

# Rivers

## HIGH SCHOOL TEACHER'S GUIDE



**Grade:** HIGH SCHOOL

**Objectives:**

Explain how fishes and rivers have coevolved.

Explain what dams are and why humans have engineered them.

Construct an explanation of how dams impact river ecosystems.

Construct an argument about if a dam should be built or not.

**Timing:**

30 minutes at Shedd Aquarium

**Materials:**

Printed activity sheet for each student

### Introduction

Rivers are home to a great diversity of plant and animal life. In this lesson, students will investigate animals in the Rivers gallery to observe, record and hypothesize about how various external structures help animals move and eat. Students will explore habitats of their choice, as well as the paddlefish exhibit. This activity is meant to be completed in the Rivers gallery at Shedd Aquarium.

### Working toward these Next Generation Science Standards

**HS-ESS2.E. Biogeology:** The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause continual coevolution of Earth's surface and the life that exists on it.

**CCC Stability and change:** Much of science deals with constructing explanations of how things change and how they remain stable.

**SEP Construct an argument from evidence:** Construct an oral and written argument or counterargument based on data and evidence.

### Background information

All living things have external structures that help them perform daily processes necessary for life, such as movement, eating, breathing and sensing their environments. These structures are adapted to the unique characteristics of each species' habitat. Similar structures can be found on closely related animals as a result of divergent evolution from a common ancestor (for example, deer and foxes have four legs because they share a four-legged ancestor), and similar structures can be found on unrelated animals as a result of convergent evolution (birds and bats evolved wings separately to perform the same function). Species can also evolve different structures that serve the same purpose in the habitat (squids use jet propulsion to move through the water while clownfishes use fins). Scientists observe animal behaviors and physiology to determine the functions of these structures.



# Lesson Outline

## Know before you go

### Rivers:

Rivers are important bodies of water. Humans can use them for energy, transportation and having fun such as fishing and swimming. Rivers are also homes to many types of plants and animals. Fishes, birds, mammals, grasses and flowers all need rivers to survive. Rivers are different from oceans and lakes because the water moves. So the plants and animals that live there have special structures that help them live in a river ecosystem.

### Vocabulary:

- Evolution is the process by which different kinds of living organisms developed and diversified from earlier forms during the history of the Earth.
- Natural selection is the process by which organisms better adapted to their environment tend to survive and produce more offspring. This process was first fully expounded by Charles Darwin and is the main driver of evolution.

## Explore at Shedd!

We are going to visit the Rivers gallery at Shedd Aquarium soon! While we are there, we will collect observations and data about different fishes that live in rivers around the world. Today we are going to construct a scientific argument around the debate for building a new dam. First, we are going learn about rivers and how fishes have adapted to live in moving waters. After that, we will look at two sides of a common conflict around industry and environmental protection.

### Students should

- read the information and use the Rivers gallery to complete the table and reflection question on page 1. We recommend that they stop at this point and compare with a partner;
- continue to page 2 to formulate their own opinions about the construction of a dam.

## Optional classroom debrief questions

Have students record which theory they supported throughout their learning process.

- How are the organisms we saw today an example of evolution driven by natural selection?
- Why do humans build dams?
- How do dams affect fishes and river ecosystems?
- What side of the debate did you side with and why?

## Optional extension activities

- Research other local fishes and consider the impacts that dams have on their populations. Take into consideration their reproductive life cycles, life expectancy, habitat needs and food resources. Create an informational resource to teach others about why this fish is impacted by rivers.
- Research other innovative ways the benefits of dams can be met. Develop a pitch for how a town that is debating the removal of their dam could still have the benefits of the dam even after the dam is removed. You can research things that already exist or if you have an idea for how to replace the function of the dam, develop a model, test it and pitch it.

## Notes/considerations

### Differentiation:

- Students do not complete the final row of table (select your own adaptation)
- Remove evidence from both sides of the dam debate
  - Irrigation and decrease of sediment transport