

**LESSON TITLE:** A Delicate Balance: How Human Actions Impact Nature’s Waterways

**GRADE LEVEL:** Grades 6-8

**TIME ALLOTMENT:** Approximately two 45-minute class periods

**OVERVIEW:**

In this lesson, students will explore the ways humans impact bodies of water in their communities. The lesson will begin with students brainstorming ways in which humans help and harm the lakes, rivers, oceans and other bodies of water and the wildlife living in and around them. Students will then view segments from the public television documentary *Fragile Waterways* to explore the ways in which humans have unintentionally contributed to an invasion of zebra mussels in bodies of water, and what people are now doing to curb the spread of these species. Students will also learn about how some scientists are trying to improve conditions in the Long Island Sound by planting eelgrass. In an optional activity, students will conduct research to find out more about eelgrass and how it benefits a variety of species. As a culminating activity, students will identify an existing problem in a local body of water and propose an action to help solve that problem.

**SUBJECT MATTER:** Science

**LEARNING OBJECTIVES**

Students will be able to:

- Describe ways in which humans positively and negatively impact waterways;
- Explain what zebra mussels are and how they move from one environment to another;
- Describe measures scientists are taking to help stop the spread of zebra mussels;
- Explain what eelgrass is and the rationale for planting it;
- Identify a need for improvement in a specific body of water and propose a plan to improve that situation.

**STANDARDS**

**National Science Education Standards**

[http://www.nap.edu/openbook.php?record\\_id=4962](http://www.nap.edu/openbook.php?record_id=4962)

**Grades 5-8:**

**Content Standard C: Life Science**

Fundamental concepts and principles that underlie this standard include:

- **Populations and Ecosystems**
  - A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.

- For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.
- The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.
- **Diversity And Adaptations Of Organisms**
  - Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations. Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.
  - Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on the earth no longer exist.

### **Content Standard G: Science in Personal and Social Perspectives**

Fundamental concepts and principles that underlie this standard include:

- **Populations, Resources, And Environments**
  - When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.
- **Natural Hazards**
  - Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.
  - Natural hazards can present personal and societal challenges because misidentifying the change or incorrectly estimating the rate and scale of change may result in either too little attention and significant human costs or too much cost for unneeded preventive measures.
- **Risks And Benefits**
  - Students should understand the risks associated with natural hazards (fires, floods, tornadoes, hurricanes, earthquakes, and volcanic eruptions), with chemical hazards (pollutants in air, water, soil, and food), with biological hazards (pollen, viruses, bacterial, and parasites), social hazards (occupational safety and transportation), and with personal hazards (smoking, dieting, and drinking).

## MEDIA COMPONENTS

*Fragile Waterways*, selected segments. To view the clips listed below, go to:  
<http://www.thirteen.org/fragile-waterways/educational-video-segments>

### **Clip 1: Invasion of the zebra mussels**

An overview of how improving water led to unintended consequences – the invasion of zebra mussels.

### **Clip 2: Mussels on the move**

An overview of how humans contribute to the spreading of zebra mussels.

### **Clip 3: Adding eelgrass to the Long Island Sound**

A brief look at why scientists are re-introducing eelgrass in the Long Island Sound.

### **Websites (Optional):**

- **United States Environmental Protection Agency Website**

<http://www.epa.gov>

This site contains a lot of valuable information and children’s activities focusing on groundwater and drinking water. The site includes the following two resources which could be used by the teacher as a resource in the introductory activity to talk about hazards to our water supply:

- **Safe Drinking Water Act Poster**

<http://www.epa.gov/safewater/publicoutreach/landscapeposter.html>

This informative poster highlights various hazards to our drinking water. It could be used by the teacher as a resource in the introductory activity for this lesson.

- **Nonpoint Source Pollution Awareness: What’s Wrong with this Picture?**

<http://www.epa.gov/owow/nps/kids/whatwrng.html>

This activity points out the different ways that people can damage the environment and, specifically our waterways.

- **Vancouver Island’s Capital Regional District Website**

<http://www.crd.bc.ca>

This website contains information about watershed protection and includes information about eelgrass. The information page about eelgrass could be used in the learning activity for this lesson. To access the eelgrass information, go to:

<http://www.crd.bc.ca/watersheds/protection/wildlife-plants/eelgrass.htm>

- **Washington State Department of Ecology Website**

<http://www.ecy.wa.gov>

This website provides a variety of information about the ecology of the State of Washington, including a section focusing on Puget Sound Shorelines. There is an eelgrass information page in this site which could be used in the learning activity for this lesson. To access the

eelgrass information, go to:

<http://www.ecy.wa.gov/programs/sea/pugetsound/species/eelgrass.html>

○ **Environmental Resource Center Website**

<http://www.uwex.edu/erc>

This site contains information about water and water quality, as well as tips on how students can mobilize to improve water quality in their community. The following two resources could help students complete the culminating activity for this lesson:

- “Educating Young People About Water”: <http://www.uwex.edu/erc/ey paw/>
- “Giving Water a Hand”: <http://www.uwex.edu/erc/gwah/>

## **MATERIALS**

For the class:

- Computers with internet access (if using any of the optional websites listed in the “Media Components” section )
- Computer, projection screen, and speakers (for class viewing of online/downloaded video segments)

For each student:

- One copy of the “Water Improvement Action Sheet.”

## **PREP FOR TEACHERS**

Prior to teaching this lesson, you will need to:

Preview all of the video segments used in the lesson.

Preview the optional websites listed for this lesson and decide if you want to use them in this lesson.

Download the video clips used in the lesson to your classroom computer, or prepare to watch them using your classroom’s Internet connection.

Bookmark any websites that you plan to use in the lesson on each computer in your classroom. Using a social bookmarking tool such as [del.icio.us](http://del.icio.us) or [diigo](http://diigo) (or an online bookmarking utility such as [portaportal](http://portaportal)) will allow you to organize all the links in a central location.

Print out one copy of the “Water Improvement Action Sheet” for each student.

## **INTRODUCTORY ACTIVITY**

- 1) Explain that today students will be learning about how their actions can directly impact their environment in both good and bad ways. Describe that in this lesson they will be exploring

the ways in which humans help and harm bodies of water and the wildlife that lives in and around them.

- 2) Ask students to think about a specific body of water and to brainstorm ways that humans can make it worse and ways that they can improve it. Here are some possible topics to discuss:

**Ask students to think of the potential impact of the following on the cleanliness of the water:**

*Potential threats to the water:*

- Family picnics and barbeques. (Throwing food & objects in the water; destroying plants &/other foliage near water)
- Fishing.
- Roads/Cars. (Emissions, Increasing traffic to lakes, oceans, etc.)
- Businesses, factories, etc. near water.
- A day at the beach (bottles, sunscreen, items left behind, destroying/ removing sea life & shells).
- Motor boats; sail boats, waterskiing, etc.
- Pouring toxic fluids down storm drains.
- Misusing fertilizers and pesticides.

*Potential Barriers to the threats:*

- Enforcing clean water regulations.
- Removing discarded objects from the water.
- Adding plants, trees and foliage surrounding bodies of water.
- Having trash bins and recycling bins where people can properly discard their trash.

For help in discussing possible threats to the environment, as well as barriers to those threats, feel free to use the following resources on the EPA's website:

- **Safe Drinking Water Act Poster**

<http://www.epa.gov/safewater/publicoutreach/landscapeposter.html>

This informative poster highlights various hazards to our drinking water. It could be used by the teacher as a resource in the introductory activity for this lesson.

- **Nonpoint Source Pollution Awareness: What's Wrong with this Picture?**

<http://www.epa.gov/owow/nps/kids/whatwrng.html>

This activity points out the different ways that people can unintentionally damage the environment, specifically our waterways.

## **LEARNING ACTIVITY**

- 1) Explain that sometimes when people try to do something good in the environment, there might be unintended things that happen as a result. For example, in the Great Lakes, after the water was cleaned up, a new species moved in. Let students know that they are now going to watch a video about what happened. Provide a FOCUS FOR MEDIA INTERACTION, by

asking the students to find out what species moved in and to name at least 3 effects the species had on its new environment.

- 2) Play Video Segment #1, “Invasion of the zebra mussels.” After the segment, ask your student to name the species. (*The zebra mussel.*) Ask your students to list at least 3 effects that the species has on its environment. (*Zebra mussels filter the water and take the nutrients from one place and move it to another. They take food from the water and move it to the bottom, which changes what food is available for the fish and throughout the food chain. Zebra mussels have caused the extinction of 6 native clam species in Oneida Lake, by colonizing the clams’ feeding areas. They attach themselves to solid surfaces and clog intake pipes for water.*)
- 3) Ask your students if they think that the people who cleaned up the water were hoping for the zebra mussels to move in. (*No. It was an unintended consequence.*)
- 4) Ask the students to discuss their thoughts about how the zebra mussels might have entered the water. (*Accept all answers.*)
- 5) Explain that students will now view a video segment describing how the mussels got into the water. Provide a FOCUS FOR MEDIA INTERACTION by asking them to observe how the mussels entered the clean water.
- 6) Play Video Segment #2, “Mussels on the move.” After the segment, ask your students how the mussels entered the clean water. (*Mainly through ballast water--the water that big ships take in or let out to keep them stable-- and by recreational boats.*)
- 7) Ask your students to discuss some of the ways that people are trying to stop zebra mussels and other species from getting into new bodies of water. (*Through ballast water exchange and by improving and testing ballast water treatment systems.*)
- 8) Explain that in the previous clips, we have seen how scientists are trying to clean the water by *removing* unwanted species. Describe that in some situations, scientists are trying to *re-introduce* species into bodies of water in order to improve the water’s condition. Explain that in the next segment students will observe how scientists in Long Island, NY are trying to re-introduce a species into the Long Island Sound. Explain that this segment features Christopher Pickerell, a scientist (marine biologist), who is the son of Howard Pickerell, a fisherman on the Long Island Sound. Provide a FOCUS FOR MEDIA INTERACTION by asking students to identify the species that Christopher Pickerell and other scientists are re-introducing into the water and to list reasons why that species is being added to the water.
- 9) Play Video Segment #3, “Adding eelgrass to the Long Island Sound.” After students have viewed the segment, ask them what species scientists are re-introducing into the water. (*Eelgrass.*) Ask students why that species is being added to the water. (*To provide a place for the young of various species to hide so that they don’t get eaten by larger species; to help make the water rich with fish.*)

- 10) Ask students what damages eelgrass. (*Pollution raises nitrogen levels which can cause blooms of algae to form on the water, which block out sunlight and suffocate the eelgrass and other life below. Eelgrass needs at least 25% of incoming light from the sun in order to grow and the algae can block the sunlight from getting to the eelgrass and prevent it from growing.*)
- 11) (Optional) Ask students to use online resources and/or other reference materials to find out more about what eelgrass is and how it contributes to its environment. Ask students to discover at least 3 facts about eelgrass to share with the class.
- 12) (Optional) Lead a discussion with students about the importance of eelgrass, including information about what species hide in eelgrass to protect themselves from predators.

### CULMINATING ACTIVITY

- 1) Remind students that they have learned about ways that humans help and harm bodies of water. Ask students to brainstorm ways they can improve a body of water in their community. Lead a brief discussion with students about what they learned from the lesson about the ways in which humans can positively and negatively impact bodies of water. Here are some possible questions to include in the discussion:
  - What was one law that was enacted to help clean up the water? *The Clean Water Act.*
  - What was one unintended consequence of that law? *Zebra mussels invaded new bodies of water.*
  - What are some ways that people have tried to limit the invasion of these species? *Posting signage to alert boaters and enforcing new ballast water regulations and cleaning systems.*
  - What is one way that scientists are trying to restore the ecosystem in the Long Island Sound? *By adding eelgrass.*)
- 2) Ask students to conduct research using online resources and available reference materials to help identify a problem/need with a body of water in their community and to explore possible actions they could undertake to positively impact a body of water. Ask each student to select one action and to complete the “Water Improvement Action Sheet.”

For help in generating ideas, go to the following pages on the Environmental Resource Center’s website:

- “Educating Young People About Water”: <http://www.uwex.edu/erc/ey paw/>
  - “Giving Water a Hand”: <http://www.uwex.edu/erc/gwah/>
- 3) Ask students to present their findings to the class.
  - 4) (Optional.) Select one or more of the actions researched by the students for the class to complete in the local community.

## Water Improvement Action Sheet

**Directions:** Select one action you could take that would have a positive effect on a pond, lake, river, ocean or other body of water. Fill out this form to describe an existing problem and how your action would help reduce or solve that problem.

**Existing Problem:** (Describe a current problem or existing need in a local pond, lake, river, ocean or other body of water.)

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**Proposed Action:** (Describe what you would like to do to help solve the problem.)

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**Desired Outcome** (Describe the potential positive effects of your actions):

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**Potential Obstacles** (Describe one or two factors that might prevent you from achieving your desired goal):

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**Additional Thoughts:**

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