



A River Runs Through It

Grades: 9-12

Activity overview:

Students will create a large river picture and draw all of the impacts humans have on that river system and what the overall effects can be on the mussel population.

Objectives:

Students will construct a model of a river and be able identify human impacts on freshwater mussels.

Standard connection

State

4.3.4.1.1 Describe how the methods people utilize to obtain and use water in their homes and communities can affect water supply and quality.

8.3.4.1.2 Recognize that land and water use practices affect natural processes and that natural processes interfere and interact with human systems. For example: Levees change the natural flooding process of a river. Another example: Agricultural runoff influences natural systems far from the source.

9.4.2.1.2 Explain how ecosystems can change as a result of the introduction of one of more new species. For example: The effect of migration, localized evolution or disease organism.

9.4.4.1.2 Changing the temperature or composition of water, air or soil; altering populations and communities; developing artificial ecosystems; or changing the use of land or water.

NGSS:

HS-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

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Time

One 45-minute lesson

Materials

- Color pencils or markers
- Big sheet of paper or whiteboard
- Computer with PowerPoint
- Computers with internet for assessment

Procedure

Section 1: Why are mussels declining?

1. This lesson assumes that students have basic information about mussels. If not, then have them do the introductory lesson before this lesson.
2. Write on the board “why are mussels declining?” and pass out student sheet.
3. Have students brainstorm with partner(s) completing as much of the grid as they can.
4. Students report back examples and the teacher record their answer. Teacher gives shows slide with possible answers and sees how many answers students got. The following are possible answers:
 - Chemical Contaminants: Examples can include (pesticides, herbicides, salt from run off, pet waste, livestock waste, fertilizers, etc.)
 - Thermal Pollution: Generally when water is used as a coolant at power plants- heats up the water.
 - Sedimentation: When particles usually sand, clay, silt and other soil particles that settle at the bottom of a body of water.
 - Nutrient enrichment: Increased nutrients that can cause nuisance plant growth.
 - Livestock Overgrazing: Livestock can get close the watershed causing negative effects.
 - Invasive fish: Fish not native to Minnesota lakes and streams that outcompete native fish that mussels need.
 - Extirpation of native fish: The elimination of native fish species greatly reduces the number of native mussels as it is a mutualistic relationship in nature.
 - Water withdrawal or diversion: MN rivers are under threat do to overuse of water a resource.
 - Impoundment: When a dam is put on a river a reservoir is created many freshwater mussels need fresh moving water.



- **Channel Modification:** Many river and streams have modification to increase river flow or reduce it. (Cement walls, removal of natural barriers, or addition of barriers) the changing of the channel effects mussel populations.)
 - **Invasive Bivalves:** Mussels (most notably the zebra mussels can completely cover or “choke out” native mussels.
 - **Restoration activities:** Care research need to be put into restoration activities- what may be good for one species may not be good for another.
5. Draw a large outline of a river on whiteboard or large roll sheet of paper. Put the letters A, B and C on the river and have students label their paper so it looks similar.
 6. Instruct students to form groups of 3-4. Each group will pick one of the categories above and research further the impact and how humans drive that impact.
 7. Show students how to diagram ton of the above back to how human caused it. For example:
 - **Livestock overgrazing:**
 - Erosion and sediment from livestock entering streams or eating the vegetation holding streambed together → Farmers allowing cows removing stream banks → People demanding more dairy/beef
 - Humans drive impact by eating beef and wanting dairy products.
 - **Invasive species:**
 - Zebra mussels “choke” native mussels by out competing for resources → People transporting boats without thoroughly checking for invasive species or following the correct protocols.
 - People cause zebra mussels to be transported to new areas.
 - **Chemical contaminants:**
 - Salt in rivers cause higher salinity values can affect the survival rate of reswashed organisms → salt run off of roads → Put on roads by city municipalities to keep ice of
 8. Have students reflect on the social, environmental and economic impacts of what they have researched. For example:
 - a. Salt on roads:
 - i. Social impact: People are safer
 - ii. Economic impact: Cheaper than other alternatives
 - iii. Environmental impact: damaging to the ecosystem.
 9. Students will then add their picture of the impact to the river on the whiteboard or large piece of paper.
 10. Have a conversation about students can see how Humans decisions play a role in mussel decline in general. How might the overall health of the river be affected by the actions defined?
 11. Next, explain to students that the letters on the maps represent different populations of mussels. The letter “A” represents the Winged Maple Leaf, one of



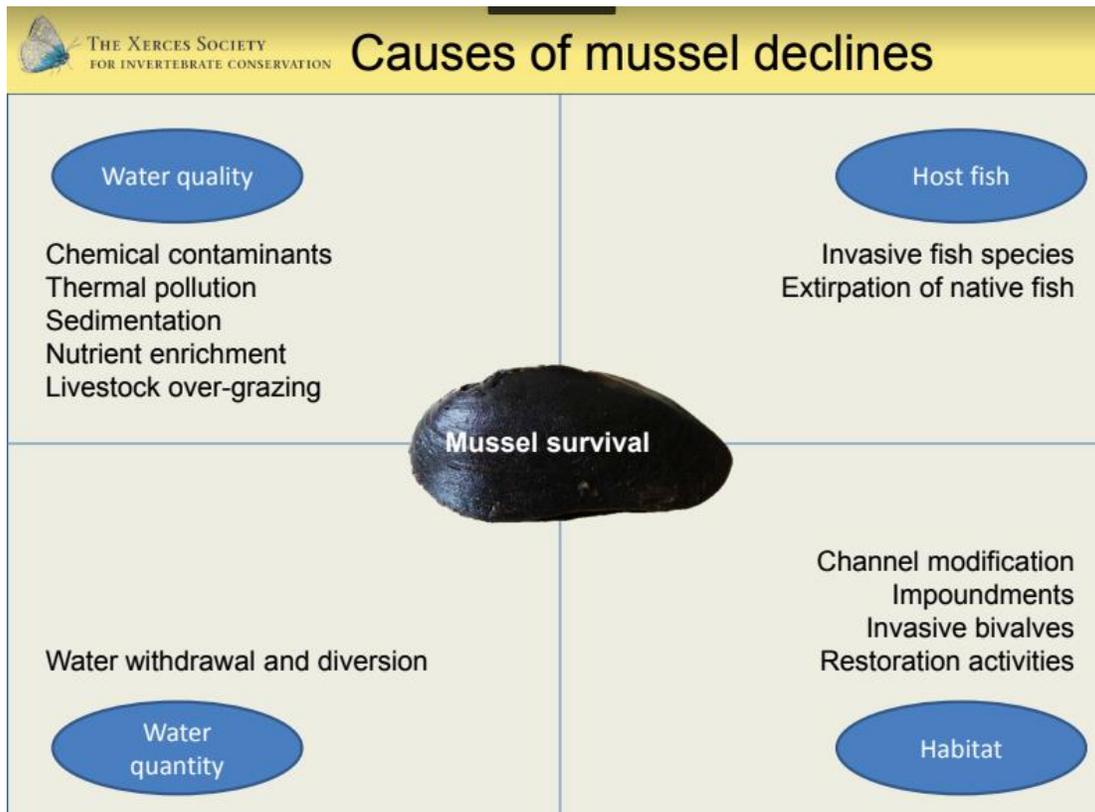
the most endangered types of mussels in Minnesota. The letter “B” represents a more common mussel called the mucket. Letter C represents a fat pocket book mussel. Have students discuss how location on the river effected local populations of rivers.

12. Go back to the idea of the triple bottom line (social, economic and environmental impacts). How do we balance these impacts?
13. At the end of class have students reflect on what they personally can do to increase water quality and help native freshwater mussels.

Assessment

- After each group has drawn their pictures on the river, students will present their particular human impact and how it relates to mussel survival. In their presentation they should include a discussion of the social, environmental, and economic impacts.
- In an exit ticket, students will reflect on what they can do to increase water quality and help native freshwater mussels.

Lesson Resources



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