

Investigation of the Relationship Between Water Quality and Biodiversity

Devin Miller, Arleen Schmude, Kathryn Speers, Justin Squillo

Introduction

Background

- Water quality in many ecosystems is declining due to human influence¹
- Aquatic plants struggle to grow in turbid water, and aquatic invertebrates need plants to survive¹
- First grade students observed this by searching for invertebrates in clear and turbid water, then compare the two
- The activity reflects our research question: "How does turbidity influence biodiversity of aquatic invertebrates?"²

Central Concept

- Diversity and abundance of aquatic life is dependent on water quality

Learning Objectives

Students will be able to:

- Explain how water quality affects plants and animal abundance
- Describe interactions amongst plants and animals within a food web
- Identify human causes of ecosystem degradation and how it can be addressed

Lesson Characteristics

- Planned for 25 elementary school students (1st grade)
- Learning activity ~45 minutes; Preparation ~45 minutes
- Lesson conducted adjacent to an aquatic ecosystem where material for the activity was collected.
- Lesson followed the learning cycle format²



Figure 1. Collecting plants and animals prior to the student lesson.

Teaching Methods

Preparation

- Collected aquatic invertebrates and plants within 24 hours of activity (Figure 1)
 - Also added toy aquatic animals
- Prepared six tubs for activity (Figure 4 & 5):
 - Three tubs with clear water, many plants and aquatic invertebrates
 - Three tubs with turbid water, trash, few plants and invertebrates
- Materials included dip nets, magnifying glasses, clipboards with student handout sheets, markers, and small trays which were set out at each station

Engagement

- Asked questions to build enthusiasm and engagement:
 - What do you think we will be doing today?
 - What are some things that live in water?
- After a short demonstration of the task, students were divided into groups and directed to their stations

Exploration

- Students made observations of both tubs.
- Students collected data in the form of counting the number of organisms that were found as well as circling specific animals on their handout (Figure 3)

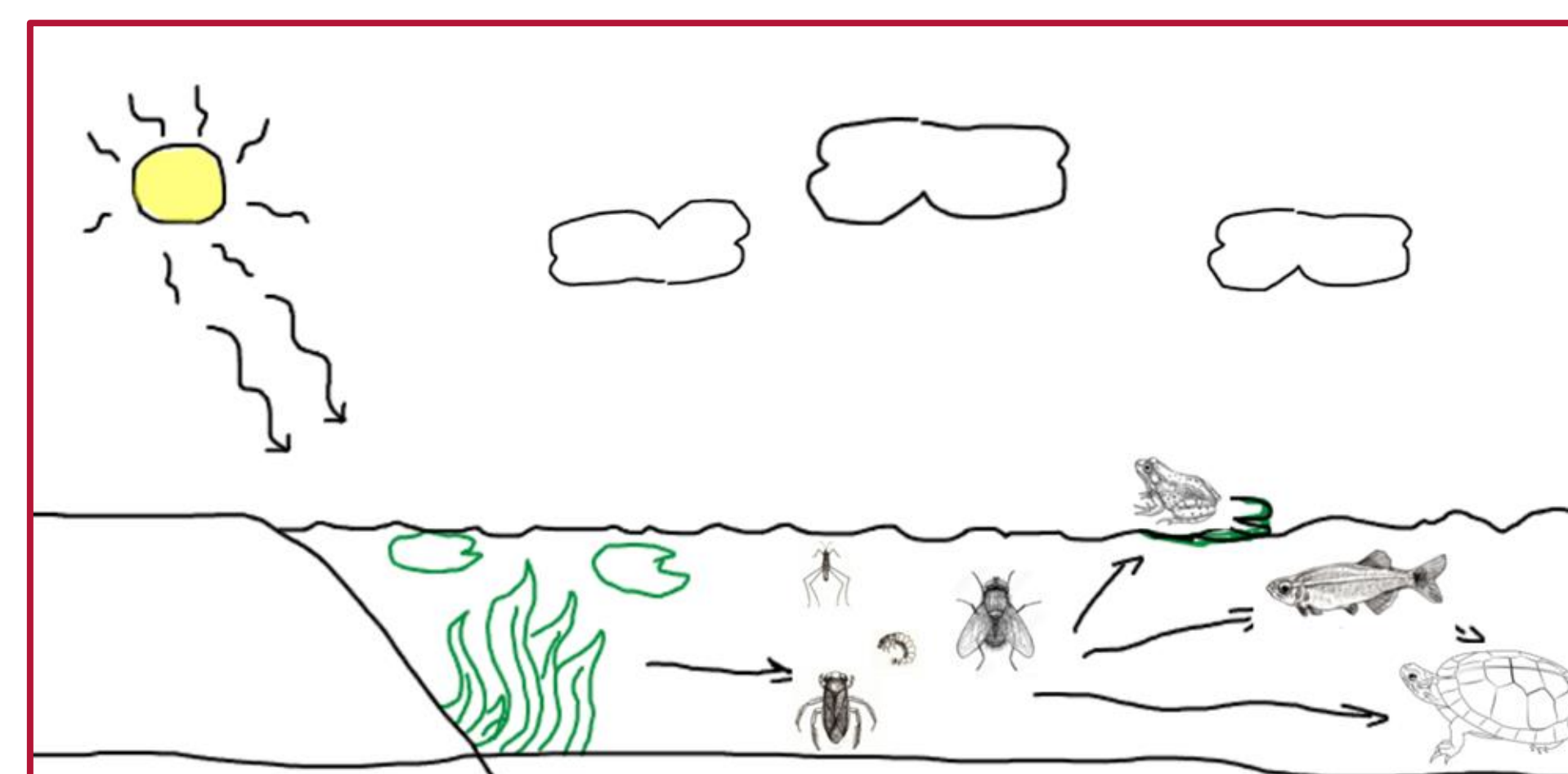


Figure 2. Sample of food web drawn.

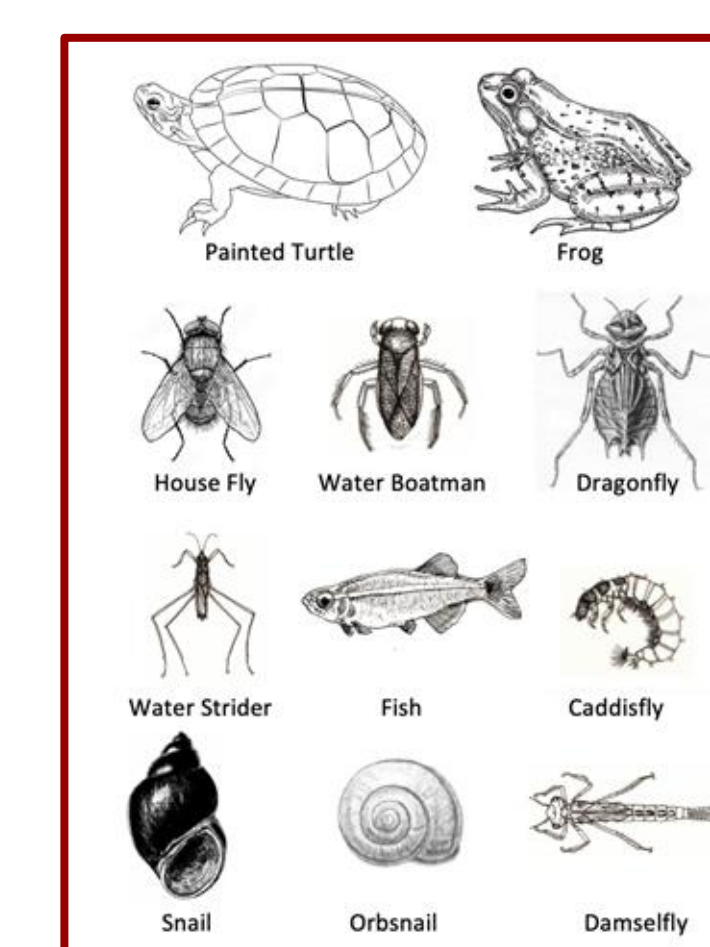


Figure 3. Animal Identification key student handout.

Concept Development & Application

- The class engaged in a facilitated discussion surrounding what they found in the two different ecosystems.
 - Do you think that the number of plants and number of animals are related?
- A food web was drawn as a visual for students to see the relationships within the ecosystem (Figure 2)
- Questions to guide critical thinking included:
 - Why are some aquatic ecosystems dirty and others clean?
 - How can we help ecosystems have cleaner water? Why does this matter?

Take Home Message

- Through this lesson, students learned the interdependent relationships between organisms within an ecosystem and the impact people can have on the ecosystems around them



Figure 4. Preparing different tub ecosystems prior to student arrival.



Figure 5. Turbid and clear water ecosystems used in this activity.

Connections to Next Generation Science Standards

Standards³

- K-LS1-1: Use observations to describe patterns of what plants and animals (including humans) need to survive
- 2-LS4-1: Make observations of plants and animals to compare the diversity of life in different habitats

Application

- K-LS1-1: In this activity students made observations of how many plants and animals were collected from each ecosystem. By the end of the lesson, students identified which habitat is ideal and better supports life
- 2-LS4-1: Through exploration of the two different ecosystems, students made comparisons about the diversity of life of plants and animals in relation to water quality

¹Stewart, T.W., and Downing, J.A. 2008. Macroinvertebrate communities and environmental conditions in recently constructed wetlands. *Wetlands*, 28: 141-150.

²Speers, K., Squillo, J., Miller, D., Schmude, A. (2021). Relationship Between Turbidity and Invertebrate Community Attributes in a Constructed Wetland of Central Iowa. *Final report for NREM 380*

³Marek, E.A. 2008. Why the learning cycle? *Journal of Elementary Science Education*, 20: 63-69

⁴NGSS Lead States. 2013. Next Generation Science Standards: for states, by states. Washington, DC: National Academies Press. <https://www.nextgenscience.org/pe/2-ls4-1-biological-evolution-unity-and-diversity>