

2 class sessions

A New Mussel in Town

Has the quagga mussel had a positive or negative effect on the Lake Michigan ecosystem?

Students conclude the chapter with an investigation of another invasive species in the Great Lakes ecosystem, the quagga mussel, which has displaced much of the zebra mussel population. This allows for the evaluation of students' understanding of dynamic ecosystems and the effects of invasive species, while setting them up to investigate possible solutions for ecosystems disruptions in the following chapter.

Rationale & NGSS Integration

This Evaluate activity concludes this chapter with an investigation of data on quagga mussels that have displaced the zebra mussels in Lake Michigan. Students analyze data from different sources and use that analysis to construct an argument about the effect of the quagga mussel on the Lake Michigan. Their written arguments can be used to assess both performance expectations for the chapter, as well as their understanding of the core ideas of dynamic ecosystems and competition for resources and their use of the practice of analyzing and interpreting data.

Activity Overview

In this Evaluate activity, students investigate data on the Quagga mussels that have invaded Lake Michigan and out-competed the zebra mussels. Students also analyze data about the steep decline in *Diporeia*, a shrimp-like organism eaten by the Quagga as well as several species of fish that are the basis of commercial fisheries in the lake. Students develop an argument about whether the effect of the Quagga has been positive or negative.

Activity 4.5

Materials and Advance Preparation

For the teacher

- Scoring Guide: Developing Arguments

For each student

- Argument Tool

Teaching Summary

Getting Started

1. Facilitate a class discussion on potential reasons an invasive species might decline or disappear from an ecosystem.

Doing the Activity

2. Students develop an argument about the Quagga mussel invasion.

Follow-Up

3. Facilitate a class discussion about the differences between the zebra mussel and Quagga invasions.
4. Revisit the Guiding Question.

Teaching Suggestions

Getting Started

1. **Facilitate a class discussion on potential reasons an invasive species might decline or disappear from an ecosystem.** (15 minutes)
 - a. Have a brief discussion about other factors that might cause an invasive species, such as the zebra mussel, to go into decline once it has invaded an ecosystem.

Ask the students, *Suppose the zebra mussel had invaded an ecosystem*

similar to the Hudson River, but there were no blue crabs or other predators. What other factors might cause the zebra mussel population to decline? Do not guide the class to any particular answer, but encourage students to listen to and react to each other's ideas while you record them. This could also be done as a written warm-up, followed by a brief class discussion.

Doing the Activity

2. (Assessment) Students develop an argument about the Quagga mussel invasion. (30 minutes)

- a. Have students construct an argument about the question “Has the Quagga mussel had a positive or negative effect on the Lake Michigan ecosystem?”

Have students read the introduction then complete the Procedure. As an Evaluate activity the students' written arguments can be used to assess both Performance Expectations (PEs) for this unit, as well as the practice of Engaging in Argument from Evidence.

You may wish to have them analyze the Information Items in pairs or groups of four before they move to constructing their arguments. Note that scientists agree that the recent decrease of the zebra mussel is due to displacement by the Quagga. Scientists therefore treat this as the same overall problem for the ecosystem, an invasive species out-competing native species, and not as if the zebra mussels decline indicates the ecosystem is returning to its pre-invasive state. A sample answer for the argument can be found in the Handouts section of the Teacher's Guide.

Follow-Up

3. Facilitate a class discussion about the differences between the zebra mussel and Quagga invasions. (20 minutes)

- a. Have the students discuss as a class the differences between the zebra and Quagga mussel invasions.

Encourage students to think about information related to biotic and abiotic factors that have an effect on the ability of either species to invade a new ecosystem.

- b. Return to the class KWL chart and complete it for the chapter.

Students should suggest adding information about the quagga mussel and how it has affected the Lake Michigan ecosystem. Ask students to

Activity 4.5

share their analysis of the data from the activity and if they concluded that the quagga had a positive or negative effect on the ecosystem. Encourage the students to reflect on what they have learned over the chapter, how they learned things (e.g. from analyzing data), and how their thinking has changed about the Guiding Question for the chapter: “How do new organisms affect the environment?”

4. Revisit the Guiding Question. (10 minutes)

- a. Have students revisit the crosscutting concepts for the chapter.

The guiding question, “Has the quagga mussel had a positive or negative effect on the Lake Michigan ecosystem?”, is also the question framing the students’ arguments that they develop in this activity. Because that has already been discussed, return to the cross cutting concepts of stability and change, cause and effect, and patterns.

Suggested Answers to Analysis

1. **What additional information would have been useful to know in developing your argument?**

*It would have been useful to have data about the levels of phytoplankton and zooplankton, besides *Diporeia*, in Lake Michigan for the time period we were analyzing. It also would have been useful to have data from other Great Lakes that are connected to Lake Michigan on the Quagga and zebra mussel population levels.*

2. **Compare the change in distribution of the zebra mussels in Lake Michigan to that in the Hudson River over the last 20 years. Do you think that the changes have occurred because of the same reasons? Explain.**

I do not think that the changes in distribution of zebra mussels in these two ecosystems have occurred because of the same reasons. It seems like the main reason there are no longer zebra mussels in Lake Michigan is because the Quagga mussels have out-competed them for food and space. As far as we know, there are no Quagga mussels or similar organisms in the Hudson River. However, in the Hudson River we know that the native blue crabs have started eating zebra mussel, causing a decrease in the population numbers and size of individual zebra mussels that survive. We do not know if there are blue crabs in Lake Michigan, or if there are whether they eat the zebra mussels.

Evaluate: A New Mussel in Town

Materials and Advance Preparation

For the teacher

- Scoring Guide: Developing Arguments

For each student

- Argument Tool
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Teaching Suggestions

Getting Started

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 - a. Have a brief discussion about other factors that might cause an invasive species, such as the zebra mussel, to go into decline once it has invaded an ecosystem.

Doing the Activity

- 2. (Assessment) Students develop an argument about the Quagga mussel invasion.** (30 minutes)
 - a. Have students construct an argument about the question “Has the Quagga mussel had a positive or negative effect on the Lake Michigan ecosystem?”

Follow-Up

- 3. Facilitate a class discussion about the differences between the zebra mussel and Quagga invasions.** (20 minutes)
 - a. Have the students discuss as a class the differences between the zebra and Quagga mussel invasions.
 - b. Return to the class KWL chart and complete it for the chapter.
- 4. Revisit the Guiding Question.** (10 minutes)
 - a. Have students revisit the crosscutting concepts for the chapter.