2009

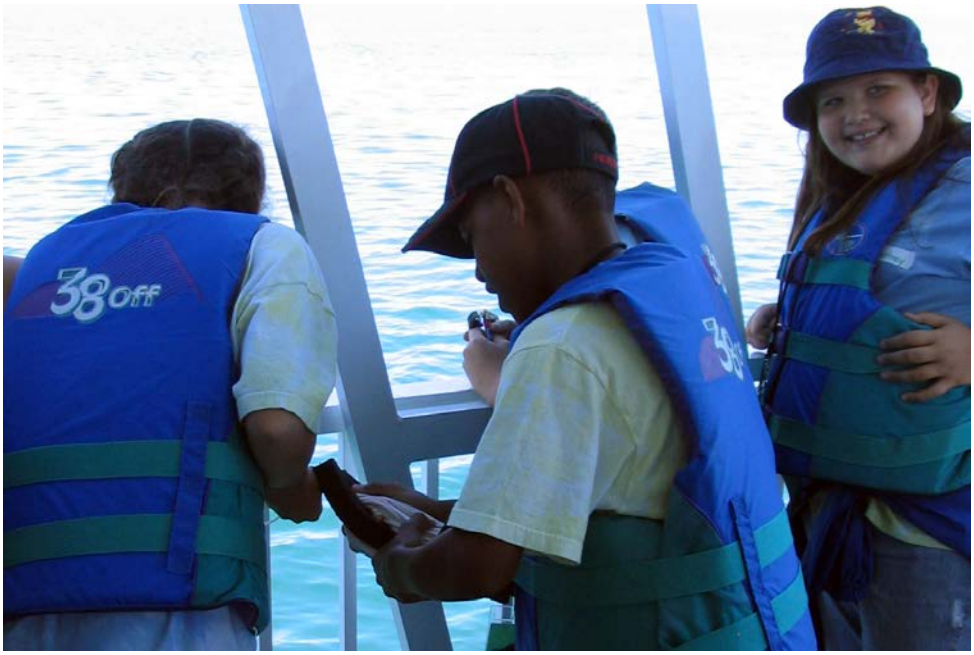
Finicky Fish Finish... Last! On-Site Programming (Grade 5)

Discover Mojave: Forever Earth

GRADE 5

FINICKY FISH FINISH...LAST!

ON-SITE PROGRAMMING



2008/2009 Edition

FINICKY FISH FINISH…LAST!

OVERVIEW

The razorback sucker is a native fish species that was once plentiful in the Colorado River system. This rugged fish is adapted to life in flowing waters, including the ever-changing cycles of drought and turbulent flooding that once characterized the Colorado. However, the Colorado River has been altered in ways that now make it hard for the razorback sucker to survive. Today, the razorback sucker is endangered, and as such is a concern of Lake Mead National Recreation Area, the Nevada Department of Wildlife, the U.S. Fish and Wildlife Service, and others. Together, these agencies are working to protect this Colorado River native from extinction.

In "Finicky Fish Finish…Last!" students explore what has happened to the Colorado River and the reasons why it is so difficult for the razorback sucker to thrive in a changed environment. Working as ichthyologists (fish biologists) at Lake Mead, students collect water quality data such as temperature, pH, and clarity—to determine whether current habitat conditions are sufficient for survival of young razorback suckers. Students observe and identify non-native fish in Lake Mead as they learn how the razorback sucker interacts with these neighbors. Students assess whether Lake Mead is still a good habitat for razorback suckers. Using the knowledge they've gained, students design ideal refuges for the razorback sucker, including ideas to get the word out about this endangered native fish.

OUTLINE

On-Site Programming

On-site programming includes activities that take place aboard Forever Earth and activities that take place on shore (typically the Callville Bay picnic area). For a large group, it is convenient to split the students into two or more groups. One or more groups can participate in the shore-based activities while one group is aboard Forever Earth; student groups switch when the Forever Earth group returns to the marina.

Forever Earth

Part 1 ▸ Welcome and Introductions

Part 2 ▸ Observation and Identification: Lake Mead Fish

Part 3 ▸ Onboard Safety Talk and Introduction to Native Fish of the Lower Colorado River

Part 4 ▸ Impact: Ecological Interactions between Native and Non-native Fish in Lake Mead

Part 5 ▸ Investigation: Physical Habitat Characteristics of Lake Mead

Part 6 ▸ Before and After

Shore

Chillin' with the Chubs

Plumbing the Colorado

Corresponding Pre-Visit Lessons

- Species and their Habitat Needs
- Why is the Razorback Sucker Endangered?

Corresponding Post-Visit Lessons

- Getting the Word Out: Visually
- Getting the Word Out: Interviews and Podcasts

THEME

Species with specialized adaptations and narrow ranges of tolerance become vulnerable to extinction when their habitats undergo change.

KEY QUESTIONS

What threatens or endangers a species? What is an organism's "range of tolerance" for survival? What are the questions and challenges associated with re-establishing an endangered species in an altered ecosystem?

GOAL

Students will demonstrate an understanding of the factors in an altered ecosystem that affect the survival of native species and the challenges of re-establishing endangered species.

OBJECTIVES

Students will:

- describe what is meant by "native species" and "non-native species;"
- describe how the altered habitat conditions of the lower Colorado River caused the native fish species populations to become endangered;
- describe the interactions of native and non-native fish in Lake Mead; and
- apply their knowledge of native fish and their habitat needs to design a refuge for razorback suckers.

NEVADA STATE STANDARDS CORRELATIONS

N.5.A.1. Students know scientific progress is made by conducting careful investigations, recording data, and communicating the results in an accurate method.

N.5.A.2. Students know how to compare the results of their experiments to what scientists already know about the world.

N.5.A.3. Students know how to draw conclusions from scientific evidence.

N.5.B.3. Students know the benefits of working with a team and sharing findings.

L.5.C.2. Students know organisms interact with each other and with the non-living parts of their ecosystems.

L.5.C.3. Students know changes to an environment can be beneficial or detrimental to different organisms.

L.5.C.4. Students know all organisms, including humans, can cause changes in their environments.

L.5.C.5. Students know plants and animals have adaptations allowing them to survive in specific ecosystems.

CLARK COUNTY SCHOOL DISTRICT SCIENCE CURRICULUM ESSENTIALS FRAMEWORK (CEF) CORRELATIONS

Students will:

(5)4.3. Investigate and describe how plants and animals require food, water, air, and space.

(5)4.5. Explain that living things get what they need from their environments.

(5)4.6. Investigate and describe the interrelationships and interdependence of organisms with each other and with the non-living parts of their habitats.

(5)4.7. Investigate and describe how some environmental conditions are more favorable than others to living things.

(5)4.8. Investigate and describe how organisms, including humans, can cause changes in their environments.

(5)4.10. Investigate and describe how environmental changes allow some plants and animals to survive and reproduce, but others die.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The on-site grade 5 activities support the following guiding themes developed by Clark County-based educators:

- Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.
- Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.

PREREQUISITE CLASSROOM EXPERIENCE

Classroom Visit. A pre-visit classroom trip will be made by Forever Earth or National Park Service staff to introduce students to the Forever Earth program and what to expect during their field trip. Students learn and agree to the "conduct rules" of Forever Earth, understand basic water safety concepts, and observe how and when to put on a Personal Flotation Device (PFD) during their time aboard Forever Earth.

VOCABULARY

- calcium concentration
- dissolved oxygen
- ecosystem
- endangered species
- interpretive plan
- population
- re-establishment
- range of tolerance
- native species
- non-native species
- pH
- refuge
- threatened species
- turbidity
- watershed
- water clarity

ON-SITE ACTIVITIES: Forever Earth

Part 1 ▸ Welcome and Introductions

Forever Earth staff greet students in the parking lot. Students are divided into groups and given team lanyards. Facilitator welcomes students to Lake Mead National Recreation Area and Forever Earth and introduces the concept of National Parks and public lands, emphasizing that the field trip is taking place on public land.

TIME 10 minutes
MATERIALS
Color-coded badges to indicate teams attached to lanyards
Facilitator Reference:
Lake Mead NRA Fast Facts

Part 2 ▸ Observation and Identification: Lake Mead Fish

As students walk to Forever Earth along the dock, they are introduced to their role as ichthyologists and are guided to use observation skills to identify some of the fish in the lake that can be seen from the marina: common carp, bluegill, striped bass, and channel catfish (see **Student Reference: Lake Mead Fish Identification**). (NOTE: Students must not run on the dock, must not lean over the water from the dock, and must remain at least one-foot from the edge.)

TIME 10 minutes
MATERIALS
PDAs
Student Reference:
Lake Mead Fish I.D. (E-book or sheet)

Part 3 ▸ Onboard Safety Talk and Introduction to Native Fish of the Lower Colorado River

Captain or facilitator leads the safety presentation (see **Facilitator Reference: Safety Talk Outline)**.

Students gain an understanding of the terms "native species" and "non-native species."

TIME 25 minutes
MATERIALS
Facilitator Reference: Safety Talk Outline

The facilitator uses a Fact or Fiction activity (see **Demonstration: Lake Mead Fish Fact or Fiction**) to introduce students to the unique attributes of the lower Colorado River native fish. Students compare these species to the non-native species that also exist in the lake today. Through discussion after the demonstration, students learn that Lake Mead was formed by the building of Hoover Dam. Students discuss how the lake differs from the river in terms of fish habitat.

Demonstration: Lake Mead Fish Fact or Fiction PowerPoint
Facilitator Reference: Razorback Sucker Fast Facts
Laptop computer
Television monitor

Part 4 ▸ Impact: Ecological Interactions Between Native and Non-native Fish in Lake Mead

Students disembark at Sandy Beach and participate in a simulation activity (see **Facilitator Reference: Razorback Sucker Survivor**) to understand the interactions between native and non-native fishes. Alternatively, this activity can be done within the main cabin or on the top deck of Forever Earth.

TIME 20 minutes
MATERIALS
Facilitator Reference: Razorback Sucker Survivor
Labeled Frisbees

Part 5 ▸ Investigation: Physical Habitat Characteristics of Lake Mead

Students are told they are going to analyze Lake Mead to see if it is still a good habitat for razorback suckers. Students collect and analyze data to determine fish habitat characteristics of Lake Mead. Data are recorded on the **Student Worksheet: Data Collection Sheet**. Students are divided into 2 groups:

Group 1 Students use probes to collect data for dissolved oxygen, water temperature, and pH.

Group 2 Students use a Secchi Disk to measure turbidity. Students use a plankton net to collect plankton. Students assist facilitator in making slides for stereoscope observation. Students view collected plankton on TV monitor. Facilitator supports students with basic identification of collected microorganisms.

Groups 1 and 2 compare data and average their results. If time allows, Groups 1 and 2 switch so that both groups have a chance to collect all of the data.

Students compare collected data to the known survival ranges and optimal ranges for razorback sucker survival. With the help of the facilitator, students review the data in their entirety to decide whether Lake Mead is a good habitat for the razorback sucker.

TIME 20 minutes
MATERIALS

Student Worksheet: Data Collection Sheet
Group 1 Station
Probes for temp/pH/D.O.
Plastic beakers (3; 500 ml)
Surface water collector
Van Dorn Water Samplers
Student Reference: pH Scale and Examples (E-book or sheet)
Group 2 Station
Collection tray
Digital stereoscope
Digital microscope
Eye droppers
Laptop computer
Petri dishes (2)
Secchi disks (2)
Plankton net
Student Reference: Plankton I.D.

Part 6 ▸ Before and After

Students work in their color teams to create visual representations of the razorback sucker's habitat before Hoover Dam was built and after the dam was built. They should incorporate what they've learned about this native fish and its adaptations, habitat needs, and ecological interactions into their representations. Students document and illustrate their ideas on chart paper. Teacher may collect the results to take back to the classroom to complete or to use in post-visit activities. If time allows, a version of "American Idol" can be introduced as a way of encouraging each team to share their work.

TIME 30 minutes

MATERIALS

Colored markers

Chart paper

Weights or clipboards

ON-SITE ACTIVITIES: Shore

CHILLIN' WITH THE CHUBS

Note: This activity is adapted from the Discover A Watershed: The Colorado River activity book. For additional information, refer to the activity write-up beginning on page 211.

In this simulation activity, students examine the effects of introduced species and dams on native fish populations in the Colorado River.

Students will:

- Compare pre-dam and post-dam habitat conditions in the Colorado River.
- Describe the effects that introduced species and dams have on native fish populations.
- Discuss solutions for protecting native fish populations.

Part 1 ▸ Introduction to Chillin' with the Chubs

Students are welcomed to Lake Mead National Recreation Area with a brief discussion of the concept of public lands, national parks, and the role of the National Park Service.

Begin by asking students what types of fish they have caught or seen in the area. Introduce the concept of native and non-native species. Ask if they have ever heard of a Colorado pikeminnow or a razorback sucker (use fish models as a visual aid); discuss how these fish were very common in the Colorado River prior to dams being built and to increased human occupation along the river. Ask students to suggest reasons why these native fish populations declined so rapidly. Lead the discussion so that three main factors, or stressors, emerge:

1) Construction of dams changed the physical environment of the river including variation of flows, water temperature, and turbidity.

TIME 30 minutes

MATERIALS

Models of Colorado pikeminnow and razorback sucker

Cones for marking boundaries

2) Introduction of nonnative species changed the ecosystem; they prey on eggs and young of native fish.
3) Over-fishing by humans has reduced populations, especially of Colorado pikeminnow and totoaba.

Part 2 ▸ Chillin' with the Chubs

Tell students that they are going to be a native Colorado River fish and experience how populations of different species have changed in response to the different stressors they just discussed. Divide students into five (or fewer) groups with each group consisting of at least four students. Have each student in group wear lanyards representing a native fish such as humpback chub, bonytail chub, razorback sucker, Colorado pikeminnow, or desert pupfish. Assign one student to be the environmental stressor; this person represents the three different environmental facts that have led to declines in these native fish populations.

Lanyards with Fact Cards

Tell students that their goal is to make it across the playing field without being tagged by the stressor. However, they will have hindrances that make it harder to cross. These obstacles represent how these native species are intolerant of new environmental changes. Refer to the table below to explain what students in each group must do as they cross the playing field.

Species	Hindrance
Humpback chub	Must stop every 8 steps and do 3 jumping jacks
Bonytail chub	Must walk sideways
Razorback sucker	Must hop on one foot
Colorado pikeminnow	Must spin in a circle every 5 steps
Desert pupfish	Must walk backwards, stopping to touch the ground every 10 steps

Record on flip chart paper the number of students in each group. Tell students that these numbers represent conditions in 1800, before dams and non-native species were introduced, and before commercial fish. The subsequent rounds represent later time periods when these factors were introduced.

Flip chart paper

For Round 1, the fish will try to make it to the end of the playing field without being tagged by the stressor. Students can walk fast, but not run. Record the number of fish that make it to the safe area. Students that get tagged should flip their Fact Cards to show the non-native or

tolerant species or environmental stressor. These students move to the middle of the playing field to become stressors. Record the total number of environmental stressors and non-native species.

Repeat the procedure for 3-4 more rounds. With more students as stressors, the number of native species left at the end of each round will be fewer. Record numbers of fish for each round.

Part 3 ▸ Conclusions

Have students discuss the results. Because this is a simplified model, the decrease in native species happens at the same rate as the increase in non-native species. In actual situations, the rates would differ since the factors involved are more complicated.

Ask students to brainstorm ideas to help protect these endangered species. Ideas may include removing non-native fish, finding ways to increase water temperature and make flows more similar to pre-dam flows, banning certain types of fishing, etc.

PLUMBING THE COLORADO

Note: This activity is adapted from the Discover A Watershed: The Colorado River activity book. For additional information, refer to the activity write-up beginning on page 277.

In this activity, students explore how water moves into and out of the Colorado River system.

Students will:

- Demonstrate water inputs and outputs of the Colorado River system.
- Gain an increased awareness of water users on the Colorado River, including those outside their geographic area.

TIME 40 minutes

MATERIALS

Part 1 ▸ Introduction to Plumbing the Colorado

Explain that the Colorado River is extremely important because much of the area through which it flows is desert. By using dams and diversions to use or “plumb” the river, we’re able to live and grow crops where it would otherwise have been extremely difficult. In this activity, the students will see how water is added to and removed from the river according to the type of process or use of the water.

Part 2 ▸ Plumbing the Colorado

First, direct students' attention to the "rope" model of the Colorado River watershed. Show where major features on the model are located: the headwaters of the Colorado and Green rivers; the confluence of the Colorado and Green rivers; Lake Mead; the U.S./Mexico border; and the Gulf of California. Use the Colorado River watershed map to reinforce the concept of the model representing the flow of the Colorado River from its headwaters to the Gulf of California.

The students are divided into teams. Each team is given a blue bucket that represents the Colorado River. Students will move down the rope model, adding or removing water from their rivers (blue buckets) according to the instructions on the laminated cards. Explain that water in the white buckets represents sources of water (rain, snow, tributaries, etc.). Before letting the students begin the activity, the facilitator should take a few minutes to have students practice using the measuring cups.

Have each team start at the headwaters of the Colorado River, Card #1, and continue down the river to the Gulf of California. Adults should shadow the teams and assist with some of the more complicated measurements. Just below the confluence of the Green and Colorado Rivers, a laminated card asks students to predict how much water will be in the bucket when it reaches the Gulf of California. Emphasize to students that it is not a race and to perform their measurements carefully.

When the river reaches the Gulf of California, there should not be any water left in the bucket. All the water has been used upriver. This is what happens to the Colorado River in most years. Only during extremely wet years does water flow all the way to the Gulf of California. Review students' predictions of how much water would be in the bucket when it reached the Gulf.

Part 3 ▸ Conclusions

Students are asked to review the reasons for when water was added to their bucket (river) and for when water was removed from their bucket (river).

Students are then asked what this means for:

People living in Mexico
People living along the Colorado River
People growing food along the Colorado River

Colorado River watershed "rope" model
6 Measuring cups
6 Blue buckets
6-8 White buckets filled with water
Colorado River watershed map
Laminated cards with information about quantity of water to be added or removed from river buckets and why

Fish and wildlife
All of us
Ask students to discuss what would happen in wet or dry years.

Conclude by having students summarize what they learned by doing this activity.

ADAPTATIONS FOR DIVERSE LEARNERS

- Consult with teachers prior to field trip to determine specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
- Implement peer assistance by involving teachers in the process of creating color teams.
- Provide diagrams, photos, or other visual organizers as appropriate for processes and techniques.

ADDITIONAL ON-SITE ACTIVITIES: Shore

NOTE: These activities may be used to replace or augment "Chillin' with the Chubs" or "Plumbing the Colorado."

BUILD A WATERSHED

In this activity, students work in small groups and build models of watersheds.
Students will:

- Be able to define the term "watershed."
- Predict where water will flow in their watershed models.
- Explain how the flow of water or drainage patterns is affected by variables such as steepness of slope and arrangement of landforms (such as mountains, valleys, canyons, lakes, etc.).
- Predict where communities or individual homes might be located on their models.
- Apply what they've observed with the created models to the surrounding landscape.
- Understand that Lake Mead is part of the Colorado River and Colorado River watershed.

TIME 40 minutes

MATERIALS

Aluminum turkey baking pans
Aluminum foil
Masking tape
Newspaper
Spray bottles filled with water colored with blue food coloring
Map of Colorado River watershed

Part 1 ▸ Introduction to Building a Watershed

The students are asked what comes to their minds when they hear the word "watershed." The responses are used to assimilate a definition that the students can picture using the surrounding landscape.

A watershed is all the land area drained by a particular river, stream, or other water channel. From an aerial view, drainage patterns in watersheds resemble a network similar to the branching pattern of a tree or a state road system. Smaller streams empty into larger streams that empty into still larger streams or rivers.

A map of the Colorado River watershed is used to illustrate how a watershed is a defined area of land and how the many streams and rivers eventually flow into the Colorado River. The facilitator points to location of the headwaters of the Colorado River and then traces the flow of the Colorado through seven U.S. states and two Mexican states to the Gulf of California. The location of Lake Mead, Hoover Dam, and Las Vegas are highlighted for students as well as the importance of Lake Mead for people living in Las Vegas. The Colorado River watershed is the fifth largest in the United States. Students might also be asked if they can guess which watersheds might be larger.

After examining the map, a short discussion follows regarding why it is important to learn about or study a watershed. For example, why is it important to know what's occurring upstream from Las Vegas?

Downstream? (Weather events; erosion; plants; animals; locations of people; quality of water; movement of pollution; roads; farms; timber harvest; etc.)

Students are then informed that they will be able to learn more about the importance of watersheds by actually building a model of a watershed.

Part 2 ▸ Building a Watershed

The facilitator uses the surrounding landscape to point out variations of landforms, steepness, and vegetation. Students picture how water would flow downhill (fast or slow) and where it would flow (what directions). The facilitator may use a pre-constructed sample model to serve as a visual to describe how to build the model.

Students work in groups of 2-3. Each group is given an aluminum turkey baking pan, newspaper pages, masking tape, and aluminum foil. One end of the aluminum pan should be cut and folded outward to represent the “downstream” direction of the watershed. The facilitator demonstrates how to use the newspaper to twist and crumple into different shapes, using the masking tape to hold its shape. The newspaper shapes are placed in the aluminum pan and then covered with sheets of aluminum foil. (When covering the newspaper, it works best to work from downstream to upstream.) The foil can be molded around the newspaper shapes to provide relief and detail to the model.

Before the groups begin their models, they are reminded to think about the various landscapes they’ve observed and plan what kinds of features they want to have in their watershed models. For example, they should plan on whether to build steep mountains and canyons, rolling hills, wide river areas, lakes, and/or valleys, etc.

The groups are given about 10-15 minutes to complete their models. The models are leaned against the side of the concrete pavilion floor so that the downstream end of the model empties into the grass. (This facilitates the water flowing down through the model after water is sprayed onto the model.) Have the students point out differences between the models: less elevation vs. steep elevation, broad expanses vs. narrow canyons or valleys, etc. Then have each group predict where water will flow through their model when it rains and where, if any place, the water might collect, even temporarily.

Each group is given a spray bottle of water and asked to make it “rain” on their watershed. Encourage them to: 1) spray water over the entire watershed model; and 2) allow everyone in their group a chance to use the spray bottle.

Groups place the spray bottles on the ground next to their models. Each group should observe where and how the water flowed through their watershed and report if their original predictions were accurate along with additional observations.

The students are then asked to choose places in their watershed where they might build a home or locations where a town or city might be found. Have them defend or provide a rationale for their choices. Additional questions for discussion include: *What kinds of things could change how fast or slow the water flows through a watershed? How do weather or weather events affect a watershed*?

Part 3 ▸ Conclusion

Have all the students gather around one group’s watershed model. Use the model and the surrounding landscape to review the definition of a watershed. Discuss the importance of understanding how a watershed works and how humans can affect how water flows through a watershed. (This can be used as a transition to the “Consequences of Dams” role-play activity.)

Note: The watershed models should be dismantled by the groups before moving on to the next activity. Newspaper shapes and the aluminum foil can usually be reused by the next group of students. Recycle any aluminum foil and newspaper that cannot be reused.

DAM CONSEQUENCES

The object of this activity is for students to engage in a role play to evaluate positive and negative effects of damming a river.

Students will:

- understand differing perspectives and concerns related to the construction of a dam.

TIME 30 minutes

MATERIALS

Part 1 ▸ Introduction to Dam Consequences

Dams are built for a number of reasons; dam construction has positive and negative effects:

- Dams provide electricity; water for irrigation of crops; and

help prevent flooding problems downriver.

- Dam construction and maintenance provide many jobs, which is good for the local economy.
- A dam can affect plants and animals in a variety of ways. It can take away food and habitat for animals like deer. It can take away nesting sites for birds and change the water temperature and clarity that native fish depend on to survive. It can also increase habitat for some species like the Bald Eagle, a threatened species that likes to catch fish from lakes.
- The lakes created by dams (called reservoirs) provide a lot of recreational opportunities such as swimming, water skiing, sailboarding, motorboating, fishing, and jetskiing. Rivers that don't have dams also provide recreational opportunities, including fishing, hiking, rafting and kayaking.

Part 2 ▸ Dam Consequences

Facilitator shows students a map/aerial photograph of Lake Mead with Hoover Dam and points out the course of the Colorado River prior to dam construction. Students are shown photos of a white-water river and told that they are being taken back to a different time and place. Students are asked to imagine what it would be like being on a raft on this river: *Would the water be fast or slow*? *What would it sound like*? *What kinds of animals might you see*? *What kinds of plants*? *How is it different from a lake? How is it similar to a lake*? Facilitator shows some photos of rivers and lakes.

Photos of rivers and lakes

The facilitator tells students that in this activity, they will explore the issues involved with rivers and dams from the viewpoints of people involved. They are going to be citizens of Rocksburg, population 900, located along the scenic Jones River some 60 miles from the nearest big city. As citizens, students will have to argue for or against the construction of the Rocksburg Scenic River Enhancement Project, consisting of a 75-foot high dam that will turn seven miles of river into a lake. Each student team will be given a role to play (**Student Activity: Dam Consequences Role-Play Cards**). Taking on the perspective of their role, they have to argue either for or against the dam to the Rocksburg City Council, consisting of another student team. Each student team will consider the pros and cons from the point of view of their assigned role, no matter what they think as students. Once they make their well thought-out argument to the

Student Activity: Dam Consequences Role-Play Cards

Rocksburg City Council, the council members will make the final decision on whether or not the dam should be built. The council members will listen to their constituency (the other five teams presenting) and keep in mind that they are elected officials—that is, they risk losing their jobs if their decision is unpopular. Of course, the council members can cast their votes according to their own conscience, if they so choose.

The facilitator divides the students into six teams. Each team is given a role card. They have 10 minutes to prepare their argument for or against the dam. The facilitator reminds students to argue from the point of view of their assigned role, no matter what they actually think. Each team will choose a spokesperson to argue their case.
Once the students have reviewed their roles, each team has two minutes to present their case to the City Council (the facilitator will be the timer). The council will then have 5 minutes to make their final decision and present to the townspeople of Rocksburg.

Part 3 ▸ Conclusions

Students review some of the pros and cons of damming a river. The facilitator provides closure to the activity by having students apply what they have learned to the construction of Hoover Dam and consider the pros and cons of its existence.