

Reading the River, Summer 2001

Rivers – A Unit for Grade 6 Science

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Create a Model Stream or River Habitat

Grade Level: 6

Objectives

In this lesson, students will:

1. identify components of a river- or stream-dwelling animal's habitat
2. analyze how these components meet the animal's needs
3. design and construct a model of this animal's habitat

Program of Studies

Scientific Inquiry

- identify and refine questions that can be answered through scientific investigations combined with scientific information
- use appropriate equipment (e.g. water chemistry kits), tools, techniques (e.g. measurement), technology (e.g. calculators, LabPros) and mathematics in scientific investigations
- communicate . . . results of scientific investigations

Conceptual Understandings

- Regulation and Behavior: analyze . . . environmental stimuli and organisms' behavioral responses. Explore how organisms' behavior changes through adaptation.
- Populations and Ecosystems: investigate factors (e.g. resources, light, water) that affect the number of organisms an ecosystem can support.

Applications/Connections

- Recognize how science is used to understand . . . changes in environments.

Core Content

Structure and Function in Living Systems

- SC-M-3.1.1 Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include . . . ecosystems.
- SC-M-3.2.1 All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.
- SC-M-3.2.3 Biological change over time accounts for diversity of species developed through gradual processes over many generations. Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.

Populations and Ecosystems

- SC-M-3.5.1 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.

- SC-M-3.5.4 The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g. quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases 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.

Materials

1. Slips of paper each printed with the name of an animal that lives in and near streams and rivers (e.g. wood duck, great blue heron, midland water snake, bullfrog, snapping turtle, red-eared slider, southern two-lined salamander, longnose gar, striped shiner, channel catfish, largemouth bass, smallmouth bass, rainbow darter, water strider, water boatman, threeridge mussel, snail, crayfish, mink, beaver, etc.) Groups of two to four students can collaborate on each animal/habitat.
2. Art supplies, including clay, poster board, papier mache, gallon jars, string, cardboard shoeboxes, etc.
3. Print and electronic resources on river animals and their habitats (books, articles, posters, internet websites, etc.)
4. Habitat survey checklists
5. Water monitoring kits and/or equipment (temperature probes, pH probes or kits, DO probes or kits, calculators, LabPros or CBL's, any other chemical/physical probes kits as desired and available, depth gauge, tape measure)

Activity Procedure

1. Discuss with students what they already know about river/stream animals and characteristics of their habitats. Guide students to understand that stream habitats consist of many inter-related physical and chemical components: substrate (bottom composition), water current, water temperature, water clarity, surrounding land use, stream shape, stream width and depth, overhead tree cover, bank conditions, etc. Using examples, discuss the concept that organisms are adapted to a particular set of conditions that support their needs. When conditions stray too far from what the organism is adapted to, the habitat will no longer support the organism's existence.
2. Discuss assignment: students will select a river/stream animal and research its habitat. They will try to gain an understanding of how that habitat supports the animal's needs for food, water, air, shelter, reproduction. They will visit a stream bank to become familiar with components of a sample habitat. Then they will design and create a model that shows their animal's habitat and how the habitat meets the animal's needs. Physical characteristics of the environment (such as water flow and temperature) as well as other habitat features (e.g. exposed roots, substrate) need to be addressed. *(Since water-bearing models require more complicated construction, use of actual water in the models is optional.)*
3. Have student pairs select one of the slips with the name of a river/stream animal written on it.
4. Have students use print and electronic sources to research their animals and habitats.
5. Following classroom research sessions, have students conduct a field study: students visit a stream or river bank where their animals' habitats might be found. Have students record

(take notes, sketch, photograph, video) features of the habitat. Also have students use a habitat survey checklist to record information regarding substrate, fish cover, stream shape, land use, flow rate, temperature of air and water, pH, dissolved oxygen, water clarity, and any other relevant observations.

6. Back in classroom, have students prepare a labeled diagram as a plan for their models.
7. When the planning sketch is approved by the teacher, students can create their models, incorporating information obtained from both the library research and field studies. Models should be accompanied by labels and written information to point out and clarify special features.
8. Have students present their models to the class, sharing information about the habitat features they have included that support their animal's needs. During demonstrations, guide students to discuss the consequences for the organism if habitat components were changed or removed.

Definition/Explanation of Concepts

River and stream habitats have certain physical characteristics that differentiate them from other water habitats. Rivers and streams are considered to be lotic (flowing) ecosystems. Churning up air, they contain high levels of dissolved oxygen. Carrying mud and gravel, they are typically less clear than lentic (still) water habitats. Flow is fast, therefore the substrate tends to be rockier than still lentic habitats where silt settles and rests. Shaded by trees and interspersed with submerged logs, these waters tend to be cooler than still water bodies. They offer plenty of hiding spots for fish and other water-dwelling and riparian species.

Animals adapted to natural river and stream conditions may not be able to survive if conditions change. For example, some species of freshwater mussels rely on rocky bottoms kept clear by rivers' fast flowing waters. When surrounding lands are cleared for development or agriculture, erosion increases. Because of watershed dynamics, excess quantities of silt flow into streams. The sediment that accumulates on the stream bottom creates an incompatible habitat for mussels that need rocky bottoms. Many species of mussels have become extinct or endangered due to human caused changes in stream characteristics. In turn, animals that depend on mussels as a food source are affected. The stream also loses the benefit accrued by mussels' water filtering function.

Human-made "improvements" can lead to broad devastation for water-dwelling species. For example, damming to control flooding adversely impacts the stream's flow, temperature, depth, etc. Upstream of the dam what was a previously a flowing river becomes a reservoir. Downstream, flow rate and temperature depend upon the dam's imperfect ability to release waters that mimic rate and temperature of naturally flowing water. The result is a potential chain of consequences for all the organisms adapted to a flowing river as the basic condition of their habitats.

It is important for students to recognize the tight connection between the physical characteristics of a habitat and the ability of an animal to survive in that habitat. Students also need to recognize the interdependence between organisms. They should understand that a widening circle of consequences results from harm to even one population of organisms. If students appreciate how

sensitive organisms are to changes in environments, they will recognize important human responsibility to preserve conditions that are supportive of all the organisms' survival.

Assessment

1. Monitor students during classroom research to assist them in seeking out the desired information.
2. After the stream visit, the students' habitat checklists can be assessed as a measure of their understanding of the components of a stream habitat.
3. Review students' planning sketches and give feedback about any necessary changes or additions.
4. As students demonstrate their models, they will describe the components of the animal's habitat and how each component helps support the animal's needs for food, water, oxygen, shelter and reproduction. Teachers can use a rubric (a sample follows) to evaluate the models.
5. As an optional additional assessment, students can write in response to the following prompt:

A "Clean the Stream" Committee is proposing to clear fallen logs and mow the banks along a community's stream. Write a letter to the committee stating your position on this action. Make sure you discuss the impact that such activities might have for the wildlife living in and around the stream.

Reference:

This lesson was adapted from "Designing a Habitat" found in:

Council for Environmental Education. (1992). *Project Wild aquatic education activity guide (Rev. ed.)*. Bethesda, MD: Author.

Rubric for Evaluating Models

Student Name(s): _____

Animal: _____

1. Model illustrates or includes information about a variety of physical conditions:

- substrate type
- width of stream
- depth of stream
- flow rate
- stream cover
- bank condition
- surrounding land use/vegetation

2. Presentation includes a discussion of each of the animal's needs and how the habitat meets them:

- food
- air
- water
- shelter
- reproduction
- other

3. Your model's construction is careful and thorough.

Comments:

- 4 – All requirements met
- 3 – Most requirements met
- 2 – Some requirements met
- 1 – Few requirements met

Lesson Context

The lesson above is sequenced midway through a science unit called “Rivers” designed for middle school students. The unit outline and lesson descriptions follow.

- I) What Are Rivers?
 - 1) Lesson 1: Where does the water come from? The water cycle: students take the role of a water molecule flowing through the water cycle.
 - 2) Lesson 2: How much water do we have? Students calculate the percentages of Earth’s water contained in oceans, icecaps, groundwater, lakes, salt lakes, atmosphere, rivers.
 - 3) Lesson 3: How does the water flow?
 - A) Part 1: Watershed model. Students model and describe water flow in a drainage basin.
 - B) Part 2: Where does the water go after school? Students calculate the amount of water running off the impervious sections of school grounds.
 - C) Part 3: Wetland Stand-ins. Students explore materials that functionally model the materials in wetlands.
- II) How Do Rivers Support Life?
 - 1) Lesson 1: Vicarious River Visit. Students take a simulated field trip to a river bank.
 - 2) Lesson 2: **Create a River or Stream Habitat. (Lesson described above).** Students use library and field study to research a river or stream animal and its required habitat. They document their findings by creating a three-dimensional model of the habitat.
 - 3) Lesson 3: Key-out Specimens. Students use fresh or preserved specimens and field guides or keys to identify river/stream organisms.
 - 4) Lesson 4: Food Webs. Students simulate feeding relationships among pond organisms.
 - 5) Lesson 5: Field Guide. Students create a field guide for a section of a river or stream.
- III) What Is the Responsibility of People to River Ecosystems?
 - 1) Lesson 1: How much water do we use? Students calculate the amount of water they use at school and develop conservation measures.
 - 2) Lesson 2: Polluted? Students measure the variety of pollutants in a hypothetical river. They consider implications for wildlife.
 - 3) Lesson 3: Organism Indicators. Students do a biological stream assessment to consider pollution’s impact upon organisms.
 - 4) Lesson 4: Damming. Students take roles in a simulated town meeting concerning a proposed dam.
 - 5) Lesson 5: Wetlands. Students model flood-absorbing effects of wetlands and consider the importance of wetlands reclamation.
 - 6) Lesson 6: Ecological Balance. Students model fisheries management.

Lessons were adapted from the sources listed on the following page.

Sources For This Unit

- Council for Environmental Education. (1992). *Project Wild aquatic education activity guide* (Rev. ed.). Bethesda, MD: Author.
- Council for Environmental Education. (1992). *Project Wild K-12 activity guide* (2nd ed.). Bethesda, MD: Author.
- Department of Education, National Aquarium in Baltimore. (1997). *Living in water* (3rd ed.). Dubuque, IA: Kendall/Hunt Publishing Co.
- Lorentz, C. (2000). *Science on the river participant packet*. Unpublished presentation materials, Thomas More College.
- National Forest Foundation. (1997). *Project Learning Tree environmental education activity guide pre K-8* (5th ed.). Washington, DC: Author.
- Slattery, B. E. (1995). *WOW! The wonders of wetlands*. St. Michaels, MD: Environmental Concern Inc.

Habitat Survey

The purpose of this sheet is to guide recognition of key characteristics of flowing water habitats.

Stream: _____ Date: _____ Collected By: _____
Weather: _____ Time: _____

Field Tests:

Water Temp. _____ Air Temp. _____ pH _____ D.O. _____
Conductivity _____ Turbidity _____

Stream Substrate:

Size:

- ___ Mostly Large (fist size or bigger)
- ___ Mostly Medium (smaller than fist, bigger than fingernail)
- ___ Mostly Small (smaller than fingernail, but not coarse)
- ___ Mostly Very Fine (not coarse, sometimes mucky)

Smothering (hard to move large pieces, black on bottom, few insects)

Are fist size pieces smothered by sands/silts? Yes No

Silting (light kicking of bottom leads to clouding, lasting more than two minutes)

Are silts and clays distributed throughout stream? Yes No

Cover for animals:

Notes or sketches:

- ___ Undercut banks
- ___ Rock ledges
- ___ Submerged tree roots
- ___ Submerged logs or stumps
- ___ Drift or log piles
- ___ Water plants
- ___ Large boulders or shingle rocks
- ___ Man-made objects; _____

Riparian Vegetation:

Notes or sketches:

- ___ Trees
- ___ Shrubs
- ___ Herbaceous
- ___ Root mats

Depth and Velocity:

Deepest Pool is at least:

- ___ Chest deep Width: _____
- ___ Waist deep
- ___ Knee deep
- ___ Ankle deep

Riffle/Run (turbulent/broken surface):

- ___ Knee deep or deeper and fast Width: _____
- ___ Ankle/calf deep and fast
- ___ Ankle deep or less and slow
- ___ No riffles/runs

Flow Types (check all that apply):

- ___ Very fast (hard to stand)
- ___ Fast (quickly takes objects downstream)
- ___ Moderate (slowly takes objects downstream)
- ___ Slow (hardly any flow)

Sources:

Citizen's Qualitative Habitat Evaluation Index (draft), Handout provided during "Reading the River"
Intensive Survey Site Data Sheet, Handout provided by Lew Kornman, Minor Clark Fish Hatchery

Habitat_Survey_

Note-taking Guide

Student Name: _____ Animal: _____

Animal's Needs: As you find the information about the animal's needs from your sources, use the table as a way to format your notes

| | |
|---|--|
| food – what does the animal eat? | |
| air – how does the animal breathe? | |
| water – how does the animal obtain water for inside its body? | |
| shelter – where does the animal hide? | |
| reproduction – what ways does the animal keep its offspring safe? | |
| other – record any other facts of interest | |

Note-taking Guide

Habitat Information – Answer the following questions to make sure you are learning all the important details about your animal’s ecosystem and its particular habitat.

| | |
|---|--|
| In what kind of ecosystem can the animal be found? (big river, big stream, small stream) | |
| Where in the ecosystem does the animal mostly or always stay? (on bank, underwater and close to shore, near bottom, on or near surface, etc.) | |
| Substrate: what kind of bottom material makes up your animal’s habitat? (big boulders, rocks, gravel, sand, silt, etc.) | |
| Flow: what speed of water flow does your animal prefer (ripple, run, pool) | |
| Depth: approximately how deep is the typical stream or river of your animal’s ecosystem? | |
| What are the characteristics of the riparian zone (the land area next to the water area)? (heavily shaded, exposed roots on banks, muddy banks, etc.) | |
| other – record any other facts of interest, especially regarding threats to the animal’s habitat | |

Student Instructions

Student Name: _____

Animal: _____

For this assignment, you and your group members will select one river-dwelling or stream-dwelling animal. You will learn about the animal's basic needs and how its habitat helps the animal to meet those needs. To show what you've learned, you will create a detailed model of the animal's habitat. You do not need to do a model of the entire river or stream ecosystem. Instead, you will try to pinpoint the animal's typical habitat—a particular area where the animal would be found. Your model will illustrate how this area meets the animal's needs.

You will proceed through the following steps:

1. Select the animal.
2. Find resources on the animal (books, encyclopedia, internet, CD-ROM, etc.)
3. Study the resources and take notes about the information you find. Use the Note-Taking Guide to make sure you are finding all the important details.
4. Visit a sample habitat (class field trip) to study its features using a Habitat Survey.
5. Draw a plan of your model that includes the important features. Use the Rubric to make sure that you are planning to include all important details.
6. Construct your model.
7. Present your model to the class, explaining its features and how the habitat meets your animal's needs.