



MINNESOTA ZOO

SHOW US YOUR MUSSELS CHALLENGE

TAKE THE CHALLENGE **TODAY!**



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DEAR EDUCATOR,

Mussels are often out-of-sight and out-of-mind. But native mussels are important for healthy rivers and lakes. Sadly, freshwater mussels are the most at-risk group of animals in the United States. Five species native to Minnesota are listed as endangered by the U.S. Fish and Wildlife Service. The Minnesota Zoo is working with the Minnesota Department of Natural Resources (DNR) to help mussel populations by rearing mussels for release into the wild. In addition, the Zoo is working to educate the public about these important species and their role in healthy ecosystems.

This curriculum guide is designed to provide lesson ideas and activities in order to incorporate native freshwater mussels and their importance to water quality into your existing curriculum. These lessons can be used individually or together, depending upon your time and resources. All lessons are aligned to address current curricular objectives and both state and national educational standards.

We hope you will not only use these lessons in your classroom, but also participate in the 2018–2019 *Show Us Your Mussels Challenge*. Resources specific to the Challenge are included at the end of this document. These include guides to using social media, rubrics and checklists to help students in the creation of their projects.

As the state's largest conservation education resource, the Minnesota Zoo believes that projects like this are essential to fulfill our mission to connect people, animals and the natural world to save wildlife.

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1. Introduction to this Guide

a. Tips for teachers

This shows you how the lesson plans best fit with each age range and class themes/topics.

2. Kick-off Lesson

a. Introduction to Native Freshwater Mussels (4–12 Grade)

This lesson can be used to introduce students to native freshwater mussels and their unique biology. Many teachers find it useful to do this lesson as a kick-off to doing the Show Us Your Mussels Challenge in their classroom.

3. Food Webs

a. Aquatic Food Webs and Invasive Species (4–9 Grade)

This three-lesson sequence is designed to introduce and build Minnesota aquatic food webs. After building the system, students will learn about native freshwater mussels and how the introduction of invasive species such as zebra mussels, affects native species.

4. Water Quality Labs

a. Water Quality and Freshwater Mussel Lab (9–12 grade)

This multi-day lab involves setting up aquariums in your classroom. Students observe how mussels filter water and its effect on water clarity.

b. Water Quality and Freshwater Mussel Lab—data given (9–12 grade)

This lesson is for teachers unable to set-up an aquarium with mussels in their classroom. It provides the lab procedure along with data from the experiment to be interpreted.

5. Symbiosis

a. Ecological Relationships (6-12 Grade)

This two-day lesson introduces students to symbiotic relationships and has students a debate which type of relationship native freshwater mussels have with their fish host.

6. Mimicry

a. Who is this Mussel Pretending to be? (4–12 Grade)

Students explore how mussels use mimicry of other organisms to attract fish to help them complete their reproductive cycle.

7. Nutrient Cycling

a. What Matters with Missing Mussels? (6–12 Grade)

This lesson introduces students to the relationship between mussels and other organisms in lakes or rivers. Ideally it can be used as an introduction to nutrient cycling or as an extension.

8. Invasive Species

a. Where are the Zebra Mussels? (6–12 Grade)

Students interpret data of where zebra mussels are currently located in the United States in order to make predictions about where they came from and how they spread.

b. Zebra Mussels and Invasive Species Population Dynamics (6–12 Grade)

This graphing activity shows what happens to native freshwater mussel populations once zebra mussels are introduced to a fictional lake.

9. Human Impact

a. A River Runs Through It (6–12 Grade)

Students simulate a river systems and see how changes on the banks of the river affect the native freshwater mussels that live there.

10. Resources for the Show Us Your Mussels Challenge

a. Sample Project Description and Rubric

This is an introduction to the Challenge and its purpose. It includes a structure for researching topics and rubrics for evaluating final projects.

b. Frequently Asked Questions for Show Us Your Mussels 2018–2019

This document there logistical questions about the Challenge.

c. Teacher Guide to You Tube in the Classroom

This document walks you through how to use YouTube videos in your classroom. It includes supporting documents to help students storyboard their films as well as details on how to upload videos and track their effect on the Challenge.

d. Teacher Guide to Tracking Website Visitors

This resources walks teachers through how to set-up websites in ways that will track how many people are reached and how to submit this evidence.

e. Teacher Guide to Instagram

Designed to introduce users to Instagram, this resource also discusses a free app that can be used to track reach of Instagram stories.

f. Final Project Checklist for Students

Students can use this checklist to check their work against to make sure they included everything and are ready to post their work online.

HIGH SCHOOL BIOLOGY TEACHERS

Note: When implementing the *Show Us Your Mussels Challenge*, most teachers will find that it fits best into units addressing ecology and human impact on the environment.

UNITS	THEMES	LESSONS TO LOOK AT IN THIS CURRICULUM
The Living World	Ecosystem	Kick-off Lesson
		Aquatic Food Webs and Invasive Species
		What matters with missing mussels?
		Who is this mussel pretending to be?
		Ecological relationships
		Where are the Zebra Mussels?
		Zebra Mussels and Invasive Species Population Dynamics
	Energy	Aquatic Food Webs and Invasive Species
		What matters with missing mussels?
	Natural	Aquatic Food Webs and Invasive Species
Where are the Zebra Mussels?		
Zebra Mussels and Invasive Species Population Dynamics		
Natural biogeochemical cycles	What matters with missing mussels?	
Earth Systems	Global	Kick-off Lesson
		Aquatic Food Webs and Invasive Species
		What matters with missing mussels?
Pollution	Impacts on the environment and human health	River Runs Through It
Global Changes	Loss of biodiversity	Zebra Mussels and Invasive Species Population Dynamics

COLLEGE BIOLOGY TEACHERS

Note: To do the *Show Us Your Mussels Challenge* in the College Biology classroom, the teachers we worked with have used the project to introduce bivalves prior to dissecting them. What follows is a description of the project.

Divide the class into nine groups, and assign each of the groups one of the main topics. Each group is responsible to research and prepare a presentation for the rest of the class about their assigned topic. The modes of presentation could be a poster, powerpoint, play, interview, or some other method approved by the instructor.

Objectives

- Identify the principal internal organs of a freshwater mussel and briefly explain the function of each.
- Explain the function of water flow through a freshwater mussel and its importance.
- Explain the reproduction and life cycle of a freshwater mussel.
- Explain the role that freshwater mussels play in the ecosystem.

For more specifics and a detailed key, please email us at digitalmussels@mnzoo.org.

MIDDLE SCHOOL LIFE SCIENCE TEACHERS

Note: When implementing the Show Us Your Mussels Challenge, most teachers will find that it fits best into units addressing Ecology or Human Impact on the environment.

UNITS	THEMES	LESSONS TO LOOK AT IN THIS CURRICULUM
Ecology	Food	Aquatic Food Webs and Invasive Species
		What matters with missing mussels?
	Invasive	Aquatic Food Webs and Invasive Species
		Where are the Zebra Mussels?
		Zebra Mussels and Invasive Species Population Dynamics
	Nutrient	What matters with missing mussels?
	Mimicry	Who is this mussel pretending to be?
Symbiosis	Ecological relationships	
Human Impact	Invasive	Aquatic Food Webs and Invasive Species
		Where are the Zebra Mussels?
		Zebra Mussels and Invasive Species Population Dynamics
	Pollution	River Runs Through It
Nature of Science	Interpreting data (charts and graphs)	Zebra Mussels and Invasive Species Population Dynamics
		Water Quality and freshwater mussel lab
		Water Quality and freshwater mussel lab—data given