 teaspoons of sand and 1/2 teaspoon of sodium polyacrylate. Have a partner hold sieve over bowl.

Pour 1 cup of water into dry mixture (sand, pebbles and polyacrylate).

Allow water to sit in bowl for about 1 minute and record your observations.

#### **Supporting Students During Exploration:**

(Teacher will facilitate, observe and listen to student's responses as students collaborate.) Students will work in groups discussing and writing their responses in their science journal.

1. Which materials remained in the sieve?

2. Feel the water in the measuring cup? Write your observations? What happened to the sand particles?

*Teacher will call on student(s) to share their responses.*

### **EXPLAIN (10 min)**

The activity we just did helped us learn about what? (Students should give information connecting the use of the sieve to demonstrate how mussels filter feed and that Zebra and Quagga Mussels are invasive species.)

*Teacher will ask the following questions:*

- Which substance did the filter trap and which substance was released.
- Why do you think a Mussel would want to trap some things and release others? (If students are struggling, ask the following question: Why do we consume some foods, and spit out other foods?)
- What was different about the sand once it was released?
- Where do you think the particles released by the Mussel will end up?
- Predict what will happen to the environment if Zebra Mussels and Quagga Mussels continue to release particles into the environment in which they live.

### **EVALUATE (25 min)**

(Pass out handout. Teacher will call on student(s) to read the paragraph below or the teacher will read the paragraph aloud to the class.) After reading the short paragraph, the class will draw a diagram (model) illustrating their understanding of how Mussels filter feed. (see below).

*Reading: "Filter Feeders"*

Like the sieve, Zebra Mussels and Quagga Mussels have the ability to filter. They are filter feeders and can filter one liter of water per day. Almost all matter in the water is filtered. When in the water, they open their shells to admit dead plants or animals, material derived from animal tissues and other waste materials. The food that they feed on are microscopic plants called **phytoplankton** and small zooplankton. Other matter filtered is expelled as pseudofeces. **Pseudofeces** are a way that filter-feeding bivalve mollusks (and filterfeeding gastropod mollusks) get rid of or exhale suspended particles which have been rejected as unsuitable for food(see diagram below). The rejected particles are wrapped in mucus, and are expelled without having passed through the digestive tract. Thus although they may closely resemble the mollusk's real feces they are not actually feces. Pseudofeces means "false" feces.

**Instruction to students:** *You have just completed the filter feeding activity and briefly read about how mussels feed in the lakes. Based on what you've learned, create a model that shows your interpretation of a Zebra or Quagga Mussel filter feeding in the lake. Use arrows and labels to demonstrate how this process would look.*

Allow students to take a walk around the room to view their classmates' diagram (model).

**Lesson Extension:** (25 min)

Students can view the video (see below) and after they gather new evidence, the students will make the necessary corrections or changes to their initial model.

Video Link: "The Spread and Impact of Zebra Mussels" <https://www.youtube.com/watch?v=PhPvAblvpXs>

**New Vocabulary**

**Invasive species:** is any organism that causes damage to an ecosystem in which it did not originate. Native: Plants and animals that got to Hawai'i by themselves, without the help of people.

**Non-native:** Plants and animals that are brought to an area by people, either on purpose or accidentally.

**Pseudofeces:** are a specialized method of expulsion that **filter-feeding bivalve mollusks** (and filter-feeding **gastropod** mollusks) use in order to get rid of suspended particles such as particles of grit which cannot be used as food, and which have been rejected by the animal.

**Filtering:** pass (a liquid, gas, light, or sound) through a device to remove unwanted material.

## Sources Consulted

“The Spread and Impact of Zebra Mussels.” <https://www.youtube.com/watch?v=PhPvAblvpXs>

Diagram of mussel feeding: <http://www.molluscs.at/images/weichtiere/muscheln/respiration.gif>

Whie, Elizabeth. Aquatic Invasive Species. University of Wisconsin Sea Grant Institute.

<http://www.seagrant.wisc.edu/home/Default.aspx?tabid=492>

Wikipedia [https://en.wikipedia.org/wiki/Zebra\\_mussel](https://en.wikipedia.org/wiki/Zebra_mussel)

Aquatic Invasive Species, Zebra Mussels. <http://www.in.gov/dnr/files/ZEBRA-MUSSEL.pdf>

Invasive Species Program, Aquatic Invasive Species. Minnesota Department of Natural Resources. May 2015.

[http://files.dnr.state.mn.us/natural\\_resources/invasives/aquaticanimals/zebramusel/fact\\_sheetzebra\\_mussels.pdf](http://files.dnr.state.mn.us/natural_resources/invasives/aquaticanimals/zebramusel/fact_sheetzebra_mussels.pdf)

What are Pseudofeces? [http://www.liquisearch.com/what\\_are\\_pseudofeces](http://www.liquisearch.com/what_are_pseudofeces)

Davis, Mark A., Invasive Species. 2002. The Gale Group Inc.

<http://www.encyclopedia.com/plants-and-animals/botany/botany-general/invasive-species>

Jeffrey L. Ram, Aosh S. Karim, Fady Banno, and Donna R. Kashian (2012) Invading the invaders: Reproductive and other mechanisms mediating the displacement of zebra mussels by quagga mussels. *Invertebrate Reproduction and Development*. 56: 21-32. DOI: 10.1080/07924259.2011.588015

**We would greatly appreciate your feedback using this lesson plan! Please visit <https://www.biaquariumstem.org/survey.html> to complete a short survey about your experience.**

## STUDENT HANDOUT

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