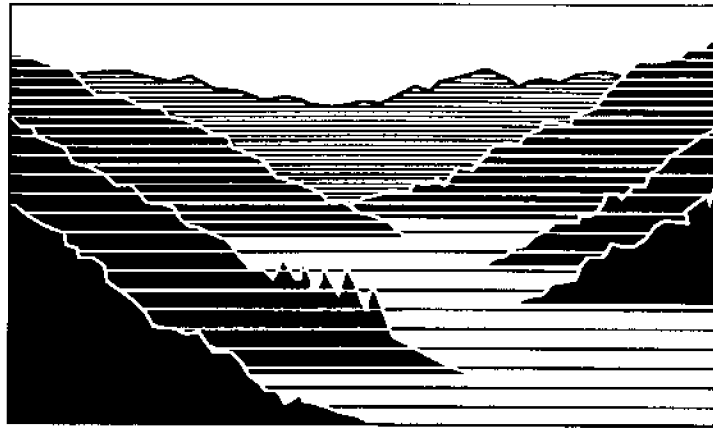


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THE

COLUMBIA

RIVER

ITS FUTURE AND YOU

GRADES 5-8

OREGON STATE UNIVERSITY
EXTENSION SERVICE
OREGON SEA GRANT PROGRAM
EM 8474 • JANUARY 1993

THE COLUMBIA RIVER

This book is part of a project to develop a multidisciplinary set of curricula and educational materials on the Columbia River.

The project is funded by Oregon Sea Grant and Washington Sea Grant, under the direction of Vicki Osis, OSU marine education specialist, and Mike Spranger, assistant director for marine advisory services, Washington Sea Grant.

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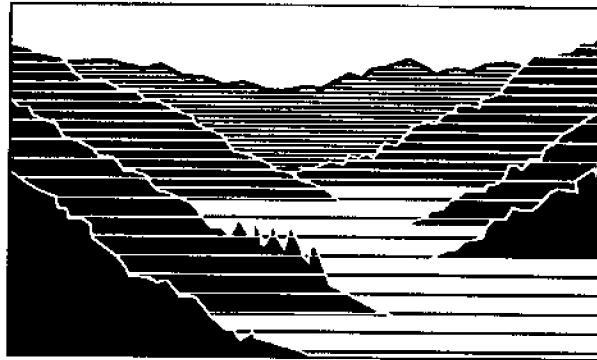
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THE

COLUMBIA RIVER

ITS FUTURE AND YOU

GRADES 5-8

VICKI OSIS, MARINE EDUCATION SPECIALIST,
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and

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ASSISTANT DIRECTOR FOR MARINE ADVISORY
SERVICES, WASHINGTON SEA GRANT

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INTRODUCTION *TO TEACHERS*

The Columbia River system is a complex topic to study. There are many activities a teacher could undertake with a class to present the major concepts in such a study.

The activities described in this book cover the basics of the Columbia River system. Completing these activities with your class will take about six weeks of your social studies and science periods. The curriculum includes extended activities for use as enrichment with interested students.

The activities are arranged by subject: general information, energy, fisheries, agriculture, recreation, and navigation. The summary at the end provides an overview.

You may want to alter the activities to better suit your style of teaching or your particular class. Such adaptation should make these activities even more effective in teaching the overall point of water budgeting.

In all your class discussions, try to stress the need to make responsible decisions on the proper use and management of the water resources of the Columbia. There are no absolute answers to the question of who should get how much water. The purpose of this educational project is to increase student understanding of the uses of the Columbia River and to start students thinking about how the resources of the Columbia should be managed.



Teaching Resources

Teachers are encouraged to send for the following materials for background information and use in class. Most of the items proved useful in preparing this curriculum.

Brochures/Newsletters

Are We Prepared For the Next Drought? Managing Low Water Year Emergencies. Charles F. Broches, Michael S. Spranger, and Bill Williams. 1983. Conference proceedings. Available from Washington Sea Grant, 3716 Brooklyn Avenue NE, Seattle, WA 98105-6716. \$9.00.

Discusses the impact and implications that a serious low-water year (drought) would have on the Columbia River system and the Pacific Northwest. Papers are from major users and water managers of the Columbia River system.

The Dalles Lock and Dam, John Day Lock and Dam, and Bonneville Lock and Dam. Obtain from Portland District U.S. Army Corps of Engineers, 319 SW Pine, Portland, OR 97204. No cost.

Pamphlets that describe the operation, management, and multiple purposes of Bonneville, The Dalles, and John Day dams.

Columbia River Salmon. Michael S. Spranger and Randall S. Anderson. 1988. Available from Washington Sea Grant, 3716 Brooklyn Avenue NE, Seattle, WA 98105-6716. \$3.00.

Traces the Columbia river salmon from its historic beginnings to the present efforts to restore and protect salmon runs.

Columbia River Sturgeon. Randall S. Anderson. 1988. Available from Washington Sea Grant, 3716 Brooklyn Avenue NE, Seattle, WA 98105-6716. \$3.00.

Discusses the biology and life history of Columbia River sturgeon and present concerns about overharvesting and efforts to manage and rejuvenate this fishery.

Politics and Economics of Columbia River Water. Charles F. Broches and Michael S. Spranger, 1985. Available from Washington Sea Grant, 3716 Brooklyn Avenue NE, Seattle, WA 98105-6716. \$10.00.

At one time the Columbia was considered an unlimited resource, but the river may no longer be capable of meeting all the demands being placed on it.

The Role of the Columbia/Snake Navigation System in Intermodal Ocean Transportation. James R. Jones. 1980. ORESU-T-80-001. Available from Sea Grant Communications, Oregon State University, Administrative Services A402, Corvallis, OR 97331-2134. No cost.

Backgrounders. Newsletter available from the Bonneville Power Administration, P.O. Box 12999, Portland, Oregon 97212.

Selected titles from this series:

"The World's Biggest Fish Story: The Columbia River's Salmon," "Downstream Fish Migration: Improving the Odds of Survival," "Columbia River Treaty Revisited."

Books

Magnificent Gateway. John Allen. 1979. Available from Timber Press, 9999 SW Wilshire, Portland, OR 97075. \$8.50.

Describes the geology of the Columbia River and Columbia River Gorge. It also contains a mileage road log excellent for self-instructed field trips on the geology of the gorge.

Cataclysms on the Columbia. 1987. John Allen, Marjorie Burns, and Sam Sargent. Available from Timber Press, 9999 SW Wilshire, Portland, OR 97075. \$19.95.

Tells the story of the cataclysmic floods that created the Columbia Gorge and of the geologist who first postulated them.

THE COLUMBIA RIVER

The Making of Oregon: A Study in Historical Geography. Samuel N. Dicken and Emily F. Dicken. 1979. Available from the Oregon Historical Society, 1230 SW Park, Portland, OR 97205. Cost \$10.95.

Discusses the natural history of Oregon.

Barbie. Roger T. Tetlow and Graham J. Barbie. 1990. Binfort and Mort Publishing, 1202 NW 17th Ave., Portland, Oregon 97209. \$25.00.

Explores the cannery industry of the Columbia River.

Reach of Tide, Ring of History. Sam McKinney. 1987. Oregon Historical Society Press, 1230 SW Park Avenue, Portland, Oregon 97205. \$19.95.

Offers a look at the history of the Columbia River.

Voyages of the Columbia to the Northwest Coast, 1787-1790 and 1790-1793. Frederick W. Howay. 1990, 2nd ed. Oregon Historical Society Press, 1230 SW Park Avenue, Portland, Oregon 97205. \$40.00.

By one of the foremost maritime historians of the Pacific coast. Contains the logs from four different captains of the Columbia.

Audiovisual Materials

The Columbia River Gorge: A Natural History. 1985. Available from Northwest Film Center, 1219 SW Park Ave., Portland, OR 97205. 16-mm film: rental \$35, purchase \$325; video: rental (check with Northwest Film Center), purchase \$225.

Student-produced 16-mm film that uses claymation to depict the formation of the gorge by floods.

Estuary: Columbia's Link with the Sea. 1982. Available from Sea Grant Communications, Oregon State University, Administrative Services Building 402, Corvallis, OR 97331-2134. 16-mm film: rental \$20, purchase \$200; VHS video: rental \$20, purchase \$50.

Twenty-eight-minute 16-mm film points out the importance of the Columbia River estuary. It also discusses the multiple uses of the Columbia and how they affect the estuary and its users.

Here Comes the Steamer. Obtain from the Oregon Historical Society, 1230 SW Park, Portland, OR 97205. Rental \$5.

Slide program showing the importance and historical role of steamboats on the Columbia and Willamette rivers.

Journey of the Kings. Obtain from Northwest Power Planning Council, 851 SW Sixth Avenue, Suite 1100, Portland, OR 97204. No cost.

A 16-mm film that discusses the plight of the Columbia River salmon and the remarkable regional program designed to protect them. This beautiful movie soars over some of the most stunning landscapes in the world as it follows the salmon from their upriver spawning grounds, through the mighty dams, to the sea, and back again. Twenty-eight minutes long.

Work is our Joy: The Story of the Columbia River Gillnetter. 1989. Available from Extension Sea Grant, OSU Seafoods Laboratory, 250 36th St., Astoria, OR 97103. Purchase: \$25.00 plus \$3.00 shipping.

A video looking at the heyday of the gill net salmon fisheries on the Columbia River through interviews with fishermen.

Other Resources

Contact a local port for a possible field trip, outside speaker, or written materials. For example, the Port of Portland offers the following:

- Tours of the port (adapted for grade 3 and above)

Requires groups of 15 or more. Your school must provide transportation—a single vehicle for the whole group—during the tour itself.

- Van Program (grades 4 and 5)

A 38-foot trailer is used to teach students about the port and Oregon's role in international trade.

Prior to your participation in either the port tour or the van program, representatives of the Port of Portland will be happy to make a background presentation to your class.

- Speaker's Bureau (high school-adult)

A presentation of current issues facing the port.

Contact a dam near you and arrange a tour. Students can watch a fish ladder in operation, see the turbines, learn about the spillway, and get some history on the development of the dam.

THE COLUMBIA RIVER

INTRODUCTION



Activity: Salt Dough Map

I. Concepts

1. The Columbia River and its tributaries drain major portions of the Pacific Northwest (nearly 260,000 square miles).
2. The river originates in south-central British Columbia and travels more than 1,200 miles before entering the Pacific Ocean near Astoria, Oregon.

II. Objectives

The students will be able to

1. identify the Columbia River on a map of the Pacific Northwest.
2. name the countries and states in which the Columbia River system is found.
3. show on a student-made map the flow of the Columbia River.
4. define the terms *tributary* and *river system*.

III. Teacher Prep

1. Read teacher information sheet.
2. Gather necessary materials.
3. Make an overhead transparency of the Columbia River basin for student use.
4. Mix the dough. Add water slowly. Dough should be thick, not sticky. Knead dough until smooth. Store in air-tight container.

IV. Materials

1. relief map of Pacific Northwest
2. 8 x 11 1/2 sheet of cardboard for each student (Cardboard found on the back of writing tablets works well.)
3. bowl
4. spoon
5. 2 cups salt
6. 2 cups flour
7. 1/4 cup water
8. poster or tempera paints
9. small paint brushes

Yields enough dough for
30 students

V. Procedures

1. Display a relief map of the Pacific Northwest. Ask student volunteers to find the Columbia River on the map. Ask students to find rivers which flow into the Columbia. Explain the term *tributary*. Ask students to name the countries through which the Columbia River and its tributaries flow. Discuss the beginnings of the Columbia and trace its flow to the Pacific.
2. Distribute maps for reference. Distribute cardboard sheets to each student. Have students write their names on the back. Have students sketch the Pacific Northwest in pencil on the cardboard sheets. Give each student a small amount of dough (approximately 2 T will complete the map). Instruct students to spread the dough thinly over the land portion of their map, leaving the Pacific Ocean untouched. Ask students to show mountain ranges by gently pinching up parts of the dough. Have students use a sharp pencil or pen to indent the map to show the Columbia River and its tributaries.
3. Allow the maps to dry overnight.
4. Have students paint their maps.

VI. Extended Activities

Working with partners or in small groups, have students make larger, more detailed relief maps of the Columbia basin for a bulletin board display. Students may choose to use felt markers to color their two-dimensional maps or salt dough to make a three-dimensional map the size of a bulletin board. Students should include labels and map legends.

THE COLUMBIA RIVER

HISTORY



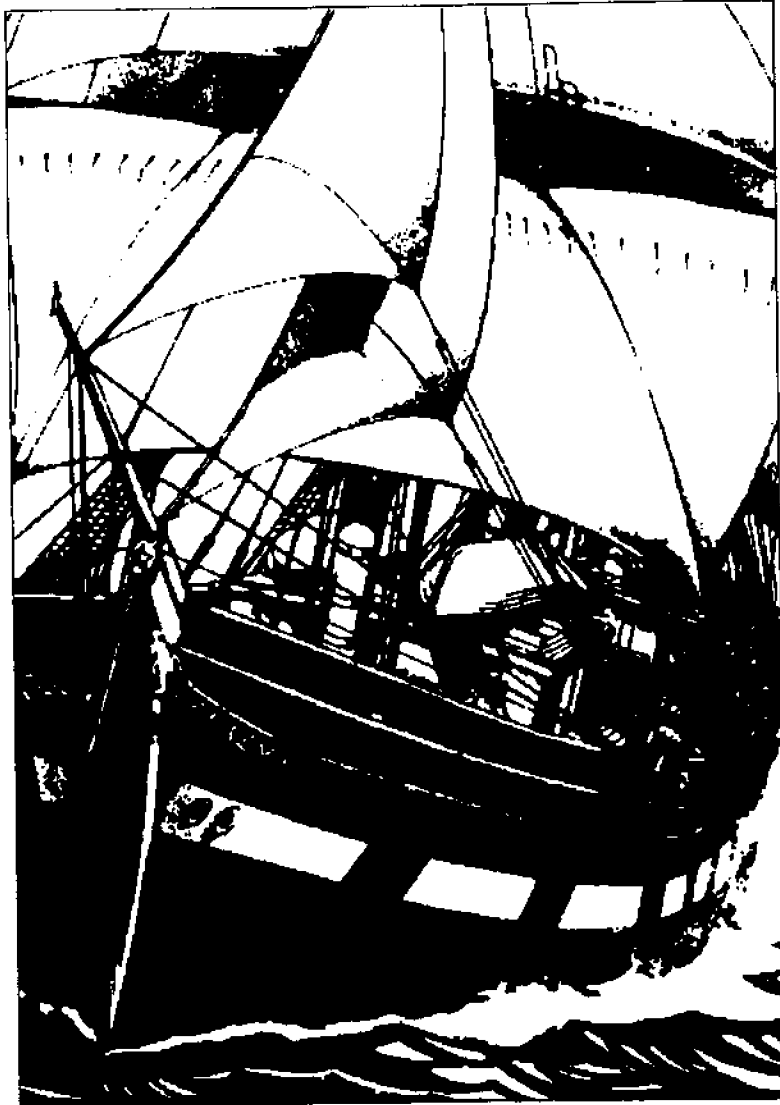
HISTORY: A READING

The Columbia River begins in the mountains of eastern British Columbia, Canada. The Snake River begins in Yellowstone National Park in Wyoming. These two great rivers come together and become one near Pasco, Washington. Together they drain an area of over 250,000 square miles. This area includes most of Idaho; most of Washington and Oregon; the western third of Montana; small portions of Wyoming, Nevada, and Utah; and part of British Columbia. The land is equal in size to the nation of France. The river itself is over twice the size of the Nile River in Egypt and is second only to the Mississippi in water volume in the United States.

People have lived along the banks of the Columbia for over 12,000 years. The oldest village in the Columbia area was found near The Dalles, Oregon. This village, known to the Indians as Wy-am, is more than 10,000 years old.

The Indians who lived along the Columbia lived by fishing and trading. Some of the tribes that lived along the Columbia were the Chinook, Sahaptin, Shoshone, Bannock, Nez Perce, and Paiute. All of these tribes caught the salmon of the Columbia. Every year the tribes would meet at Wy-am, near the fishing grounds of Celilo Falls, to trade. There, the natives of the interior traded dried salmon, hides, and baskets for the shells and woven bark of the coastal tribes. This culture flourished for thousands of years until the early 19th century, when settlers from the east came. They would completely change this ancient way of life.

In 1805, Captains Lewis and Clark, on a mission from President Jefferson, entered the Columbia-Snake region. Other explorers followed. After Astoria was started



THE COLUMBIA RIVER

in 1811, fur trappers began making their way along the Snake River. Fort Vancouver was started by England's Hudson Bay Company in 1825.

The mountain men made their living on fur trade all along the Snake. Jedediah Smith and his men took a hot, dry route from the Rockies to California and up into Oregon from the south.

In the 1830s, missionaries Jason Lee, David Lee, and Marcus Whitman brought Christianity and farming to the region.

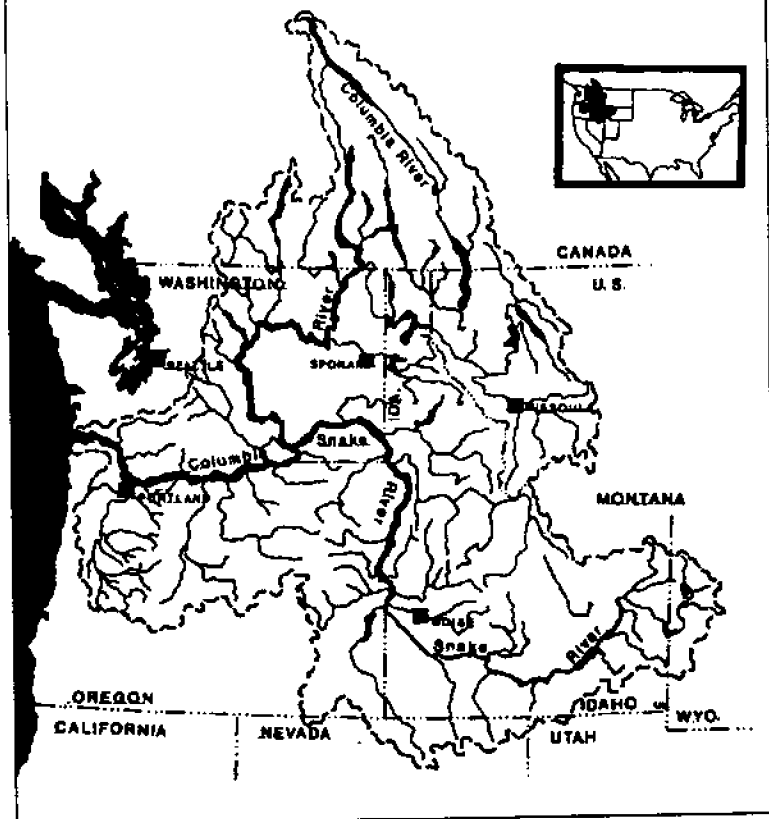
Wagon trains followed, bringing settlers 2,000 miles over the rough Oregon Trail. With them came the customs and values of European Americans.

These settlers began to claim the lands for themselves, changing the Indian ways. They also brought disease, which killed most of the Indians, and plows, which tore up their land.

Afraid of disease, disgusted with land claims and plows, some of the natives fought back. Because they fought against the taking of their land, they were put on reservations. The United States continued to grow and move west. Some nations in the Oregon Territory, like England and France, left the area. Other nations, like the Chinook and Sahaptin, were defeated because they had no other place to go.



The Columbia-Snake River Drainage System



THE COLUMBIA RIVER

Early Indian Tribes of the Northwest



Activity: History Filmstrips

I. Concepts

1. The Columbia River was the last major waterway discovered and explored in the U.S.
2. Indian culture has flourished along the banks of the Columbia for over 12,000 years.
3. Many explorers, fur traders, and missionaries are known for their part in developing this region.

II. Objectives

The students will be able to

1. define *explorer*, *fur trader*, and *missionary*.
2. name several famous people of historical significance to the Columbia River region.
3. illustrate, in detail, the importance of explorers, fur traders, and Indians to this region.

III. Teacher Prep

1. Gather necessary materials.
2. Make student copies of filmstrip guide sheet.

IV. Materials

1. fine-tipped permanent marking pens
2. blank film strip (about 12 inches per student)
3. film strip guide sheet for each student
4. encyclopedias, library books, and other research materials on the history of the Columbia River region
5. 15-minute blank cassette (optional)

V. Procedure

1. Ask students to name any famous people they can that lived or worked in the Columbia River region long ago. List the names on the board. If the students cannot think of specific names, ask them what kind of people would have been important in the development of the Columbia River area. List the categories of people on the board. Beneath each category write the names of these famous people and any others thought of by your class. When discussing the Indians, point out that several different tribes from two different nations were found in this region.

Missionaries

Jason Lee
Daniel Lee
Marcus Whitman

Explorers

David Thompson
Robert Gray
Lt. William Broughton
Capt. George Vancouver
Meriwether Lewis
William Clark
John Townsend

Indians

Chinook nation
Sahaptin people

Fur Traders

John Jacob Astor
Dr. John McLoughlin

2. Ask students to choose one category (or you might assign students particular categories to ensure that each topic is covered). Give them an opportunity to research their topic and write a one-page report on the topic. After you have approved each report, distribute filmstrip materials. Have students use their report as the narrative for the filmstrip. Show students how to make a title frame (writing clearly, neatly, and very small) for their filmstrips and then how to advance the film through the guide to draw illustrations to go with the narrative. Encourage students to make illustrations which fill each frame and are as detailed as possible. When the filmstrip is complete, you might want to have students record their narrative on cassettes. (Be sure they record a bell tone to signal when to turn the filmstrip.)
3. Have a Columbia River filmstrip festival. Give students an opportunity to show their filmstrips to the class. You might share your filmstrips with other classrooms or invite parents in to view the finished products.

VI. Extended Activities

1. Have interested students research the settlers of the Columbia River region. How did they get to this area? Where did they come from? What dangers did they face in their travels? Students could write their findings in diary form.
2. Students interested in Indian culture could try their hands at beadwork or basketweaving. You might find an expert in your community who could work with these students or do a presentation for your entire class.

Filmstrip Instructions

Before using, cut out the blackened slits.

Thread the film through these slits so that the film lies on top of the guide frames.

Note the small guide marks on the left side between sprocket holes. Mark these spots on your filmstrip right away, and then use them as guides when moving up your filmstrip

Use permanent magic markers to draw images.

TIP: Use big, bold areas of bright color.

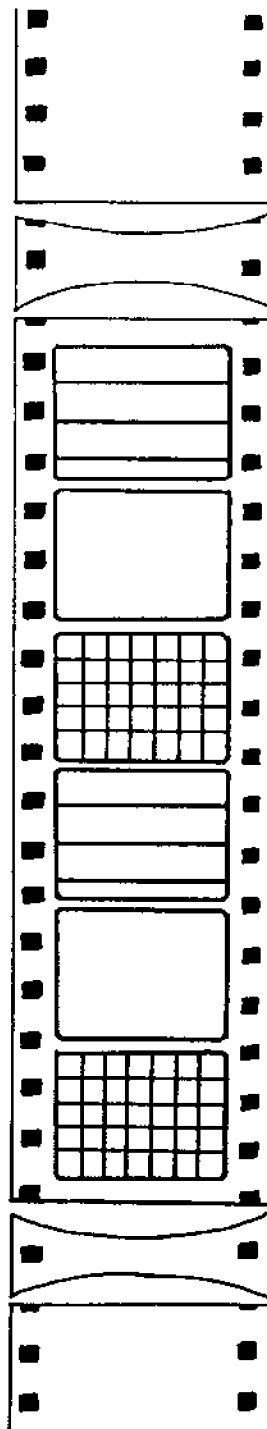
TIP: Color in the background with a light-colored, wide-tipped marker, then draw the picture with darker, fine-tipped markers. Always start with the lightest color first and end with the darkest. Otherwise, the darker color may smudge.

Do each drawing in one frame or rectangle. Use whichever guidelines are most useful.

Filmstrip "U" film is available from any audio-visual equipment and supply house, such as

Highsmith Co.
W 5527, Highway 106
Fort Atkinson, WI 53538
1-800-558-2110

The cost for a 25-foot roll of film from Highsmith is \$5.55. When ordering from Highsmith, use this number for "U" film: L3B75442.



Activity: Indian Legends—Puppet Plays

I. Concepts

1. The Columbia River Indians used legends to explain major features of their environment.
2. The Columbia River Indians developed a complex culture including legends and other art forms.

II. Objectives

The students will be able to

1. define the term *legend*.
2. tell how legends were shared and passed on among the Indians.
3. retell an Indian legend.

III. Teacher Prep

1. Make a class set of the Indian legends and of the reading "What Is a Legend?"
2. Duplicate puppet patterns.
3. Gather necessary materials.

IV. Materials

1. class set of student reading selections
2. felt squares of various colors
3. yarn
4. glue
5. scraps of cloth, lace, and trim
6. fine-tipped permanent markers
7. cotton swabs
8. butcher paper

V. Procedures

1. Distribute copies of the Indian legends. Have students read the legends aloud. Ask students to look for the main characters in each. Ask students the main idea of each story. Explain that these stories are part of the culture of the Columbia River Indians and that they were told for a reason. Ask students to define *legend*. Ask them how they think legends were shared by the

Indians. Distribute the reading selection "Indian Legends: A Reading." Read and discuss it with the class. Stress that legends (1) were an important part of Indian life; (2) were passed on to other people through storytelling, dancing, singing, paintings, and carvings; and (3) explained the natural surroundings or environment.

2. Ask students to pick their favorite Indian legend. Divide the class into small groups based on the legend chosen. Have students write a script for a puppet play of their legend.
3. Distribute the puppet patterns and instructions. Make available the necessary materials. Have students make felt finger puppets of the characters in their play, following the printed instructions.
4. Give the students time to practice their plays with their finished puppets. Encourage them to make scenery by drawing or painting backgrounds on butcher paper.
5. Have the students present their plays to the class. Share the plays with other classrooms.

VI. Extended Activities

1. Have students create their own legends to explain (1) why salmon travel to the ocean and back upstream to spawn, (2) why the wind blows in the Columbia Gorge, (3) why the Columbia River flows to the Pacific Ocean, or (4) why eels are found in the Columbia River. Have students share their legends with the class.
2. Have students make soap carvings of the major characters in one Indian legend. Have students write their version of the legend on an index card. Display the carvings and legends in a prominent place in the classroom or school.

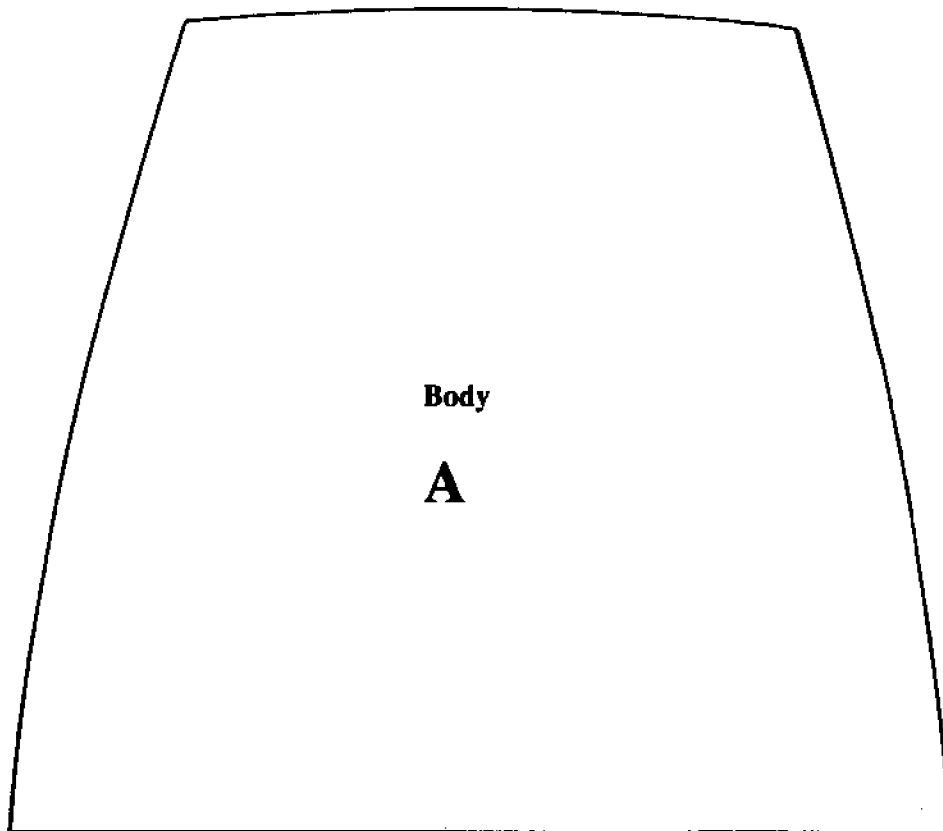
Puppet Instructions

Imagine what your character looks like. Choose the right color felt to match the skin or fur of your character. Cut two body pieces (A). Overlap the sides of the body. Glue the pieces together, leaving the top and bottom open. (These patterns make a human puppet. If you are not making a person, change the shape of the head, arms, and hands to look like your character.) Cut two arms (B), two hands (C), and two heads (D).

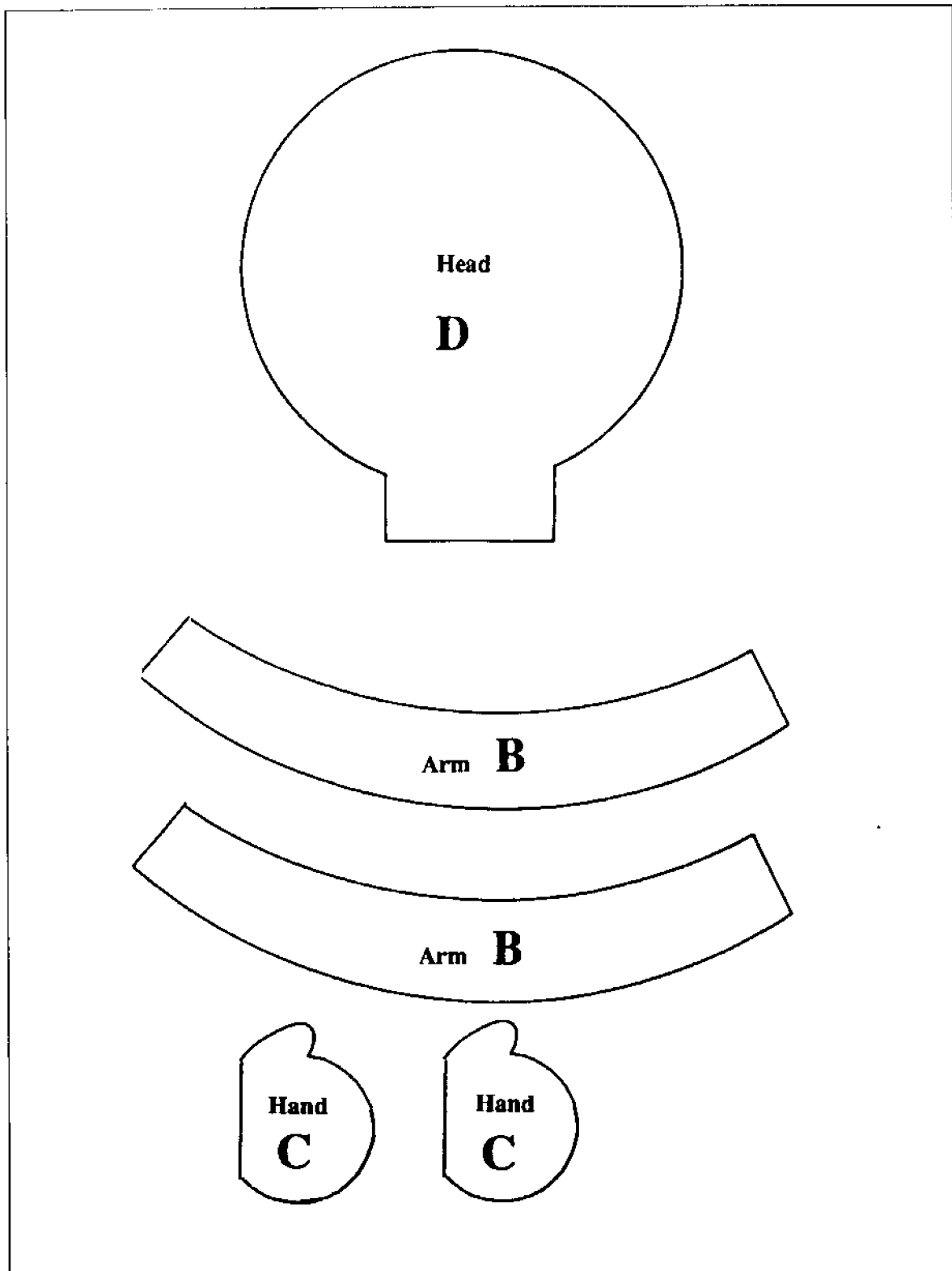
Glue the arm pieces together with hands between them. Glue the arms to the back of the body. Put a cotton swab between the head pieces and glue them together.

Push the other end of the swab into the neck opening of the body. Glue the head to the body.

Dress the puppets using yarn, lace, trim, and other materials to look like the characters you have chosen.



THE COLUMBIA RIVER



The Legend of Multnomah Falls

Many years ago, a terrible sickness came over the village of the Multnomah people and many people died. An old medicine man of the tribe told the chief of the Multnomahs that a pure and innocent maiden must go to a high cliff above the Big River and throw herself on the rocks below. Then, the sickness would leave at once.

The chief did not want to ask any maiden to make the sacrifice, but when the chief's daughter saw the sickness on the face of her lover, she went to the high cliff and threw herself on the rocks below. The sickness passed away.

As a token of the maiden's welcome by the Great Spirit, a stream of water, silver-white, streamed over the cliff. The stream broke into a floating mist along the face of the cliff. Even today, as you carefully watch, the maiden's face can be seen in the upper waterfall. You can see the breeze gently rustling the watery strands of her silken hair.



Guardians of the Columbia

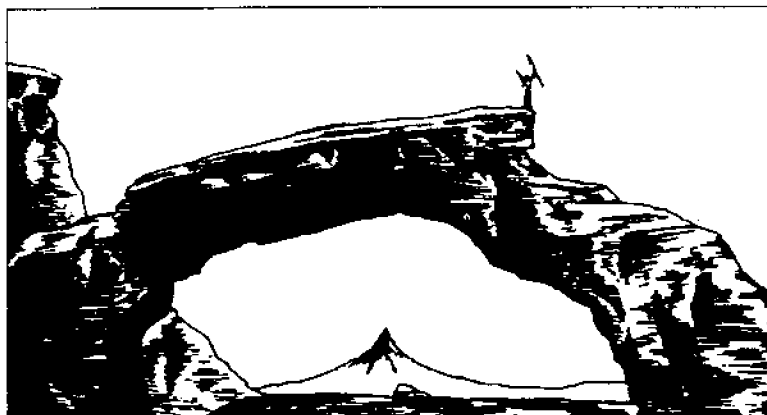
There are many legends about the Bridge of the Gods. This land bridge was claimed to span the Columbia River near present-day Cascade Locks, Oregon. Various Indian tribes living in the Gorge had their own version. This version comes from the Klickitat Indians.

The old men of the tribes say it was Tyhee Saghalie, chief of all the gods, who put the Guardians of the Columbia there, and they say it was an act of harsh justice tempered by the melancholy of a tired old man whose sons took up arms against each other.

They say Tyhee Saghalie and his two hot-tempered sons came down the river from the far north in search of a land suitable for the Tyhee of all gods, and after a long, arduous trip that was difficult even for a god, they found the land beside the river where the rocks were like stepping stones, which the white men named The Dalles.

They had never seen a land so beautiful, and Tyhee Saghalie made it his own. But his two sons quarreled over the possession of that land, and Tyhee Saghalie settled the dispute by shooting two arrows from his powerful bow—one to the west and one to the north. One son, Klickitat, followed the arrow to the north and made it his land and became the grandfather of a tribe named for himself. The other son, Wy-east, followed the arrow to the west and became the grandfather of the Multnomahs, who lived beside the river called Willamette.

Then Tyhee Saghalie raised the mountains on both sides of the river for a boundary between the sons' land, but he did not raise any high enough to have a cap of snow, perhaps remembering the cold of the far north. Then he built the most beautiful structure man had ever seen—Tahmahnawis, the Bridge of the Gods—so that his sons and their children might pass across the river in safety and that



his family might not always be divided.

The Tyhee Saghalie did a good thing that led to the destruction of his family. On the river lived a witchwoman, Loowit, who was the ugliest of the ugly crones. But being a woman, Loowit had a way to make herself needed and wanted: she had charge of the only fire in the world.

She saw how miserable the tribes on both sides of the river were during the long, wet winters with no fire to keep them warm or to cook their fish and venison. It hurt Loowit's heart to see the women always cold and wet and to see the little children sick and dying.

So one day she made a gift of the fire to Tyhee Saghalie. His gratitude was without limit, and he offered Loowit anything she wanted.

She asked what any ugly woman would ask and she became the most beautiful maiden in the world. All the young men fell in love with her, but she paid them no attention.

Then she met Tyhee's sons, Klickitat and Wy-east. She could not decide which to marry, and their tribes quarreled among themselves over which of their chiefs should have Loowit's hand. Soon war broke out between the brothers' people.

Tyhee Saghalie was sad and angry. He knew that to end the fighting he must destroy the cause. First he destroyed the Bridge of the Gods. Then he put Loowit, Wy-east, and Klickitat to death.

But he felt responsible for the tragedy, and he loved all three he had put to death. Because they were beautiful in life, he wanted them to be admired forever.

He made Wy-east into Mt. Hood, Klickitat into Mt. Adams, and Loowit into Mt. St. Helens.

And the rocks from the Bridge of the Gods that fell into the river created the great Cascades.

From Archie Satterfield's Moods of the Columbia (Seattle: Superior Press, 1968).

The Legend of Rain and the Cascade Mountain Range

When the world was still young, Rain lived out in the Pacific Ocean. He sent rain clouds with plenty of moisture for all the lands west of the Rockies.

Streams flowed with water, fish were plentiful, and trees and plants grew everywhere. The fields were green and full of wildlife. The Indians had plenty of food, and they were happy.

Coyote lived east of where the Cascade Mountains now stand. He wanted another wife, and so he asked Beaver's beautiful daughter to marry him. She refused. In revenge, Coyote sought help from Wind. Now, Beaver's daughter lived near the coast in the streams of clear water. Wind blew the clouds past the western land where she lived and over to Coyote's land. This left the coast lands without any moisture. Plants and trees died, the streams became dry, and the fish vanished.

"Our land is drying up," cried Beaver's people. They asked Rain to help them.

Rain then sent his beautiful daughter Mist to plead with Coyote. Coyote wanted Mist to be his wife. He tried to hug and kiss her, but she was so soft Coyote could not hold her. She slipped away from him and returned to her father. Rain was very angry with Coyote. He called upon the Great Earth Spirit to build a wall of mountains so that Coyote and Wind could not steal all the clouds. In response, the Great Earth Spirit formed the Cascade mountain range. Now the western slope has moisture, and east of the mountains it is dry.

*Adapted from Jim Attwell's
Tahmahaw: The Bridge of the Gods
(Skamania, WA: Tahlikie Books, 1973).*

1871 Etching of Beacon Rock



The Legend of Beacon Rock

Once there was a young Indian princess named Wehatpolitian. She made her father, the chief, angry when she married a young brave. The Indian princess and her husband had a baby boy. Then the chief and his sons killed the princess' husband. Wehatpolitian

took her baby and ran away to Beacon Rock. She climbed to the top of the rock. There, she and her son died. Some Indians say that even now if you stand at the foot of Beacon Rock and listen you may hear the baby cry.

Coyote Takes Water From the Frog People

Coyote was out hunting when he found a dead deer. One of the deer's rib bones looked just like a big dentalia shell. Coyote picked it up and took it with him to see the Frog People. The Frog People had all the water. When anyone wanted any water to drink, to cook with, or to wash with, he or she had to get it from the Frog People.

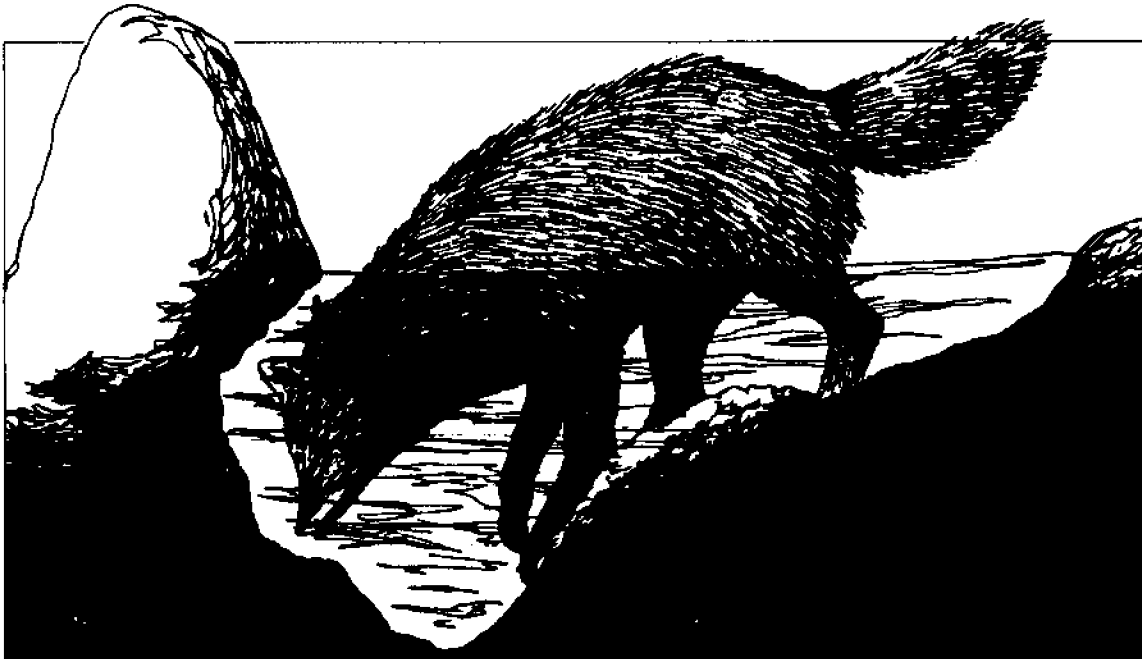
Coyote said, "Hey, Frog People, I have a big dentalium shell. I want a big drink of water, and I want to drink it for a long time." "Give us that shell," said the Frog People, "and you can drink all you want." Coyote gave them the shell and began drinking. The water that Coyote drank was behind a large dam.

Coyote began drinking. He drank for a long time. Finally, one of the Frog People said, "Hey, Coyote, you sure are drinking a lot of water there. What are you doing that for?" Coyote brought his head up out of the water. "I'm thirsty."

After a while one of the Frog People said, "Coyote, you sure are drinking a lot of water. Maybe you had better give us another shell." "Just let me finish this drink," said Coyote, putting his head back under the water. The Frog People wondered how Coyote could drink so much water. They thought Coyote might be trying to trick them.

All the time he had his head underwater, Coyote was digging out under the dam. When he was finished, he stood up and said, "That was a good drink—just what I needed." Then the dam collapsed and the water went out into the valley and made the creeks and rivers and waterfalls. The Frog People were very angry. "You have taken all the water, Coyote!" they cried. Coyote said, "It is not right that one group of people has all the water. Now it is where everyone can have it."

Now, anyone can go down to the river and swim or get water to drink or to cook with.



WHAT IS A LEGEND? A READING

What is a legend?

From the stories you have read, you can see that a legend is a special type of story. It is based on fact and told as though it were true. It centers around an actual person or place or event.

Why were legends told?

These stories were told to explain the natural surroundings or environment of the story tellers and listeners. The legend of the Guardians of the Columbia, for example, explains the origins of Mt. St. Helens, Mt. Adams, and Mt. Hood.

How were legends shared?

The word *legend* comes from the Latin *legendus*, which means *to be read*. But the Indians of the Columbia did not write out their legends for others to read. Instead, they shared their legends and passed them on to others in several interesting ways. They told their legends as stories around the fire, sang them, and acted them out in dances. They also painted their legends as petroglyphs, or rock carvings.

THE COLUMBIA RIVER

ENERGY



HYDROPOWER: A READING

Years ago, waterwheels were used to turn machinery to grind grain and sharpen tools, but waterwheels were slow. In the early 1800s, a new kind of waterwheel was invented: the turbine.

The turbine is a wheel with blades. Water hits the blades to spin the wheel. A turbine needs high-pressure water in order to turn. High-pressure water is produced when the water is very deep. Thus, turbines can be powered by the water pressure at the bottom of the dam.

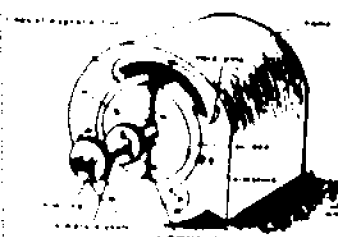
How is an artificial lake made? On the Columbia River and its tributaries, dams have been built to trap water. The water is then released to turn the turbine and create electricity. Valves are used to control how much water reaches the turbines.

The pressure from the water turns the turbines, which are connected to a generator. The turning turbine spins the generators, and the spinning generators produce electricity. The electricity is sent out on transmission lines to where it is needed.

Whenever you turn on your TV set, flick on the lights, or cook your dinner, a turbine goes to work for you. In the Northwest, as you watch TV or cook, the water that passes through the dam to produce the electricity may be lost for other uses. For example, a tugboat may have to wait to move upstream because there is not enough water to fill a lock to lift it over the dam. A farmer in eastern Washington may not have enough water to sprinkle on his field of peas. Or the

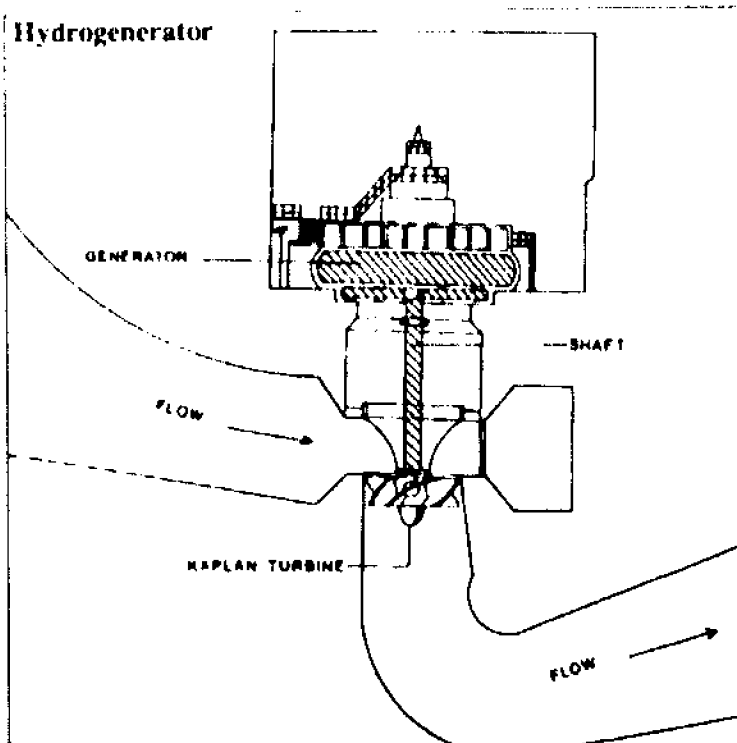
salmon migrating upstream to spawn may not have enough water to complete its journey.

Elementary Generator



It is hard to believe that there is not enough water in the Columbia to provide for all its different uses. The Dalles Dam, one of those huge dams erected on the Columbia River to turn turbines, can produce enough electricity for two cities the size of Seattle. But we also need the water to raise all the crops we want, to move tugs and barges up and down the Columbia, and to provide for fish and other wildlife. We must plan carefully how we use the water so that everyone and everything depending on it will have a share.

Hydrogenerator



Activity: Hydropower—Waterwheel and Bicycle

I. Concepts

1. Water is a source of energy.
2. Water can turn a turbine to spin a generator.
3. The Columbia River system supplies the Pacific Northwest with most of its energy needs.

II. Objectives

The students will be able to:

1. define *hydropower*.
2. explain how water can be used to produce electricity.
3. construct a waterwheel.

III. Teacher Prep

1. Gather materials.
2. Make an overhead transparency or student copies of hydropower illustrations.
3. Make a class set of the reading selection "Hydropower."
4. Make a tagboard waterwheel pattern for each student.
5. Make an overhead transparency or student copies of a map of dams.

IV. Materials

1. class set of hydropower reading selection
2. overhead transparency or student copies of hydropower illustrations
3. tagboard
4. straight pins
5. scissors
6. bicycle with generator and headlight (check with your students or local bike shop)
7. classroom faucet
8. optional: used bike generator (available at most bike shops for less than \$5)

V. Procedures

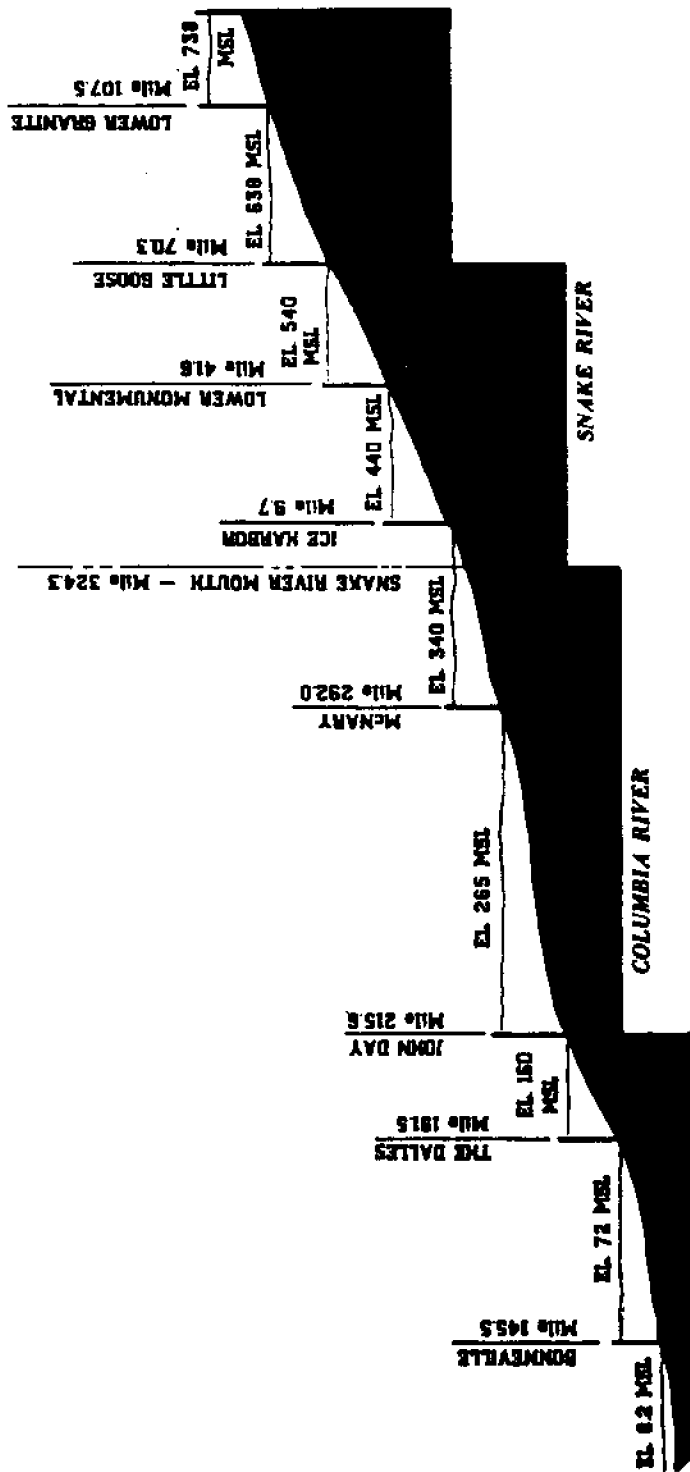
1. Ask a student volunteer to define *hydropower*. Explain that you will explore the meaning of hydropower through an experiment.
2. Bring in a bicycle with a generator and headlight. (If possible, use one belonging to a class member and involve that student in the demonstration.) Have a student turn the wheel to make the electricity to light the headlight. Ask students to explain how turning the wheel produces power to light the headlight. If possible, dismantle a used generator to show the students its inner workings or draw the insides on the board.
3. Distribute the waterwheel patterns. Have students follow the instructions to construct the wheel. Give students an opportunity to use the classroom faucet to turn their wheels. Ask students how water could be used to make electricity.
4. Distribute the reading selection. Have students read aloud. Trace the production of electricity through the illustrations. Point out on the overhead transparency or student copy of the illustrations how turbines are like giant waterwheels which run generators to produce electricity.
5. Show students the overhead transparency of the map of Columbia River dams, or distribute student copies. Point out the great number of dams (38 major projects) constructed for electrical power. Ask students why the Columbia might be suitable for such dams. Show the side view of the river, illustrating the elevation of the dams. Stress that the topography of the Columbia River area allows for dams to be built on a narrow, powerful river and thus to create the waterfall necessary to turn the turbines.

VI. Extended Activities

1. Have interested students make a waterwheel using the end of a tin can (it will last longer than the tagboard one). Challenge them to use this waterwheel to light the bicycle headlight.
2. Have students contact the nearest energy extension agent to research microhydropower systems. Have students report their findings to the class.

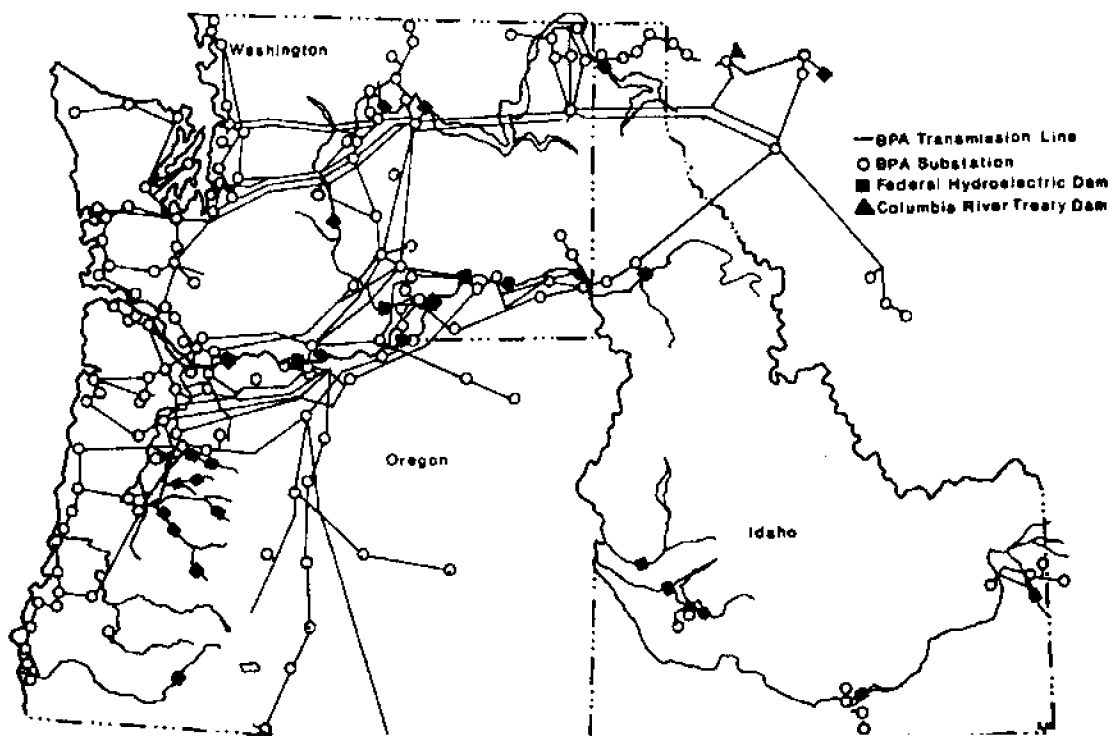
THE COLUMBIA RIVER

Side View of the Columbia and Snake Rivers



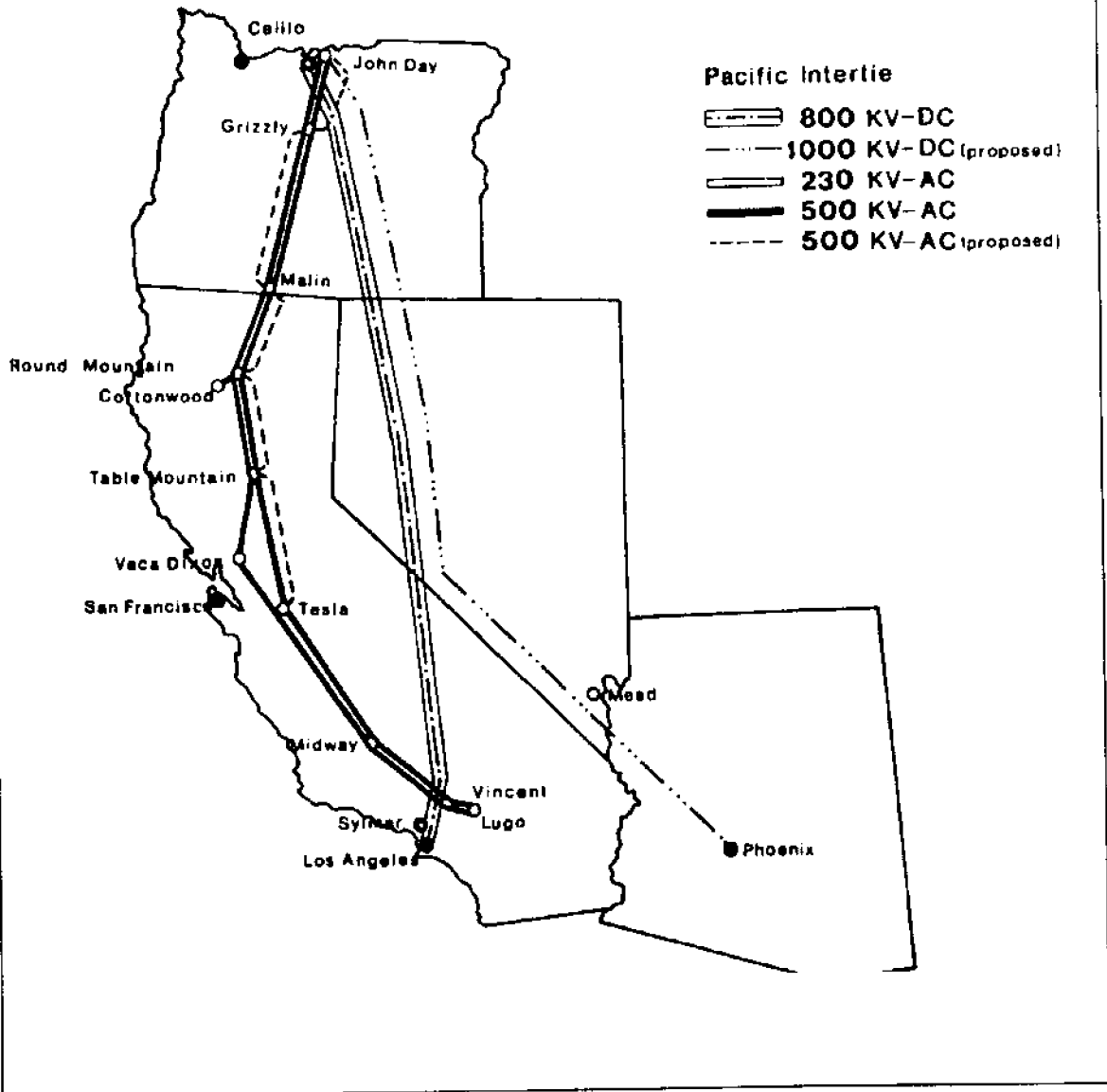
THE COLUMBIA RIVER

Federal Columbia River Power System



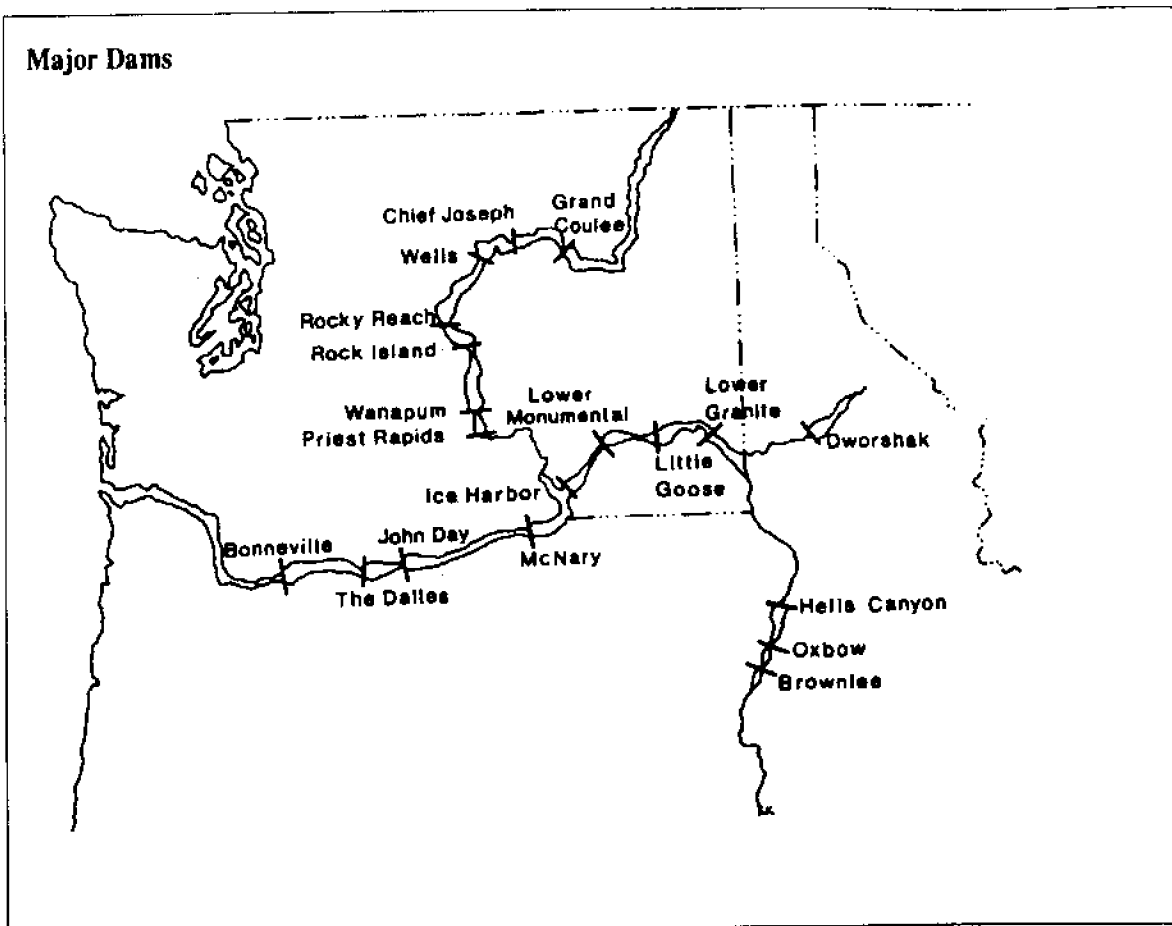
THE COLUMBIA RIVER

Power Transmission



THE COLUMBIA RIVER

Major Dams



Activity: Brainstorming—Uses of Electricity and Crossword Puzzles

I. Concepts

1. Hydropower produces electricity which is used in many ways by the people of the Columbia River area.
2. Power demands are increasing.
3. Water held back to meet energy demands means water lost for other potential uses.

II. Teacher Prep

1. Duplicate a class set of the reading selection "Hydropower."
2. Gather materials.

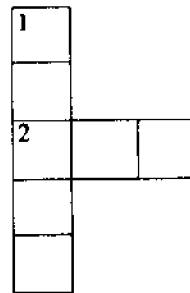
III. Materials

1. class set of the reading selection
2. graph paper (two sheets per student)

IV. Procedures

1. Ask students the following questions and list their responses on the board. What are some of the ways you use electricity in your home? What are some of the ways we use electricity at school? In what additional ways do we use electricity in town? Review how the Columbia River system water is used to produce electricity. Ask students these additional questions. What do you think might happen as more electricity is needed in the future? How could we make more electricity to supply the power needed by more people, new businesses, new appliances?
2. Distribute the student reading selection. Have students read the selection aloud. During your discussion of the reading, stress the conflicts that arise concerning the use of water and the difficulty of making decisions about who gets how much water.

3. Draw the following crossword puzzle section on the board. Have students solve this puzzle. Then distribute the graph paper. Ask students to make a hydropower crossword puzzle. Words used in the puzzle must have something to do with making electricity by water, using the electricity made, or making the decisions about who gets how much water. Have students make two copies of their puzzles, one with the answers filled in the squares and one with the squares empty.



Down

1. Making electricity by using flowing water is _____ power. (HYDRO)

Across

2. Built to slow the flow of water and create an artificial waterfall. (DAM)

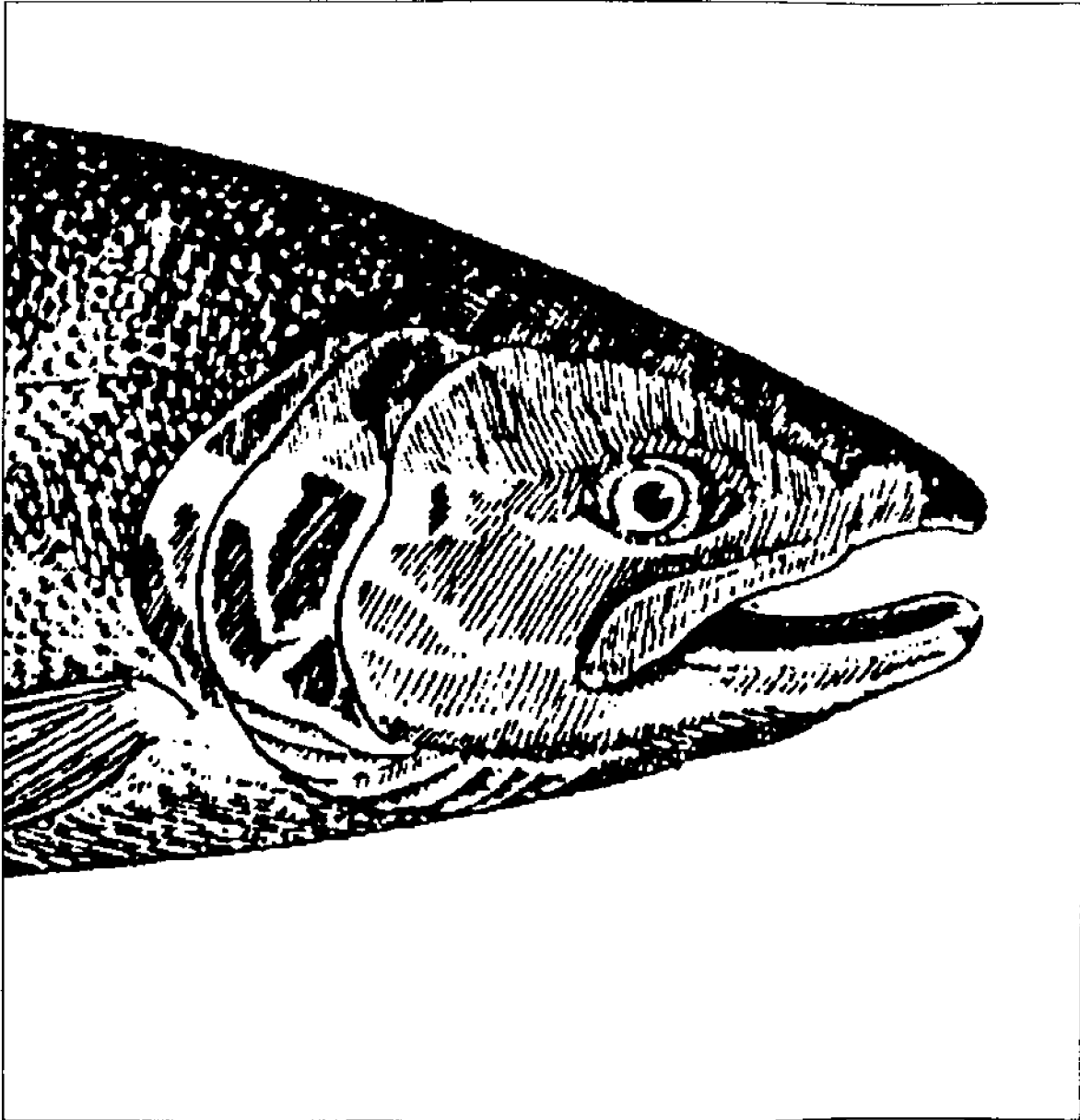
4. Duplicate the completed puzzles. Give students an opportunity to try to solve the puzzles created by their classmates.

V. Extended Activities

Have students make a collage of pictures cut from magazines which show ways in which we use electricity. Have students cover a bulletin board or large sheet of tagboard with pictures. Have students label their collage, "Ways We Use Hydropower," or something similar.

THE COLUMBIA RIVER

FISHERIES



ENDANGERED SALMON: A READING

Many kinds of fish live in the Columbia River system. The largest freshwater fish in the United States, the white sturgeon, is found in the Columbia and Snake rivers. Other fish in these waters include American shad, eulachon, Pacific lamprey, northern squawfish, bass, chiselmouth, peamouth, walleye pike, mountain whitefish, yellow perch, and many kinds of sculpins, sticklebacks, daces, shiners and suckers. However, salmon are the fish most closely associated with the Columbia and Snake rivers. Chinook, coho, sockeye, and chum salmon are kinds of salmon found there.

Salmon are the most valuable fish caught in the Columbia system. Commercial fishermen catch salmon and sell them. Recreational or sport fishermen catch them for

fun or food. Indian fishermen also catch salmon for special ceremonies, for profit, and for food.

Salmon are unusual fish in that they are anadromous: that is, they lay their eggs in fresh water, the young hatch, and then the young migrate to the ocean where they grow. Eventually they return to their original spawning area in fresh water to lay their eggs. After they spawn, most salmon die.

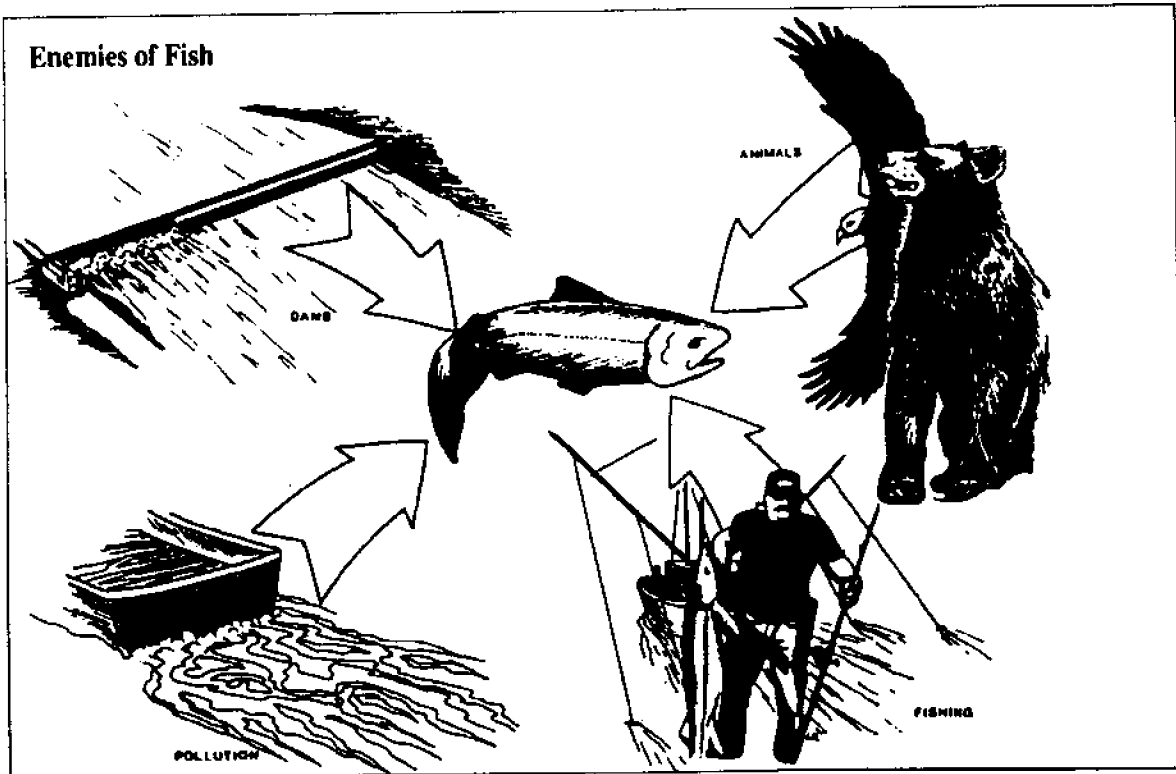
Once the Columbia-Snake river system was the most productive salmon and steelhead area in the world. One hundred years ago more than 11 million adult salmon returned to the system to spawn each year. Today, there are about 2.5 million spawners.

There are fewer adult fish today for several reasons. First, commercial fishermen overfished

the rivers. Second, poor land practices in mining, forestry, and agriculture destroyed many spawning areas. Finally, beginning in the 1930s, the construction of hydroelectric dams put barriers in the way of the fish as they moved up and down the river. Many fish died because of the dams.

Dams slow the flow of the river, which slows the movement of fish out to sea. If the young fish take too long to reach the ocean, they die. The turbines at each dam also kill about 15 young fish out of every 100.

Adult salmon swimming upriver to spawn also are slowed by dams and by the fish ladders at some dams. Some fish do not reach their spawning grounds in time to spawn, while others do not reach them at all.



One hundred years ago, the fish spent their entire lives in the wild. Raised in a local stream, they found their way back to that stream to spawn. Clearly, these "wild" fish were well-adapted to that natural place.

Today, nearly all the fish produced in the Columbia system are raised in hatcheries. Society has turned to hatcheries because much of the wild environment the fish used to inhabit has become altered, and often spoiled, in the last hundred years.

Hatcheries have successfully produced salmon, but they have not been able to offset the losses caused by overfishing and by the damage to the fish's environment. And hatcheries have not helped the "wild" fish. Many of the runs of wild-spawned salmon that returned to local streams have vanished. Some biologists believe that perhaps 200 wild runs are extinct.

Today, the decline of the salmon has reach a crisis.

In 1990 some groups concerned about the fish asked the federal government to give special protection to five vanishing runs of salmon. They asked for them to be protected under one of our country's strongest environmental laws, the Endangered Species Act.

In mid-1991 the National Marine Fisheries Service (the government agency responsible for deciding about the salmon) ruled that four of the five runs deserve protection. All four are upriver runs: the Snake River sockeye, the Snake River spring and summer chinook, and the Snake River fall chinook. The Fisheries Service proposed to give the sockeye "endangered" status and the chinook the slightly less serious "threatened" status.

These rulings became final in 1992 indicating that these runs were definitely in bad shape.

Protection for salmon under the Endangered Species Act will bring changes to the Columbia and Snake rivers. Under the law, the federal agency must not only protect the threatened or endangered salmon but also make a plan to increase their numbers and prevent them from going extinct. Such protection and restoration will mean that the other users of river water will have to modify their activities so as not to harm the fish. These users include the utility companies who use the water to generate electricity, the farmers who withdraw water to irrigate crops, and the shippers who depend on a certain amount of water in the river to float barges which carry grain and other items.

The costs of making adjustments are hard to predict. Some regions, businesses, and people will lose money. But on the whole, economists predict that the overall cost for the Northwest will be minor.

The salmon crisis raises important questions not only now but for the future. Salmon have been residents of the Northwest for millions of years. In only about 100 years we have brought some of them to extinction and threatened the existence of others.

How many salmon do we want? How far into the future do we want to have them? Finally, what sort of an environment do we want for the Northwest?

Activity: Tissue Paper Fish

I. Concepts

1. A variety of fish can be found in the Columbia River system.
2. The catch of salmon has declined greatly over the years.
3. The Columbia-Snake system was once the best salmon and steelhead area in the world.
4. Fisheries need to be considered in making decisions about the uses of Columbia River water.

II. Objectives

The students will be able to

1. name several fish found in the Columbia system.
2. draw different fish found in the river.
3. tell how dams affect anadromous fish.
4. tell how other river uses affect fish.

III. Teacher Prep

1. Make overhead transparencies or student copies of illustrations of different types of Columbia River fish and copies of the reading "Endangered Salmon."
2. Gather necessary materials.

IV. Materials

1. class set of the reading
2. illustrations of different Columbia River fish
3. sheets of colored tissue paper
4. glue
5. scissors
6. string
7. felt markers

V. Procedures

1. Distribute student reading selections. Have students read aloud the selection on fisheries. When different fish are mentioned, have students find them in the illustrations. Discuss problems for fish caused by dams and other uses of the river. Ask students to think of other

problems besides those mentioned in the reading (predator fish eating anadromous fish as they are slowed up at the dams, sport anglers and commercial fishermen catching fish, water pollution from irrigation and waste disposal). Define and discuss *preserve*, *protect*, and *enhance*.

2. Ask students to choose one fish found in the Columbia-Snake system. Distribute sheets of colored tissue paper (it comes in sheets 28" x 32"). Have students fold the sheets in half. Then have students sketch in pencil the outline of their chosen fish. Remind students to include fins. Ask them to carefully cut through both thicknesses of tissue. The students can then use felt markers to draw in details such as eyes and scales. Have students glue the two tissue fish together just along the outside edge, leaving a small section unglued. When the glue is dry, have students stuff the fish with the scraps left from cutting out their fish. Some extra tissue may be necessary to make plump fish. Next, have students finish gluing together the edges of the fish. Then attach a piece of string to the center of the fish's back and hang all the fish around your classroom. You might want to hang a label from the bottom of each fish to identify the species. The fish hang well from classroom lights. When the fish are accompanied by thin strips of blue tissue hanging from the lights, your classroom will look like an underwater river scene.

VI. Extended Activities

1. Have students make mobiles of different species of fish found in the Columbia River system.
2. Have students make a bulletin board showing reasons for the decline in the salmon population in the Columbia-Snake system and ways in which we are trying to increase the fish population.

Salmon of the Columbia River

The coho salmon, also known as silver, is smaller than the chinook, averaging about eight pounds. It is metallic blue along the back, fading to silver on the sides and belly. Often confused with chinook, coho salmon are distinguished by the absence of black spotting on the dorsal fin and the lower lobe of the tail. Coho are three years old at maturity.

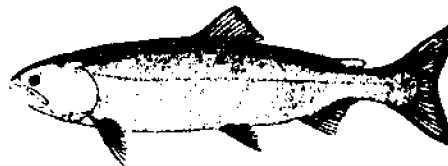
The sockeye salmon, also known as blueback and kokanee, is the smallest salmon, weighing up to four pounds. Its back is green-blue, and its side and belly are silver. It has no black spotting. Columbia River sockeye are normally four years old at maturity.

The chinook salmon, also known as king, spring, and tyee, is recognized as the king of salmon. A robust, deep-bodied fish with lengths of up to nearly five feet, it is a favorite catch of fishermen. Weights range from 10 to 45 pounds. Chinook are normally four years old at maturity, but may range from three to seven years old. The chinook's back is greenish, fading to silver on the sides and belly. Profuse black spotting appears on the back dorsal fin and both lobes of the tail. As with all Pacific salmon, spawning fish turn darker.

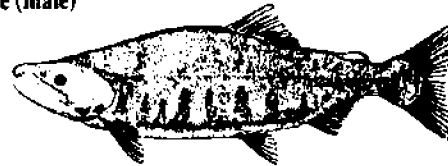
Steelhead are rainbow trout that, like salmon, migrate to the ocean and then return. They migrate to sea during their first or second year and return to the rivers two to three years later. Oregon steelhead may be found returning from the ocean on their spawning runs almost any time of the year. After they enter the river, they take on the characteristic rainbow coloration.

Chum salmon are second in size only to chinook. Chum average about 10 pounds but have been recorded up to 33 pounds. This species of salmon is not very abundant in Oregon. It occurs mostly in Tillamook streams. It is not as popular a sport fish as other species of salmon.

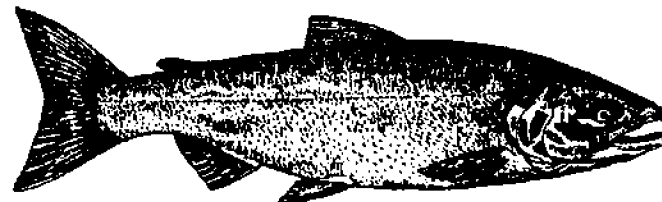
Sockeye (female)



Sockeye (male)

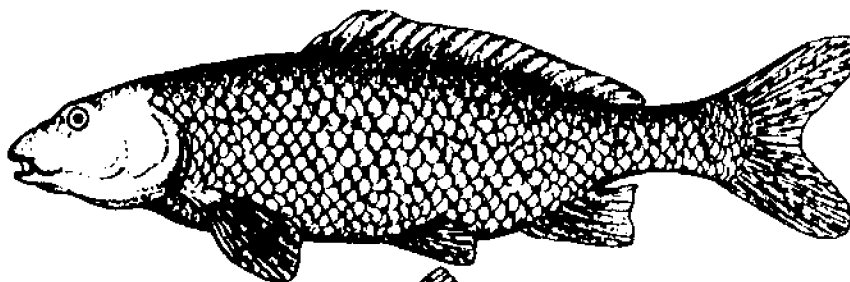


Chinook

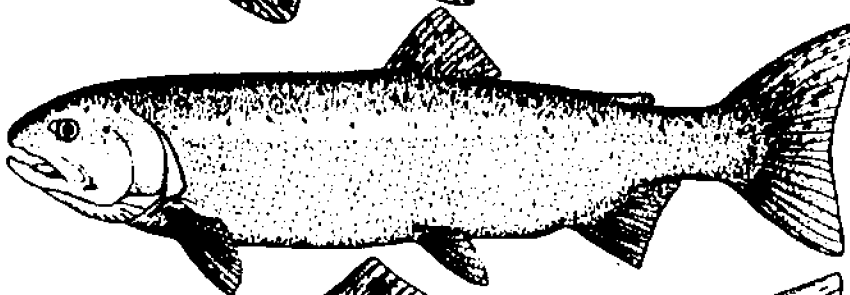


THE COLUMBIA RIVER

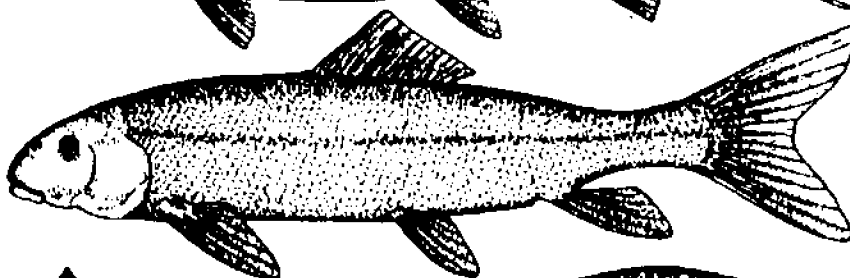
Fish of the Columbia River



Carp



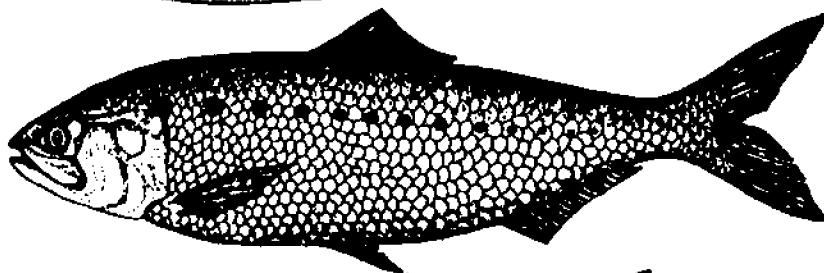
Coho Salmon



Sucker



Lamprey



Shad



Sturgeon

Activity: Diorama—Salmon Harvesting Techniques

I. Concepts

1. Salmon fishing in the Columbia River system began with primitive fishing methods.
2. Fishermen used new technologies to catch more fish.
3. Dipnetting, gillnetting, horse seining, fish wheels, trolling, and hook-and-line have been used to fish the Columbia.
4. So that salmon will be protected, fishermen are now forbidden to use more efficient methods of harvesting them.

II. Objectives

The students will be able to

1. tell how fishing for salmon in the Columbia River changed over the years.
2. describe in detail different ways to catch salmon.
3. define *salmon harvesting*.

III. Teacher Prep

1. Make a class set of the reading "Salmon Harvesting."
2. Gather necessary materials.

IV. Materials

1. shoe box or small box of similar size for each student or pair of students
2. toothpicks
3. string
4. construction paper
5. modeling clay
6. glue
7. scissors
8. any other art materials available
9. 5" x 8" index cards
10. photographs of different fishing techniques, if available

V. Procedures

1. Read the student reading selection with the class. Discuss with students the illustrations of the harvesting techniques. Show students

photographs of different harvesting techniques. Ask students to explain how each technique works.

2. Divide the class into pairs or have students work individually. Ask students to choose one of the techniques discussed (or you may assign the techniques so that each is covered). Distribute boxes and have students make a diorama illustrating their harvesting technique. Remind students to use a variety of materials in the diorama. Encourage students to make the diorama as detailed as possible, showing the people who used this fishing method and where they fished. Have students be sure to pay attention to the background of their diorama.
3. Give each student or pair of students an index card. Have students write a brief description of the harvesting technique they presented in their diorama. Attach the descriptions to the diorama.
4. Give students an opportunity to share their finished dioramas with the class. Put the diorama on display in the classroom, in the school showcase, or in the school library.

VI. Extended Activities

1. Have students paint a mural for classroom display, showing the various harvesting techniques.
2. Ask students to make a time chart showing when various harvesting techniques were used, when new techniques were invented, and when techniques were outlawed.
3. Purchase salmon (fresh, frozen, smoked, or canned) for the class to taste. Brainstorm different ways salmon can be eaten. How has salmon been prepared in meals eaten by your students?

SALMON HARVESTING: A READING

How can you catch a salmon? Salmon have been caught, or harvested, in many different ways.

Long ago the Indians used nets and spears to catch them. Some Indians built small wooden platforms over the river. They would stand on these platforms, stretch out, and drop dip nets into the river below. About 18 million pounds of salmon and steelhead were harvested from the river each year.

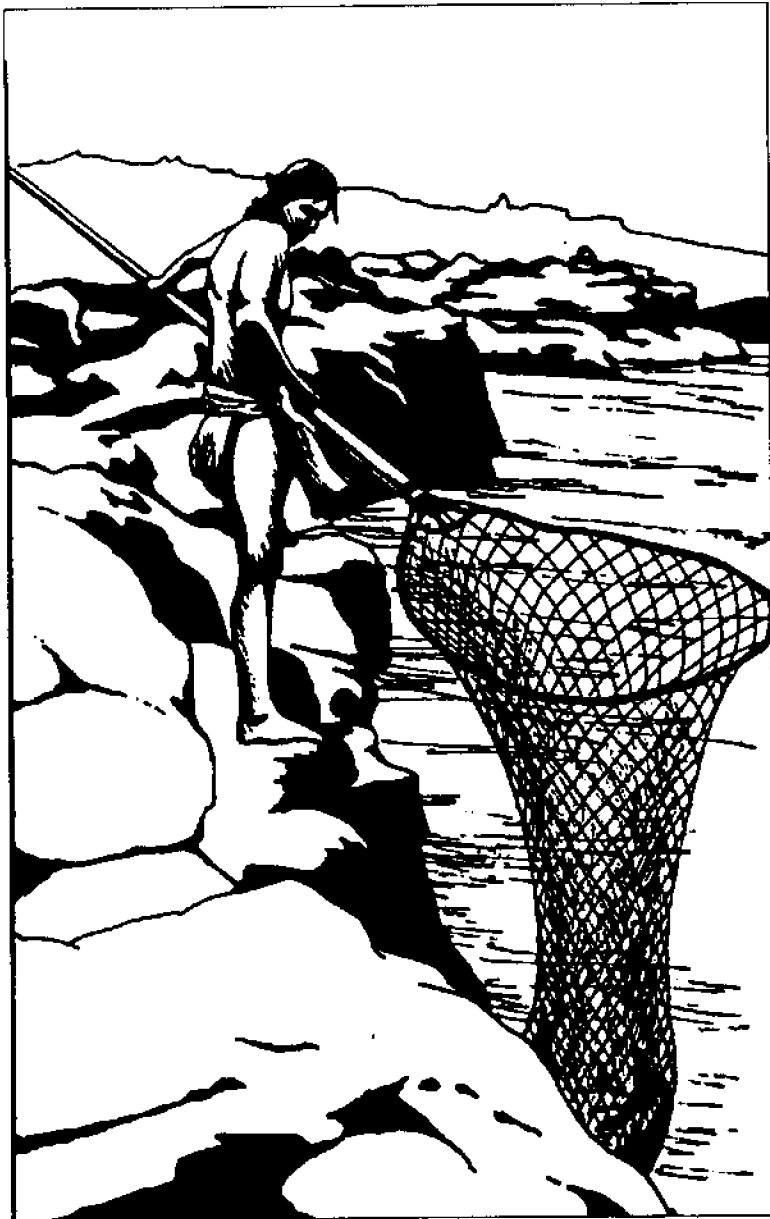
Then white settlers began to fish for salmon, using fish wheels, horse seines, and gill nets.

Fish wheels were water-powered machines which scooped salmon out of the river and dumped them into a box. They were placed in swift water in the path of migrating salmon. Samuel Wilson built the first fish wheel on the Columbia in 1879. By 1899, there were 76 fish wheels. A good fish wheel could catch about 100,000 pounds of salmon in a year. In 1913, one fish wheel caught 70,000 pounds of salmon in one day. Fish wheels were outlawed in Oregon in 1926 and in Washington in 1934.

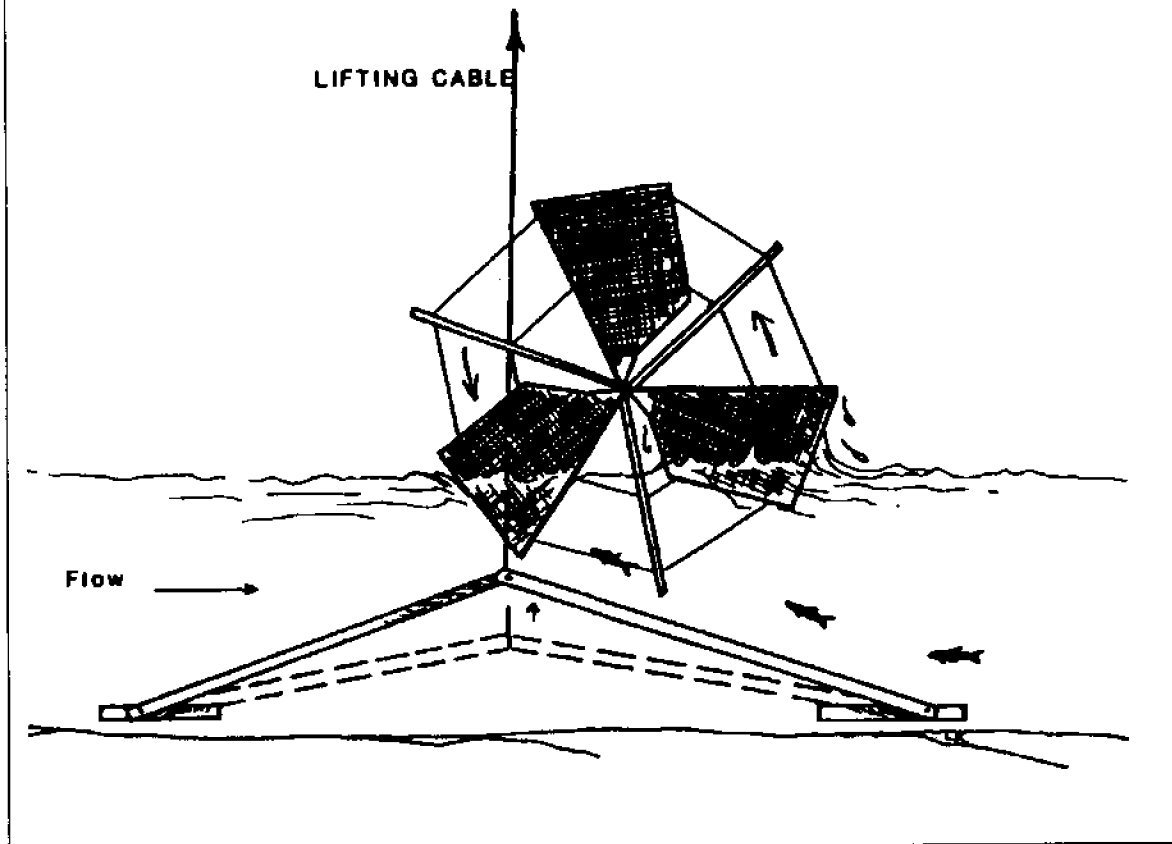
Horse seining was another way to catch salmon. Fishermen put seines, special types of nets, in the river. Horses were used to pull the seines shut, trapping salmon inside. The horses pulled the seines to shore where the salmon were taken from the nets. One fisherman using horse seining caught 60,000 pounds of fish one day in 1921. You can see that this method worked very well. It was outlawed in the 1950s.

People also used traps to harvest salmon. Gill nets, which tangled up the salmon to catch them, were used. Trolling and hook-and-line fishing were other methods of catching salmon.

Today gillnetting, sportfishing (hook-and-line), and Indian dipnetting are the only legal ways to harvest salmon on the Columbia.

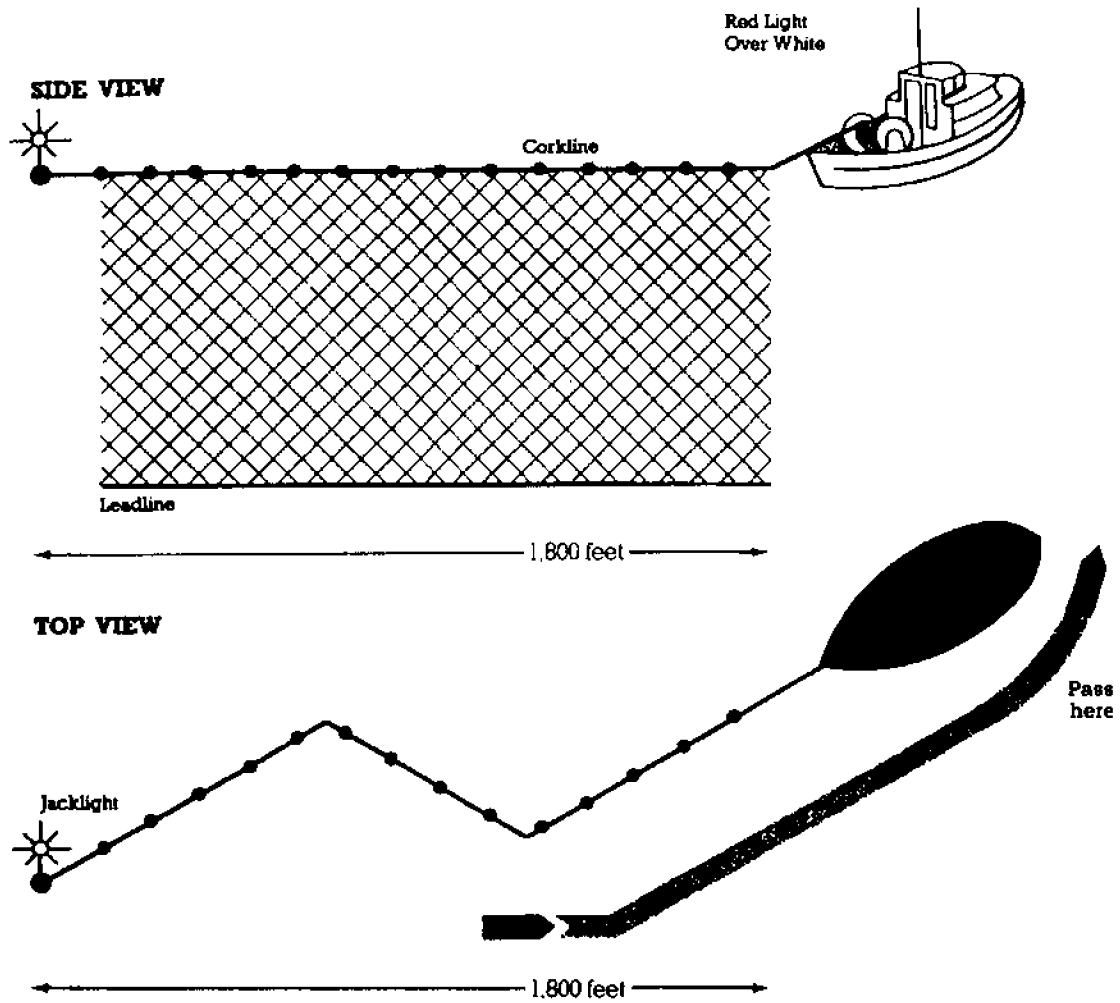


Inclined Fish Wheel



THE COLUMBIA RIVER

Floating Gillnet



Activity: Career Ed/Create a Game

I. Concepts

1. Salmon and steelhead are anadromous fish.
2. Anadromous fish face many dangers in their life cycle.
3. Only 1 percent of the salmon hatched in the Columbia-Snake system survive all of the dangers faced and return to spawn successfully.

II. Objectives

The students will be able to

1. define *anadromous*.
2. define *spawning*.
3. briefly describe the work done by a fisheries biologist.
4. create a game detailing the life cycle of a salmon.

III. Teacher Prep

1. Make an overhead transparency of the student reading "Career Ed Fisheries," or make a class set.
2. Gather necessary materials.
3. Put together spinner and markers for Splash game.

IV. Materials

1. student copies of reading material or an overhead transparency
2. Splash game
3. tagboard sheets or heavy construction paper
4. felt markers
5. rulers
6. small construction paper squares or 3" x 5" index cards
7. laminating paper or laminator (optional)

V. Procedures

1. Distribute student reading selection. Explain that this is a letter written to a middle school student by a fisheries biologist who works on the Columbia River system. Have students read the letter. Ask students: What does a fisheries biologist do? What questions was the biologist answering in his letter? What are smolts? How can you use scales to tell the age of a fish?
2. Show students the Splash game. Select four students to play the game in front of the class. (The version we provide in this book is greatly reduced from the original, now out of print. You might want to enlarge it. Put the game board on a bulletin board. The game goes very quickly and should hold the class' attention.) Review with the class the dangers faced by salmon during their life cycle. What dangers are shown on the Splash game board?
3. Ask students to create their own game, complete with game board, markers, and rules, which shows the life cycle of an anadromous fish. Supply the students with the necessary materials to do so. Encourage students to illustrate their gameboards with scenes from the life of an anadromous fish. Encourage advanced students to include "chance" cards (as in Monopoly) which must be drawn and followed upon landing on special spaces.
4. When the games are completed, have students share their games orally in front of the class. Set aside time for students to play each other's games. You might choose six or seven games to highlight each day, set them out in stations around the classroom, divide the class into six or seven groups, and have the groups rotate from game station to game station as you keep track of the time. (Laminating finished game boards helps them last longer for classroom use.)

THE COLUMBIA RIVER

VI. Extended Activities

1. Have students write to a fish hatchery found in the Columbia River system. Have them address the letter to the attention of a fisheries biologist. In the letter, students could ask any question they have about fish found in the Columbia or about current research projects.
2. Have students create a game which depicts the life of a fisheries biologist. It could include the required schooling, the perils of federal funding, the tasks performed at work, and the controversy of setting fishing seasons and limits.
3. Have students read the article "Fish Show Their Age." Obtain a fish with large scales. Have interested students attempt to find the age of the fish.
4. Have students research the differences among chum salmon, chinook salmon, and sockeye salmon. Have them report their findings to the class.

Career Ed Fisheries Reading

Dear Corey:

Thanks for the nice letter. Sounds like you are busy at school. Being a fisheries biologist at Grand Coulee keeps me busy, too.

This week was a very busy one. I spent the first part of the week working with the computer. We store information in the computer about how many fish are caught, what kind of fish are caught, the age of fish caught, and where different kinds of fish are caught. I used the information kept in the computer to help me write my yearly report. The report goes to people in our government and to other groups who make decisions about the fish in the Columbia system. They decide things like how many fish can be caught, where people can go fishing, and how much water is needed in the river for the fish.

After I finished my report, I got to go out on Lake Roosevelt and leave my office work behind. On Friday I pulled fish out of gill nets for our regular sampling. We try to estimate how many walleyed pike and other fish are found here. Sunday I interviewed fishermen, or anglers, as we fisheries biologists call them, to see how many fish they were catching and where they were catching them. Interviewing two deaf anglers was my biggest challenge. I also measured fish and took scale samples to see how old the fish were.

Now let me answer the question you asked in your letter.

1. Spawning takes place when adult female salmon lay their eggs in the gravel of stream bottoms and male adult salmon fertilize the eggs with milt.

Young salmon hatch in two to four months. They stay in the gravel for about 30 more days, living on materials in the yolk sac that is attached to their stomach. When the yolk sac has been used up, the "fry," as the fish are called at that point, leave the gravel and start to feed. Some swim to the ocean right away. Other salmon stay in fresh water a year or more before they head to the ocean. The salmon grow up in the ocean. When they are full grown (two to seven years old), the salmon return to the fresh water to spawn. They swim to their "cradle stream," where they were hatched.

After spawning, the Pacific salmon die. Their eggs hatch and the cycle repeats.

2. Anadromous fish hatch in fresh water, live part of their lives in the ocean, and swim up rivers and streams to spawn.

3. The life cycle of each type of salmon is a little different. The salmon differ in where they spawn, the time they spend in the Columbia River system, the time they spend in the ocean, the water temperature they seek and at which they spawn, and where they are found in the ocean.

It's time for me to go work. Today I'm going to a meeting to talk about ways to help young salmon get past the dams to reach the ocean safely. Smolts have been put on barges or trucks and moved closer to the mouth of the Columbia. We'll talk about how that has worked. It should be an interesting meeting.

Thanks again for your letter and questions about the fish of the Columbia system. I'm glad you are studying about fisheries and are thinking about the hard decisions of how best to use the water of our great river.

Sincerely,

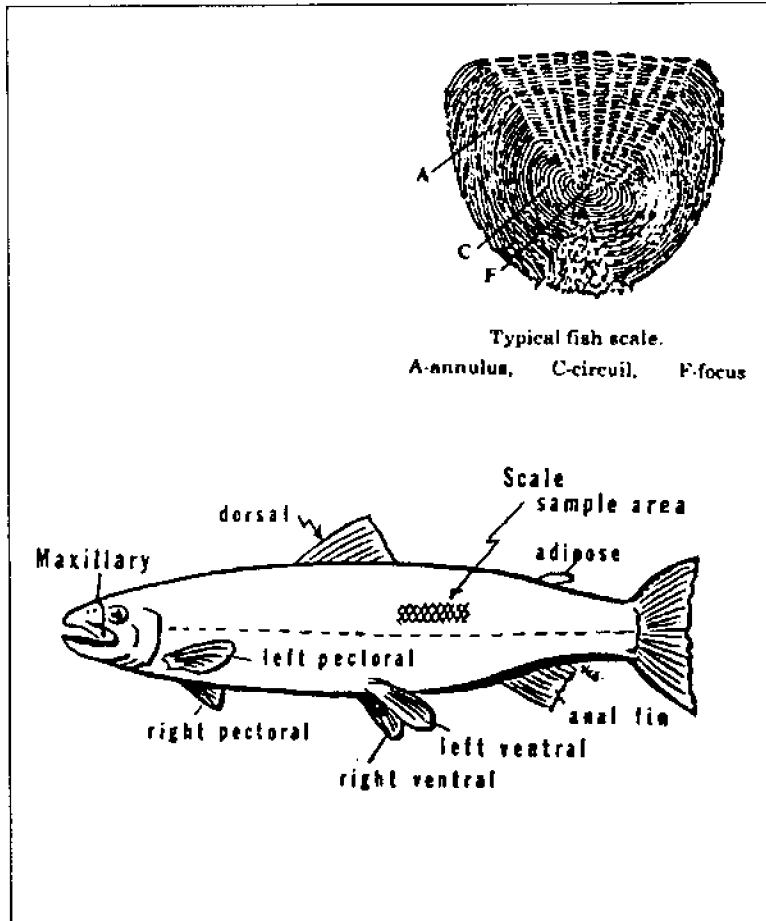
Riley Willard

Fish Show Their Age*

Determining the age of fish is an important part of fisheries management. Knowing how old fish are in a population helps biologists determine how well the population is doing. Examining fish scales is one way to find out how old fish are.

Most fish are born without scales; however, before long the scales form. As the fish grows, the scales increase in size while the number of scales remains about the same. Growth begins at the fins near the center of the scale. As growth proceeds, fine ridges called circuli are laid down in a circular pattern around the focus. The circuli are widely spaced when food is plentiful and growth is rapid, and closely spaced when food is scarce and growth is slow. One year's growth is usually revealed as a series of widely spaced spring and summer circuli followed by a series of closely spaced fall and winter circuli. The pattern is repeated each year; however, in temperate regions such as the Willamette Valley and coastal area of Oregon, this pattern may not always follow the seasons so closely. The outer edge of a series of closely spaced circuli, called the annulus, represents the end of growth for that year. You can determine the age of the fish by counting the number of annuli (plural form of annulus). Often the circuli are so close together they form dark rings that can be easily counted.

With the aid of a good hand lens, you can age fish with large scales, such as carp or bass, as you catch them. Remove some scales from the fish using tweezers (or your fingers). A good place to get well-developed scales is just



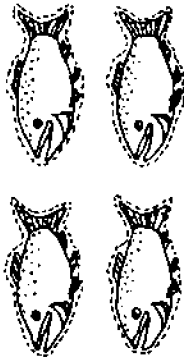
above the lateral line and below the dorsal fin. When you examine the scales, it works best to place them on a flat glass slide or piece of clear or colored plastic. Any flat surface will work if the light is right; you can adjust for light conditions.

Examine the scales with the hand lens, using the drawing as

a guide. Look for the closely spaced circuli, sometimes so close together that it appears they do not reach all the way around the scale, to identify the annuli.

* Article adapted from *Oregon Wildlife*, August 1983; illustration used without change.

THE COLUMBIA RIVER

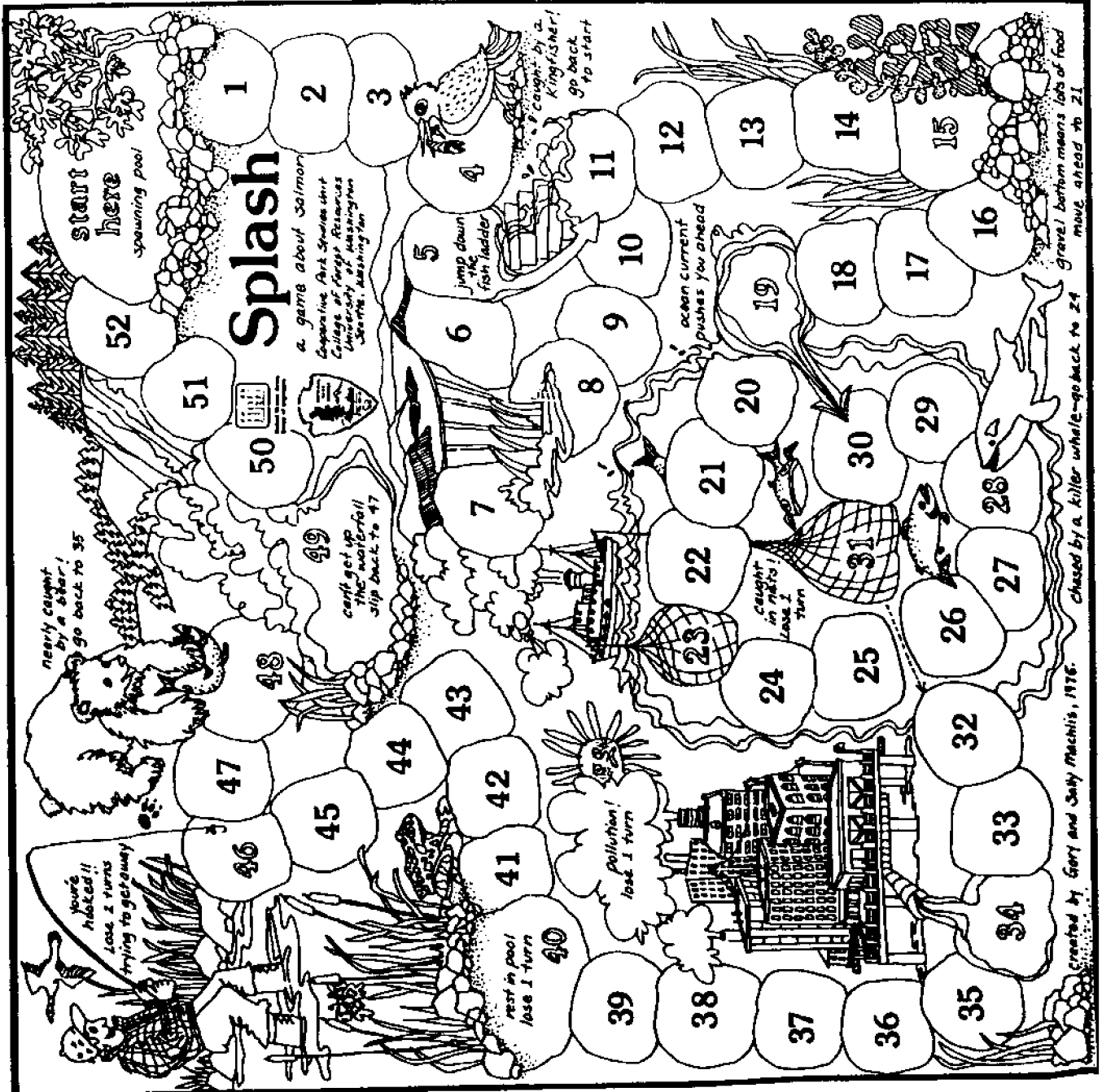
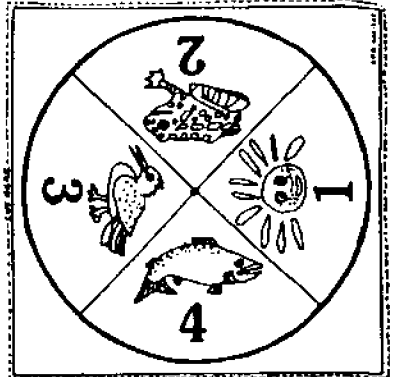
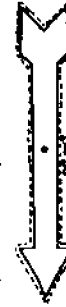


directions

1. Cut out the spinner and tape it to a piece of thick cardboard.
2. Cut out the arrow and stick a pin through the dot on the arrow and into the spinner.
3. Cut out and color the fish markers and tape a penny to the back of each one. You're ready to play!!

rules

1. the object of the game is to be the first player to return to the spawning pool.
2. each player takes his/her turn by spinning the arrow and moving ahead the number of spaces the arrow points to.
3. if you land on a number that looks like this **2** rather than this **2**, you must follow the special directions on the board.

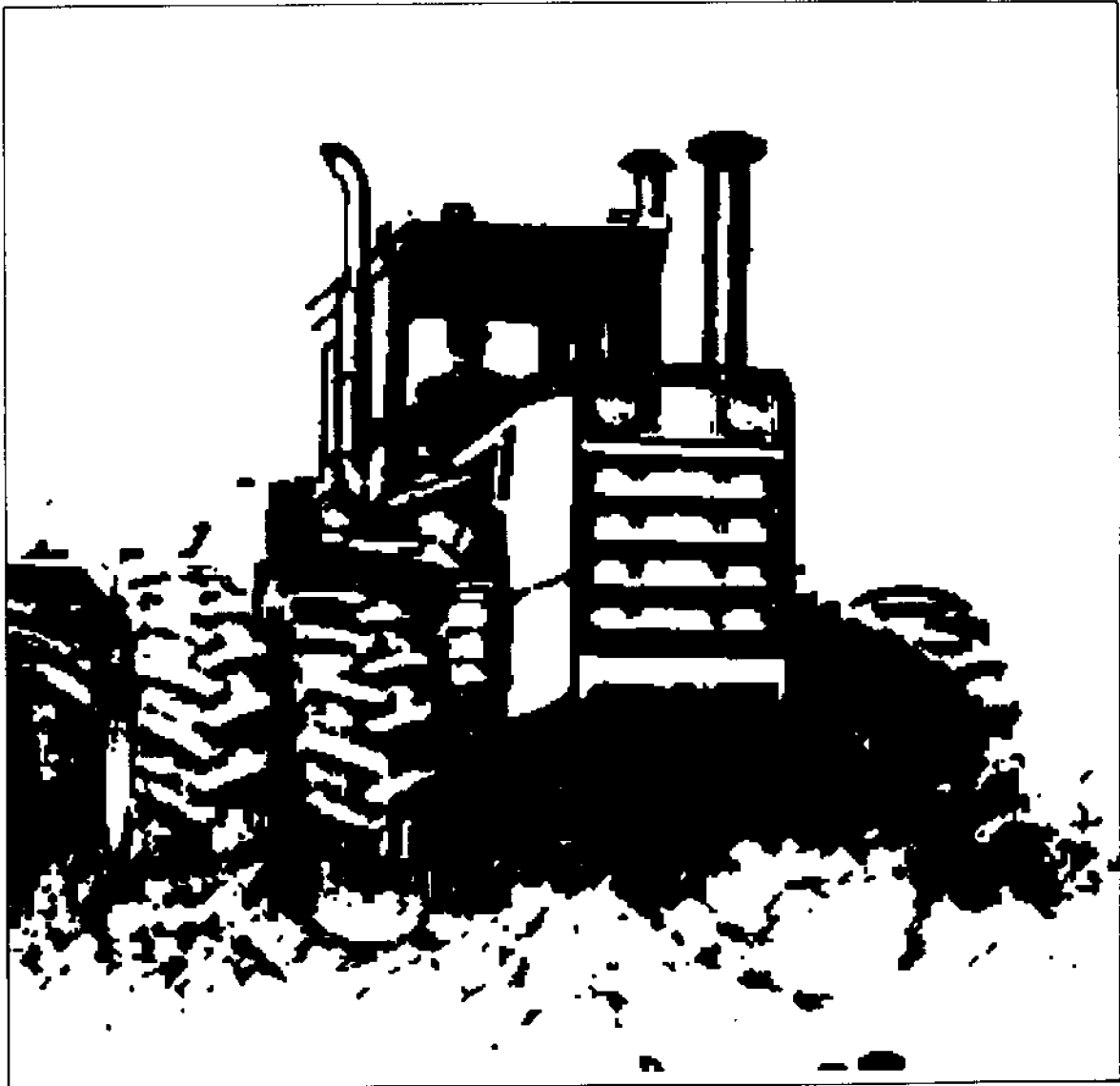


THE COLUMBIA RIVER



THE COLUMBIA RIVER

AGRICULTURE



AGRICULTURE AND IRRIGATION: A READING

If you were a farmer who wanted to raise crops or livestock on desert land, what would you do? Imagine that you have good soil and good weather and that your land is near a great river system. How could you make things grow?

Farmers and ranchers in the Columbia River area, faced with this problem, irrigate their land. To irrigate means to supply land with water by means of channels, pipes, ditches, or sprinklers. The river water is sometimes called "liquid gold" because it helps change dry land into valuable farmland.

In the 1830s, the first farmers in this area began to irrigate their lands. They did this by diverting water from nearby streams. Diverting water means to take it away from where it usually flows. As time went on, farmers joined together to pay for bigger and better irrigation systems. Then dams were built on the river. The dams made storage reservoirs for water and also produced inexpensive electricity which could be used to pump water to where the farmers and ranchers needed it.

Today, many crops are produced by irrigation in the Columbia River area. Currently grown are wheat, alfalfa, onions, plums, seed crops, mint, peas, dry beans, melons, apples, pears, potatoes, hops, cherries, and wine grapes. Cattle and sheep are raised in this area, too, and dairy farming is important.

About 8 million acres of land are irrigated in the Columbia River area. Products grown on irrigated land are worth about \$3 billion a year. Clearly, agriculture—the science and work of growing crops and raising livestock—is an important part of the Pacific Northwest economy.

New irrigation systems, such as center-pivot sprinkler systems,



and modern high-lift pumping methods have been developed to grow crops. However, with these new irrigation methods, farmers and ranchers want more water from the river to irrigate more land.

Irrigation takes water from the Columbia River system and uses it to help plants grow. However, it returns very little of that water to the river system. The water goes into the plants or evaporates. The water that does return to the river system sometimes carries chemicals such as the pesticides, herbicides, and fertilizers used in farming.

So, irrigation has its good points and its bad points. It helps farmers and ranchers grow a variety of agricultural products that feed hungry people. And these products are worth a great deal of money. But irrigation takes water from the river system. It changes the flow, volume, and quality of the water. These changes affect fish, wildlife, navigation, recreation, and hydropower production. Irrigating land can also use a great deal of energy.

Activity: Columbia River Feast

I. Concepts

1. The Columbia River is used to irrigate approximately 8 million acres of farmland.
2. Irrigation produces a variety of crops.
3. Much of the water diverted for irrigation does not re-enter the river.

II. Objectives

The students will be able to

1. name several crops produced by irrigation in the Columbia River area.
2. prepare an edible dish from Columbia River crops.
3. define *irrigation*.
4. define *agriculture*.

III. Teacher Prep

1. Gather necessary materials, including ingredients and cooking utensils.
2. Make an overhead transparency of the recipes.
3. Make a class set of the reading "Agriculture and Irrigation."

IV. Materials

1. class set of student reading selection
2. ingredients and utensils as required for each recipe
3. tagboard or construction paper
4. lined paper
5. yarn
6. hole punch

V. Procedures

1. Ask student volunteers to define *agriculture*. Ask students what crops might be grown in the Columbia River area. Ask students to define

irrigation. Ask students to describe orally any examples of irrigation they may have seen. Suggest the use of sprinklers on the school lawn, if your students cannot think of any irrigation they have seen.

2. Have students read the selection "Agriculture and Irrigation."
3. Then write *apples* on the board. Ask students to name all the ways they can think of to cook and eat apples. Do the same for wheat, lentils, pears, and corn. Prepare the following (easy and delicious) dishes with your class. Time, budget, and equipment restrictions may determine what dishes to make with your students. You may have favorite recipes of your own featuring crops from the Columbia region.
4. Make a transparency of the recipes chosen. Have students copy the recipes on lined paper. A sheet 8 1/2" x 11" cut in half horizontally works well.
5. If you make more than one dish, have students put the recipes together into a Columbia River cookbook. Give students construction paper or tagboard for covers (again, cut 8 1/2" x 11" sheets in half). Punch two holes in the left edge of the recipe booklet. Have students string yarn through the holes to hold the cookbook together. Encourage them to decorate the cover with Columbia River scenes.
6. Invite parents to come sample the class' favorite Columbia River recipes on a Columbia River Day. Students could share their favorite dishes, show work completed earlier in the unit, such as dioramas and mobiles, present their legend puppet shows, or recite poems about the Columbia River.

VI. Extended Activities

1. Have students bring in recipes which use agricultural products from the Columbia River area. Display the recipes on a bulletin board or duplicate the recipes to send home with classmates.
2. Encourage interested students to try out at home recipes using agricultural products from the Columbia River area and to bring samples for the class.
3. Have students inventory their kitchen at home, looking for all the agricultural products which could have come from the Columbia River area.
4. Have students check with the school's cook or food purchaser to see what Columbia River agricultural products are used by your school.
5. Give interested students an opportunity to research different types of irrigation systems. Have them make models of different types for display in the classroom.

Forlorn Lakes Salad

For each salad

Utensils

paper towels
salad plate
fork
kitchen scissors or knife
teaspoon

Ingredients

1 lettuce leaf
1 pear half
1 raisin
1 maraschino cherry
2 canned mandarin orange segments

Wash 1 lettuce leaf and pat dry with paper towel. Place on salad plate.

Place the pear half, cut side down, on the lettuce leaf. Place the orange segments at the small end of the pear half for a fish tail.

Scoop out a tiny hole in the pear half of the eye. Place 1 raisin in the hole. Cut the maraschino cherry into quarters.

Scoop out a little hole in the pear half for the pectoral (side) fin. Place a maraschino quarter in the hole. Place the other maraschino quarter at the top of the pear half for a dorsal (middle of the back) fin.

Alfalfa Sprout Salad

(8 large servings)

Utensils

knife
mixing bowl
sauce pan
jar

Ingredients

4 cups alfalfa sprouts
2 medium tomatoes
1/2 cup sliced green onion
1/2 cup snipped parsley
4 tablespoons chopped green pepper
Garlic Dressing (see below)
2 cups cubed cheddar cheese

Cook sprouts, uncovered, in small amount of boiling water for 3 minutes; drain and cool. Peel

and chop the tomato. In mixing bowl combine sprouts, tomato, onion, parsley, and green pepper. Pour Garlic Dressing over sprouts mixture and toss gently to coat. Cover and chill 30 minutes. Add cheese and mix lightly. Serve in lettuce cups, if desired.

Garlic Dressing

In screw-top jar combine 3 tablespoons salad oil, 2 tablespoons wine vinegar, 1/8 tsp. garlic salt, and a dash of freshly ground pepper. Cover; shake well.

Sprout Gardening in a Jar

You can easily set up a sprout garden in the dark corner of a classroom shelf. All you need is a quart jar, cheesecloth, and alfalfa seeds. Wash and sort 1/2 cup of seeds, discarding damaged seeds. Soak seeds overnight in 2 cups water (seeds will swell to twice their size). Drain and rinse. Place 1/4 cup of soaked seeds in each quart jar. Cover tops of jars with two layers of cheesecloth; fasten each with a rubber band or string. Place jars on their sides so seeds form a shallow layer. Store in a warm (68° to 75°F), dark place. Rinse seeds once daily in lukewarm water. Harvest sprouts in 3 to 5 days.

You can eat the whole sprout: seed, root, stem, and outer hull. If you prefer to remove the hulls, place sprouts in a bowl. Cover with water and stir vigorously, skimming away husks as they rise to the top. Drain. Pat dry with paper towels. Sprinkle sprouts over tossed salads or use to make Alfalfa Sprout Salad.

Columbia Basin Lentil Soup

Utensils

knife
large sauce pan

In a large pot saute for 3 to 5 min:

1/4 cup olive oil
2 large onions, chopped
1 carrot, chopped

Add and saute 1 min more:
1/2 tsp each dried thyme and marjoram leaves

Add:
3 cups stock or seasoned water
1 cup dry lentils, washed
salt to taste
1/4 cup chopped fresh parsley
1 pound canned tomatoes

Cook in covered pot until lentils are tender (about 45 minutes). Have ready: 2/3 cup grated Swiss cheese. To serve, place 2 tablespoons of grated cheese in each serving bowl and top with soup.

This soup is especially delicious served with corn muffins.

Hood River Brew

(Serves 8-10)

Ingredients

2 quarts apple cider
juice of 2 oranges
3 sticks cinnamon
1 tablespoon whole cloves

Combine cider, orange juice, cinnamon, and cloves in a pan and heat. Ladle out into cups.

Pacific Delight Cookies

Ingredients

1 cup finely chopped dried apricots
1 cup chopped walnuts
1/2 package miniature marshmallows
24 crushed graham crackers
1 can sweetened condensed milk
fine coconut

Mix the first 5 ingredients in a large bowl. Shape into balls and roll in fine coconut.

Willamette Snack

(Serves 10)

Ingredients

1 cup wheat germ
1 cup old-fashioned rolled oats
1 cup apple juice
2 tablespoons lemon juice
2 apples
2 pears
1 cup seedless grapes
1 cup roasted hazelnuts, chopped

Combine wheat germ, rolled oats, and apple juice. Set aside to let it soak. Mix together lemon juice; honey; coarsely grated, unpeeled apples; finely chopped, unpeeled pears; seeded and halved grapes; and hazelnuts. Add to the oat mixture and stir well.

Oregon Apple Cobbler

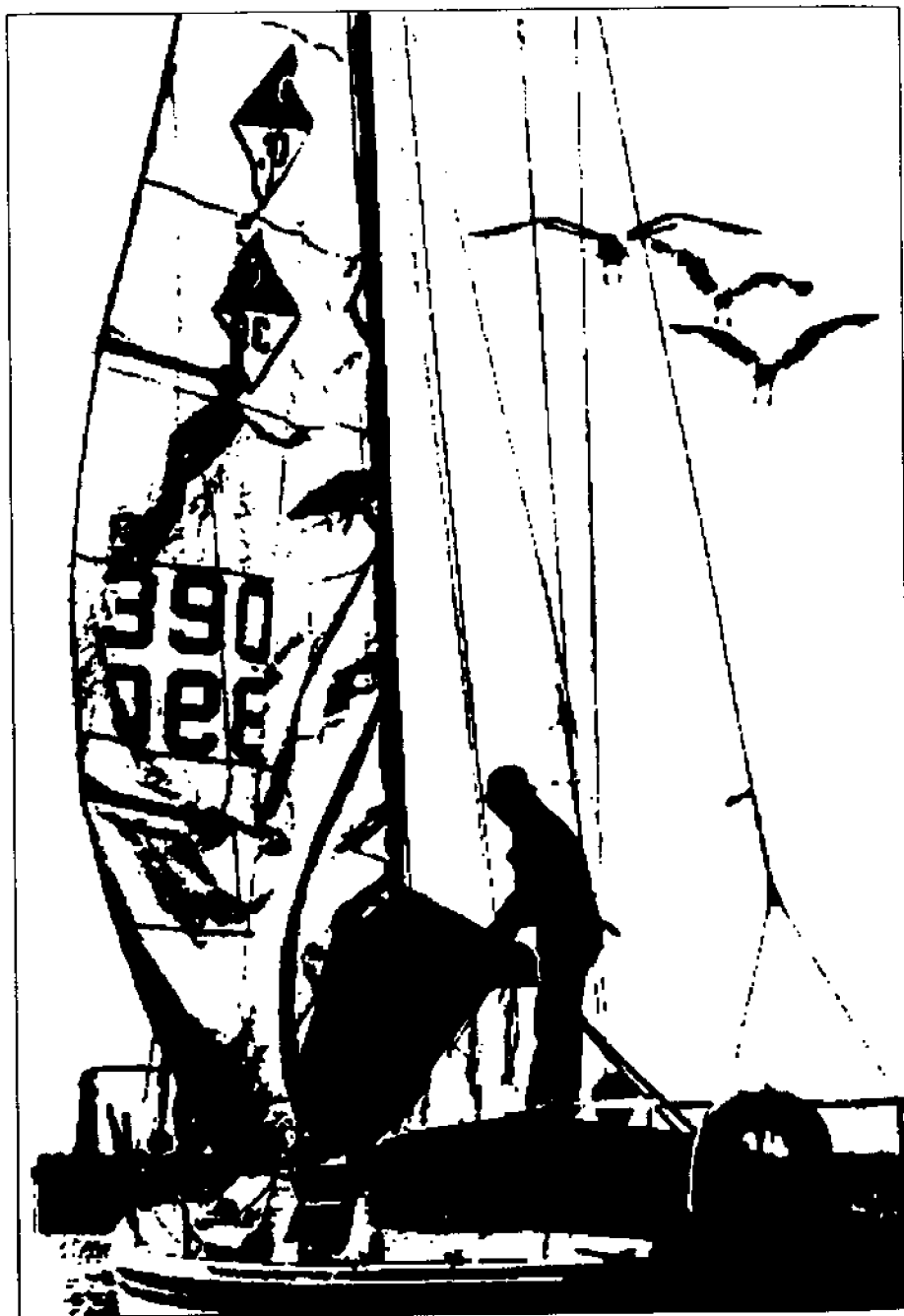
Ingredients

8 apples, peeled and sliced
3 tablespoons sugar
1/2 cup orange juice
2 cups old-fashioned rolled oats
1/2 cup flour
1/2 teaspoon cinnamon
1/3 cup coarsely chopped walnuts
1/4 cup butter
1/4 cup honey

Arrange apples in a greased baking dish. Sprinkle with sugar. Pour orange juice over sliced apples. Combine oats, sifted flour, cinnamon, and walnuts. Sprinkle evenly over apples. Bake in moderate oven 40 minutes or until golden brown and crisp. Serve hot or cold.

THE COLUMBIA RIVER

RECREATION



RECREATION, WATER SUPPLY, AND WASTE DISPOSAL: A READING

What do you like to do when you go on vacation? Do you like to go sailing? Power boating? Waterskiing? Fishing?

You can do all those activities and many more if you visit the Columbia River system.

You can go sight-seeing. Places like Maryhill Museum of Fine Arts and the Whitman Mission National Historical Site are both fun to visit and interesting. At hatcheries, such as the Spring Creek Fish Hatchery or Willard Fish Hatchery, you can see how fish are raised and released into the Columbia.

Do you like to camp or picnic? The Columbia system has many beautiful places, such as Oregon's Ainsworth State Park, where you can do either.

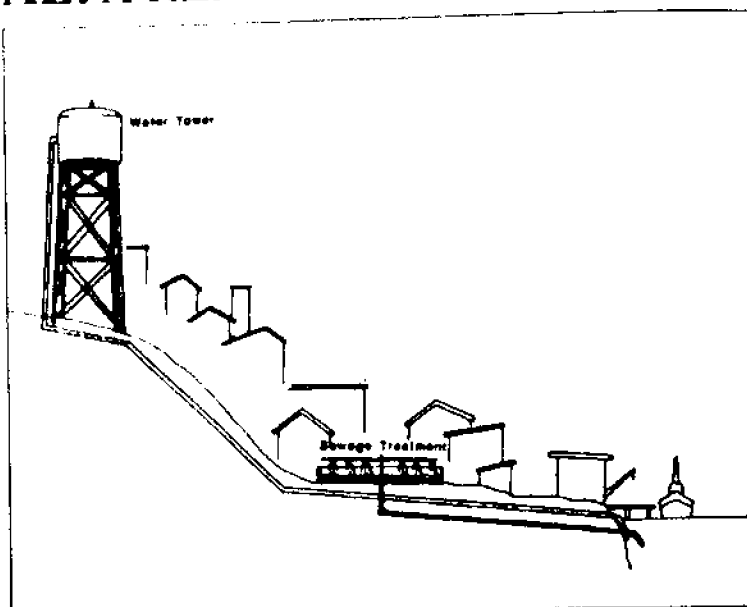
Have you ever been hiking? Oregon's John B. Yoen State Park and Washington's Beacon Rock State Park are two of many places with great hiking trails.

Do you like to ride your bicycle? In the Lewiston-Clarkston area bikeways connect a series of parks.

What makes the Columbia River area such a good place for recreation or free-time activities? Water does. All of the activities people enjoy in this area depend on a clean, safe, natural environment with plenty of water.

We often take our water recreational activities on the Columbia River for granted. We also often forget that the river is used for domestic, industrial, and municipal purposes. These uses, too, require clean water.

But did you know that we often use the river to dispose of the many wastes that our society generates and accumulates?



Many municipal, industrial, and agricultural waste treatment facilities are located along the Columbia River. They need clean water to operate efficiently. Water is used to remove the majority of pollutants from waste material and then is returned to the river. The river helps to further dilute these wastes.

The river is sometimes used for cooling purposes. In some nuclear- and coal-powered electric generating plants, water is heated to steam to turn generators and turbines. Water from the river also is used to cool the steam.

These uses of the river are neither glamorous nor well known, but they are important. They also are closely monitored. Overuse in these areas could

result in water pollution problems which could affect the other users of the river. Here, too, the uses of the river must be balanced.

When we decide who gets how much of the water from the Columbia, we must also consider all of the people having fun in recreational activities (and spending money on them). They need water to go fishing, boating, swimming, wind surfing, and sailing. Hydropower dams provide people with beautiful lakes for these activities. But dams also destroy the river's fish. Irrigation provides people with food to take on picnics. But irrigation takes energy, pollutes, and uses up water from the river. Deciding what uses of the river are most important is very hard to do.

Activity: Brainstorming/Graphing Waterfalls*

I. Concepts

1. The Columbia River Gorge is one of the most beautiful areas in the country.
2. Many tourists visit the gorge and enjoy its beauty.
3. More than 20 waterfalls contribute to the beauty of the gorge.

II. Objectives

The students will

1. understand that tourists visit the gorge to enjoy the beauty of the waterfalls.
2. construct a bar graph of the heights of the major falls of the gorge.

III. Teacher Prep

1. Gather necessary materials.
2. Read teacher information sheet.

IV. Materials

1. student data sheets of the major waterfalls of the gorge and their respective heights
2. graph paper
3. colored pencils
4. scratch paper and pencils
5. pictures of the major waterfalls

V. Procedures

1. Tell students that more than 20 waterfalls can be found in the Columbia River Gorge. Ask students why so many waterfalls would be found in this area. List their suggestions on the board. Review with students, through class discussion, how the Columbia River Gorge was formed.
2. Show students pictures of the major waterfalls. Instruct students to take out pencils and paper and to put down the pencils. Ask students to close

their eyes and think of all the words that come to mind to describe the waterfalls of the Columbia River Gorge. Give students 15 minutes of silence to do so. Then tell students that when you say "Go," they are to write down all the words they can think of that describe the waterfalls. Tell them they will have 60 seconds to do their writing. Have them share their lists with the class. Remind students during this sharing that the beauty of the waterfalls is one reason tourists visit the gorge.

3. Distribute a sheet listing major waterfalls and their heights. Go over the pronunciation of waterfall names. Review the construction of a bar graph. Distribute graph paper and ask students to graph the heights of the major waterfalls of the gorge.
4. When the graphs are finished, ask students the following:
Which waterfall is the highest?
Which is the lowest?
What is the difference between the highest and lowest?
5. Display the graphs on a bulletin board.

VI. Extended Activities

1. Have interested students guess the origin of the names of the major waterfalls. Then have students investigate where the names really came from. Have the students share their information with the class.
2. Have students make a display, matching drawings of Multnomah Falls with their version of the Indian legend explaining the falls. (See page 16).

*This lesson plan focuses on major waterfalls; however, teachers may want to study waterfalls that are closer to their school.

Waterfalls of the Columbia River Gorge

There are more than 20 waterfalls in the gorge area. The following are some of the major falls and their respective heights:

Horsetail Falls	221 ft.
Elowah Falls (McCord Creek)	289 ft.
Multnomah (fourth highest in the U.S.)	620 ft.
(Upper 542 ft.; Lower 69 ft.)	
Wahkeena Falls	242 ft.
Starvation Creek Falls	186 ft.
Latourell Falls	249 ft.

Activity: Reading a Chart/Designing a Park

I. Concepts

1. Recreation is an important use of the Columbia River system.
2. Many recreational activities are available in the Columbia River area.
3. These activities require a clean, safe, natural environment.
4. Most of these activities are water related.

II. Objectives

The students will be able to

1. name several recreational activities which can be enjoyed in the Columbia River area.
2. define *recreation*.
3. read a chart to find what facilities are available at different parks.
4. design a park with recreational facilities.
5. tell how different river uses might conflict.

III. Teacher Prep

1. Make student copies of the reading "Recreation, Water Supply, and Waste Disposal."
2. Make an overhead transparency and student copies of the chart.
3. Gather the necessary materials.

IV. Materials

1. student reading selection
2. parks chart
3. butcher paper
4. felt pens or colored pencils

V. Procedures

1. Ask students what they enjoy doing when they go on vacation. List their responses on the board. Distribute the student reading selection. Have students read the selection orally. Go over the list

on the board. What activities listed could be done in the Columbia River area? Discuss the last section of the reading selection. Ask students to think of other ways in which different uses of the Columbia might cause problems for recreation.

2. Distribute parks chart. Make sure the students understand the terms *facilities*, *concession*, *sanitation facilities*, and *boat moorage*. Ask students the following questions:

How many parks have places for trailers with a hookup?

Which parks have places for picnicking?

Which parks have places for fishing?

Would you have to pay money to use Biggs Park?

Could you camp overnight at Lepage Park?

If you liked to water-ski, what parks might you visit?

Could you swim at Cliff Area?

Which park has the fewest facilities?

Which park has the most facilities?

What is special about Philippi Park?

Which park would you like to visit? Why?

How many parks have a concession? What do you think they sell?

3. Ask students to think about what facilities they would use if they visited a park. Distribute butcher paper. Ask students to draw a map of their own park, complete with all the facilities they would enjoy using. The park should be located on the Columbia River. The drawing should show the park from the air. You might want to draw an example on the board so the idea of an aerial view is clear to the class. Ask students to name their park.
4. When the maps are completed, give students an opportunity to share them with the class. Then make a parks chart similar to the one used earlier in this activity but listing the student-designed parks. As the park maps are shared, ask students to point out the water-related activities.

VI. Extended Activities

Have students write for information on recreational activities. Students could write to the following agencies or to any town on the Columbia. Have students share with the class the materials they receive.

State Parks and Recreation Division
State of Oregon
525 Trade Street, SE
Salem, OR 97310

Washington State Parks and Recreation
Commission
7150 Cleanwater Lane
Olympia, WA 98504

Idaho Department of Parks and Recreation
Statehouse
2177 Warm Springs Ave.
Boise, ID 83707

Oregon Department of Fish and Wildlife
P.O. Box 59
Portland, OR 97207

Washington Department of Fisheries
115 General Administration Bldg.
Olympia, WA 98504

U.S. Forest Service/National Park Service
Outdoor Recreation Information
Henry M. Jackson Building
915 2nd Avenue, Room 442
Seattle, WA 98104

THE COLUMBIA RIVER

Columbia Parks

	Boat Launch Ramp	Picnicking	Fishing	Swimming	Water Skiing	Boat Moorage	Overnight Camping	Trailer with Hookup	Trailer—No Hookup	Drinking Water	Sanitation Facilities	Concession	Fees Charged
Biggs Park	•	•	•								•		
Lepage Park	•	•	•	•	•	•	•		•	•	•		
*Philippi Park		•	•	•	•	•	•			•	•		
Arlington Park & Marina	•	•	•	•		•				•	•		
Quesnel Park	•	•	•	•	•		•		•		•		
Boardman Park	•	•	•	•	•		•	•		•	•		•
Irrigon Park	•	•	•	•	•	•				•	•		
Umatilla Park & Marina	•	•	•	•	•	•	•	•		•	•	•	•
Maryhill Park	•	•	•	•	•		•	•		•	•	•	•
Cliffs Area	•	•	•				•		•		•		
Railroad Island	•	•	•	•	•								
Rock Creek Park	•	•	•	•	•	•					•		
Sundale Park	•	•	•	•		•					•		
Roosevelt Park	•	•	•	•	•	•				•	•		
Alderdale		•	•										
Crow Butte Park	•	•	•	•	•	•	•	•		•	•		•
Plymouth Park	•	•	•	•		•	•	•		•	•		•

*Access by boat only

Activity: Waste Assimilation (Disposal)

I. Concepts

1. Modern society generates many wastes which must be properly disposed of.
2. Water is often used to treat and dilute these wastes.
3. The Columbia River is used for waste assimilation by municipalities and by industrial and agricultural enterprises.

II. Objectives

The student will be able to

1. describe what waste assimilation is.
2. discuss the concept and how and why it works.
3. state the benefits and costs of using the river for waste assimilation.

III. Teacher Prep

1. Make student copies of the reading selection.
2. Gather necessary materials.

IV. Materials

1. several empty milk cartons
2. two water glasses
3. a water source
4. instant coffee

V. Procedure

1. Distribute the reading selection. Have students read it aloud. Have students discuss the types of wastes that individuals, industries, agriculture, and cities generate. Ask students: How do we dispose of these wastes?
2. Fill two water glasses with water and fill the milk containers half full with water. Put some instant coffee in the water glasses to color the water. *Make sure you put equal amounts in each.*

Take one glass and pour its contents into a milk carton. Take the contents of the first milk carton and pour it into the second milk carton. Pour some of the contents of the second milk carton into an empty glass.

Compare the color of the contents of this glass with the color of the contents of the first glass. What happened to the color? What did the water do to the coffee? Discuss how this process is used in your community to dilute wastes.

VI. Extended Activities

Ask students to find out if any nearby communities or industries are using the river for waste assimilation. Have interested students contact the local municipal waste treatment operator. Perhaps you can invite the operator in to discuss the job and its responsibilities.

Activity: Water Filtration

I. Concepts

1. Water is needed for domestic, municipal, and industrial use.
2. Water needs to be of high quality for these uses.
3. Water often needs to be "purified" so that we can use it.

II. Objectives

The students will be able to

1. define what water filtration is.
2. discuss the concept and how it works.
3. state the benefits of using the river for our needs and why it is important that the water we use be of high quality.

III. Teacher Prep

1. Make student copies of the reading selection.
2. Draw a diagram of the filtration column.
3. Gather materials; make the filtration column ahead of time, or do it in class.

IV. Materials

1. glass or plastic tube, at least one inch in diameter.
2. funnel
3. water
4. rubber band
5. window screen (fine mesh)
6. charcoal granules, sand, fine gravel, coarse gravel
7. dirt
8. two glasses or containers

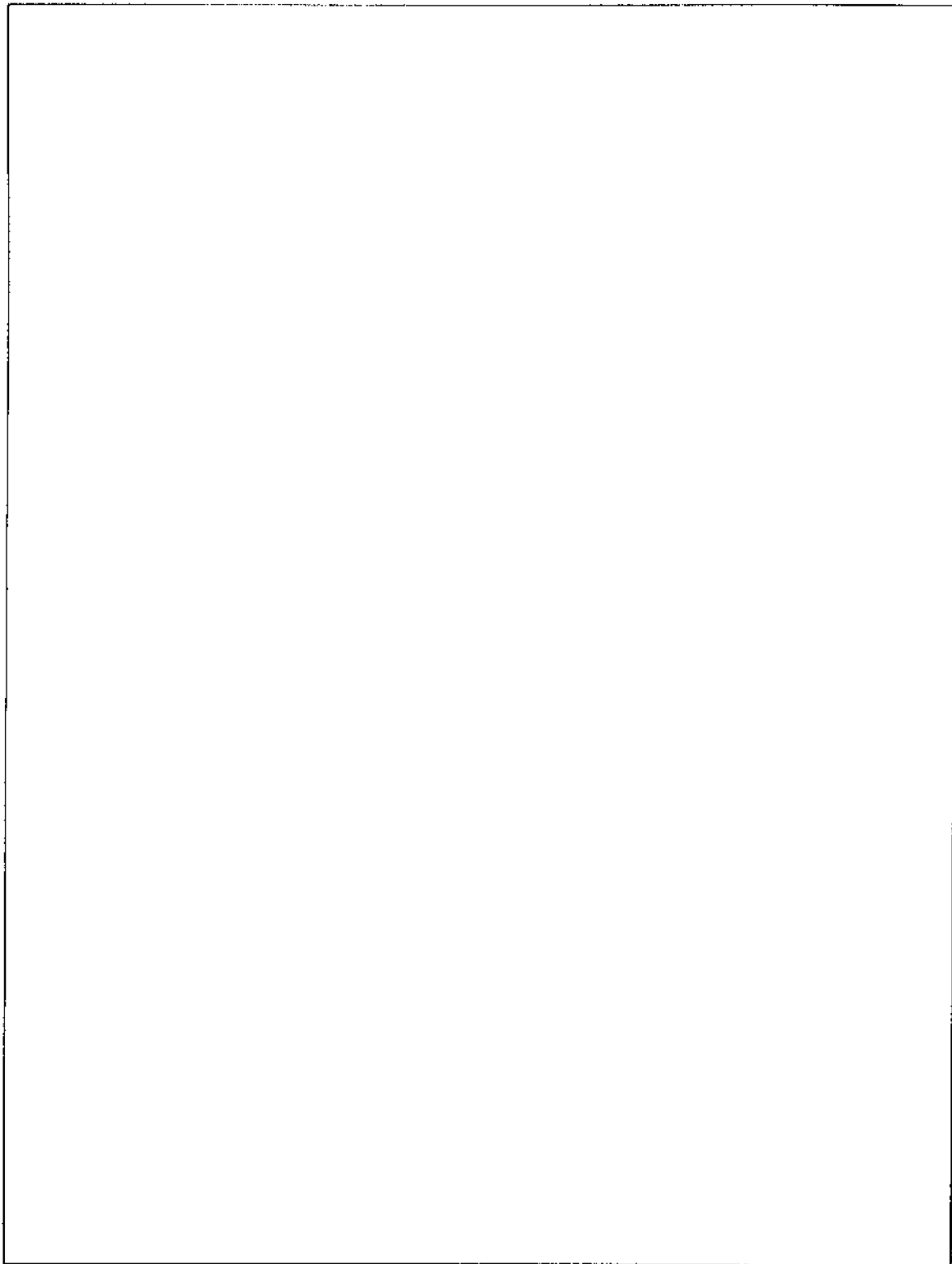
V. Procedure

1. Distribute the reading selection. Discuss reasons water needs to be treated for use in homes, industries, and cities.
2. Make a filtration tube: wrap the window screen around the bottom of the tube; secure it with a rubber band. Pour in charcoal, then a layer of fine gravel, then a layer of sand, then a layer of coarse gravel. Mix some dirt into the glass of water (the water should look dirty with particles of dirt floating in the glass).
3. Pour some of the contents through the filtration tube. Make sure you pour slowly and have the container at the bottom end of the tube to collect the water. This may take several minutes. Discuss what is happening while the water is going through the tube.
4. What is happening to the water? What happens to the dirt in the water? Discuss how this process happens in nature (that is, how water percolates through the soil).

VI. Extended Activities

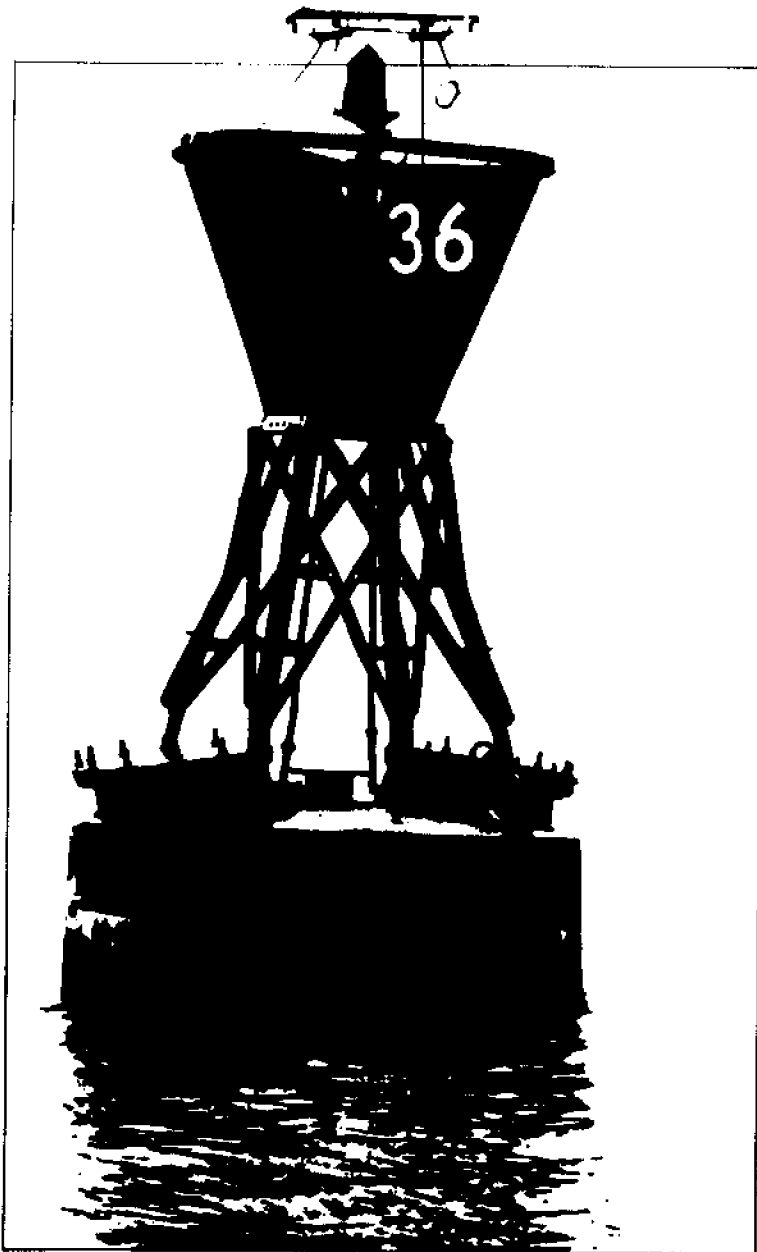
Ask students to find out where the school gets its drinking water. Is it supplied by a well? By the city? Have interested students contact the local water department to see if the local water needs to be treated before it is used. Have the students report their findings to the class.

THE COLUMBIA RIVER



THE COLUMBIA RIVER

NAVIGATION



TRANSPORTATION AND NAVIGATION: A READING

Close your eyes. Picture the Columbia River many years ago. What kind of boats do you see on the river?

For hundreds of years, Indians traveled by canoe on the Columbia River. Thousands of Indians brought goods to trade at the Long Narrows and Wy-am, where many different Indian cultures traded, fished, and played.

Early white explorers such as Lewis and Clark used the river, too.

Fur companies established trading posts on the Columbia. In 1811, the first port on the Columbia was founded at Astoria by the Astor Company. By the 1830s the Hudson Bay Company had a trading empire on the river.

Early settlers traveled down the Columbia after a hard 2,000-mile journey along the Oregon Trail. They built towns along the river. Portland became the chief port because it was as far up the river as oceangoing schooners could go.

Steamboat travel began on the Columbia in 1850. By the 1860s steamboats served the Columbia and Snake from Astoria to Lewiston.

Steamboat travel was sometimes made dangerous by low water, rapids, or ice. At some spots in the river, such as the Great Cascades and Celilo Falls, even powerful sternwheelers could not move through the waterfalls and rapids. Portages, or places where boats or goods were carried overland, were needed to get around the trouble spots.

The Corps of Engineers made its first navigational survey of the Columbia in 1867. It removed rocks, rapids, and snags, made a channel from Portland to the ocean, and built canals to make river travel easier.

When people began to use railroads and trucks for travel and for moving goods, traffic on the river dropped. Then the Corps of Engineers built the North and South Jetties at the mouth of the Columbia. These jetties made it easier for ships to enter and leave the river, and as a result trade on the lower Columbia increased.

In the 1930s modern barge traffic began on the river. The Bonneville Dam and lock made

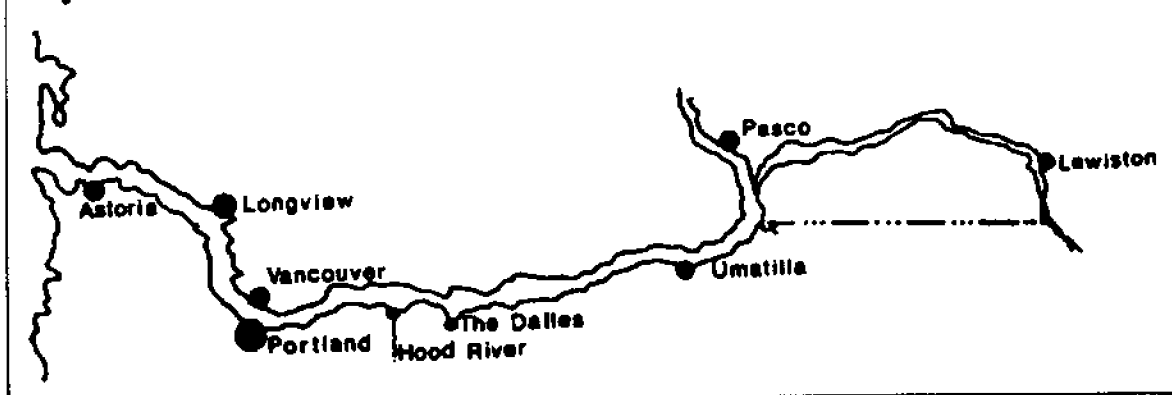
river travel easier for barges. Seven more dams were built, thus making it possible for barges to travel all the way to Lewiston, Idaho.

What do these vessels carry? Where do they take their cargoes?

Look at a world map. Find the mouth of the Columbia River at Astoria, Oregon. Follow a route north along the coast of Canada and the coast of Alaska and west across the Aleutian Islands. Turn west and south to Japan, Korea, Taiwan, China, the Philippines, Indonesia, and Australia. You have just traced the "Pacific Rim." This is where many of the products from the Columbia River system are sent, or exported.

Many different products are exported, as you will see in a later activity. Grain is one of them. It is loaded on barges in many upriver ports, such as those at Lewiston, Umatilla, and Pasco. At downriver ports, such as those at Portland, Vancouver, Kalama, or Longview, it is moved to ocean-going ships, on which it is carried to Pacific Rim Countries.

Major Ports



Activity: Fabric Pillows/Vessels of the Columbia

I. Concepts

1. Navigation is a traditional use of the river system.
2. Steamboat travel was most important from the 1850s through the 1880s.
3. About 100 million tons of cargo go up and down the Columbia each year.

II. Objectives

The students will be able to

1. describe vessels found on the Columbia River in the past.
2. describe vessels found on the Columbia River today.
3. find the Pacific Rim nations on a world map.

III. Teacher Prep

1. Gather necessary materials.
2. Make student copies of the reading selection.

IV. Materials

1. student reading selection
2. muslin fabric (12" x 12" square for each student)
3. fine-tipped permanent markers
4. fabric of any bright color of pattern (12" x 12" square for each student)
5. stuffing
6. sewing machine or needles and thread
7. world map

V. Procedure

1. Distribute the student reading selection. Have students read aloud. Point out the Pacific Rim

countries during the reading. Trace the movement of grain exports on the world map. Discuss the changes in vessels used on the river. Discuss power sources for the vessels. What kind of fuel was and is used by each vessel? Where was and is that fuel obtained? Ask student volunteers to draw these vessels on the board: canoe, steamboat, tugboat and barges, deep-draft ship.

2. Distribute muslin squares and felt markers. Ask each student to draw on his or her square a vessel used on the Columbia in the past or today. Remind students to make large, colorful drawings which do not go closer than one inch to each edge. Have students label their vessels and sign and date their drawings. Have students sew their muslin square to another fabric square, putting right sides together and leaving part of one side unsewn. After they have finished sewing, have them turn the fabric right side out, stuff the pillow, and carefully sew the squares shut. The result will be a colorful Columbia River vessel pillow.

VI. Extended Activities

1. Have students make a classroom display of drawings matching Columbia River vessels to their typical cargo.
2. Have students investigate naval architecture. What is a naval architect? What schooling does a naval architect need? Where can you learn to be a naval architect?
3. Have students find the book *Pacific Tugboats*, by Gordon Newell, in the library. They might want to memorize and recite "His Majesty the Tug Boat" for the class.

Activity: The Navigation Lock

I. Concepts

1. A lock is needed for vessels to pass a dam.
2. A lock uses 43 million gallons of water.
3. A lock works through a system of gates and valves.

II. Objectives

The students will be able to

1. define *navigation*
2. show how a lock works.
3. state the benefits and the drawbacks of a lock.

III. Teacher Prep

1. Make an overhead transparency of the side view of the river, showing the location of the locks.
2. Make student copies of the reading selection.
3. Make felt pieces, as shown in the diagram.
4. Gather necessary materials.

IV. Materials

1. student reading selection
2. side view transparency
3. felt squares
4. flannel board or a large piece of flannel tacked to a bulletin board
5. map of the Columbia

V. Procedures

1. Distribute the reading selection. Have students read it aloud. Have students show the route from Lewiston to Portland on the map. Discuss the use of locks. Ask students, What is navigation? What is a vessel? What types of vessels would use a lock on the Columbia? What might be transported in a vessel on the Columbia? What dangers could you face going through a lock? Discuss the conflicting uses of Columbia River water.

2. Show students the flannel board lock. Ask volunteers to be tugboat captains and to put their tugs and barges through the lock. Be sure to have students show both upstream and downstream lockages.

VI. Extended Activities

1. Ask students to design a model of a lock using milk cartons. Have students work in the class sink. Give students an opportunity to share their models with the class.

2. Have interested students write to the Corps of Engineers for further information on locks.
Addresses:

Public Affairs Office
Portland District
U.S. Army Corps of Engineers
P.O.Box 2946
Portland, OR 97208-2946

Public Affairs Office
Walla Walla District
U.S. Army Corps of Engineers
City-County Airport, Bldg. 602
Walla Walla, WA 99362

U.S. Army Corps of Engineers
P.O. Box 564
The Dalles, OR 97058

Visitors' Center
Bonneville Lock and Dam
Cascade Locks, OR 97014

3. Have students investigate how locks are built.
4. Have students investigate who operates the lock and how that person is trained.

THE NAVIGATION LOCK: A READING

You have been hired as a tugboat captain. Your job is to move barges loaded with grain from Lewiston, Idaho, to Portland, Oregon. How are you going to get past the dams in the river? How are you going to drop from one level of the river to another? (Look at the side view of the river. You can see many levels through which you must pass.)

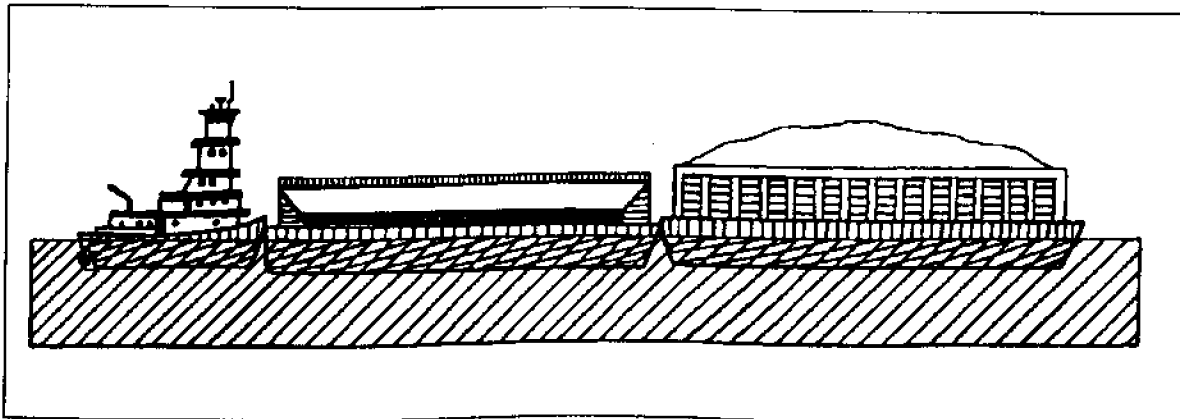
In the Columbia River system, the level of the water behind a dam may be as much as 100 feet higher than that of the water below. A navigation lock permits vessels to pass from one level to the other.

Look at the diagram of the lock. As the tugboat captain, you would put your tug and barges through a downstream lockage. You would enter the lock when the downstream gate was closed. The upstream gate would be closed behind you. The water in the lock would be lowered through a system of valves. The downstream gate would open, and your vessel would leave the lock. This would take about 20 minutes.

If you were going the other direction, things would happen in

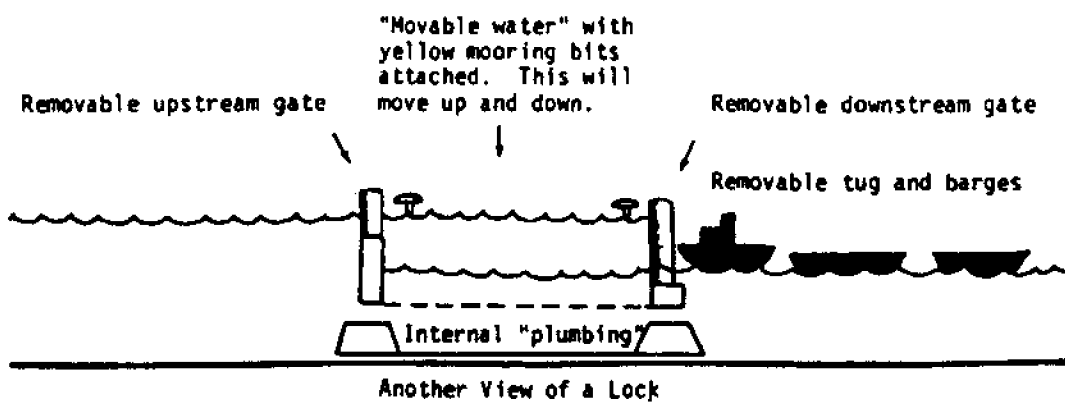
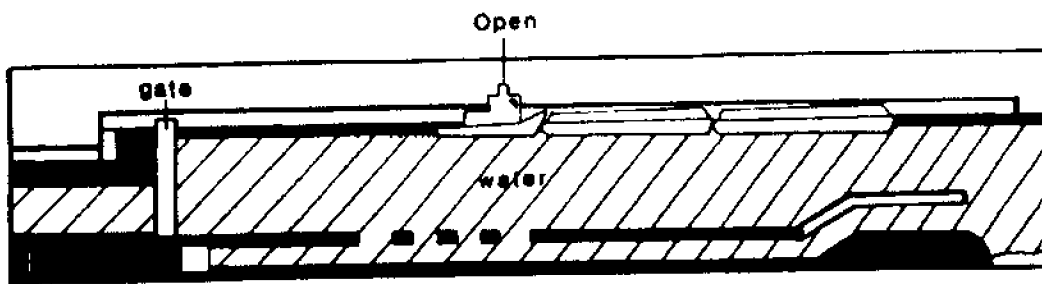
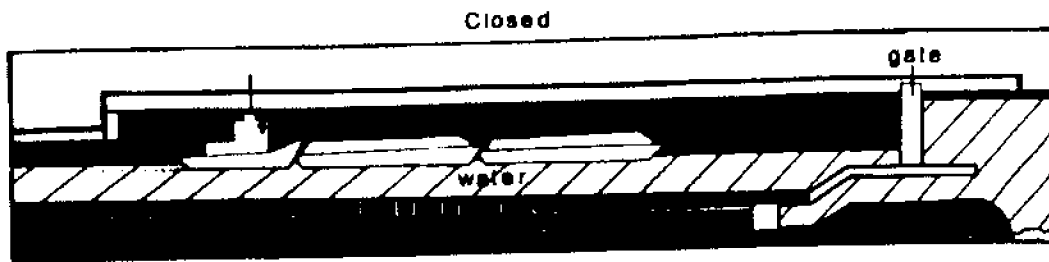
reverse. In an upstream lockage, the upstream gate closes. Water empties out of the lock through a system of valves. The downstream gate opens and the vessel enters the lock. The downstream gate closes behind the vessel, and the lock fills up again with water. Finally, the upstream gate opens and the vessel leaves the lock.

The eight Columbia River locks are open to all vessels, whether they are used for business, like tugboats and barges, or for fun, like sailboats and powerboats. Every time a boat goes through a lock, about 43 million gallons of water are used (except at the small Bonneville lock). Forty-three million gallons of water could produce enough energy to supply the electricity used in one Northwest home for half a year.



THE COLUMBIA RIVER

The Lock



Activity: World Maps/Exports and Imports

I. Concepts

1. Commerce on the Columbia River is an important part of the economy of the Pacific Northwest.
2. Exports and imports involve many foreign nations, especially Pacific Rim countries.
3. About 10 million tons of cargo move up and down the river each year.

II. Objectives

The students will be able to

1. define *export*.
2. define *import*.
3. name several countries involved in Columbia River trade.
4. find on a world map foreign nations involved in commerce.

III. Teacher Prep

1. Make student copies of the world map (two for each student).
2. Make student copies of the commerce chart.
3. Gather necessary materials.

IV. Materials

1. world map (two copies per student)
2. commerce charts for each student
3. colored pencils or fine-tipped markers

V. Procedures

1. Distribute one world map and the commerce charts to each student. Ask students, What is an export? What is one product we export from the Columbia River area? Where do you think that product might be sent? What is an import? What is one product we in the Columbia River area import? Where does that product come from? Have students read the list of leading export nations and their matching tonnage. Ask students to color export nations green on their maps. Have them label their map and make a map legend.
2. When students have completed their export maps, distribute the second set of world maps. Have students color import nations red. Have students label these maps and make a map legend.
3. Ask students to compare the two maps. What nations lead in both exports and imports? Why might we do so much business with these countries?

VI. Extended Activities

1. Ask students to choose one of the leading foreign commerce nations for further study. Have students prepare a report for the class on the chosen nation.
2. Have students make a bulletin board on foreign trade and the Columbia River. It could include magazine pictures of the leading foreign commerce nations, maps, graphs of exports and imports, samples of goods traded, and so on.

Leading Foreign Commerce Nations

Exports	Short Tons	Imports	Short Tons
Japan	3,485,277	Japan	536,224
Republic of Korea	1,478,030	Australia	419,731
Egypt	1,058,867	Canada	244,423
Republic of China (Taiwan)	636,829	People's Republic of China	88,427
India	608,829	West Germany	62,321
Philippines	560,040	Philippines	37,164
Indonesia	410,616	Malaya	34,864
Malaya	258,286	Belgium	22,064
People's Republic of China	131,302	United Kingdom	13,705
Belgium	63,421	Venezuela	6,724

Activity: Graphing Commodities

I. Concepts

1. Commerce on the Columbia River is an important part of the economy of the Pacific Northwest.
2. Foreign exports are handled at several ports besides Portland, Oregon.
3. A variety of commodities are exported from Columbia River ports.

II. Objectives

The students will be able to

1. define "commodities."
2. graph the leading exported commodities handled by Columbia River ports.
3. name four Columbia River ports.

III. Teacher Prep

1. Make student copies of the commodities chart or make an overhead transparency.
2. Gather necessary materials.

IV. Materials

1. student copies or transparency of commodities chart
2. graph paper
3. colored pencils

V. Procedures

1. Distribute the commodities charts. Ask students to read the title of the chart. Ask students: What is an export? What is a port? What ports besides Portland are found on the Columbia? What are commodities? Have students read the list of commodities and their matching tonnage. Be sure students know what each commodity looks like and how it is used.
2. Distribute the graph paper and colored pencils. Review how a bar graph is made. Ask students to make a graph showing the 13 leading exported commodities. Remind students to label their graphs.
3. Display the graphs in the classroom.

VI. Extended Activities

1. Have students bring in samples of the 13 commodities. Make a display of the samples. Use magazine pictures if samples are not available.
2. Have students investigate the uses of each commodity. Have students present their findings to the class.

**Principal Foreign Exports Handled
by Columbia River Ports 1989-1990**

**Thirteen Leading Commodities
(Short Tons)**

Wheat	11,569,427
Corn	6,968,267
Logs	3,155,651
Soda ash	1,464,768
Woodchips	898,804
Barley	715,265
Lumber	513,361
Sorghum	498,374
Coke	332,416

Activity: Reading a Chart

I. Concept

A great variety of commodities are imported and exported through Columbia River ports.

II. Objectives

The students will be able to

1. list several commodities imported through Columbia River ports.
2. list several commodities exported through Columbia River ports.
3. locate specific data in a chart of exports and imports.

III. Teacher Prep

1. Make student copies of the foreign commerce chart and the question sheet.
2. Make an overhead transparency of the chart.

IV. Materials

1. foreign commerce chart
2. student question sheet

V. Procedures

1. Distribute the foreign commerce chart. Ask students, as a review: What is a commodity? What is an export? What is an import? Show students how to find specific data on the chart. Go through examples of finding data with the class until they understand how to read the chart.
2. Distribute the student question sheet. Ask students to answer the questions by using the foreign commerce chart.
3. When students have finished the question sheet, have them exchange and correct the papers. While they are correcting the papers, point out the great variety of commodities exported and imported.

VI. Extended Activities

Have students make a display showing one commodity exported or imported, the type of vessel which carries it on the Columbia River, and a finished product made from the commodity.

Activity: Reading a Chart—Foreign Commerce

Name _____ Date _____

1. How many tons of canned and frozen salmon are exported?
2. Is marble exported or imported?
3. How much basketware is imported?
4. How many tons of hides are exported?
5. How many tons of hides are imported?
6. How many tons of toys are imported?
7. How many boxes of pears are exported?
8. Are lentils imported or exported?
9. Is coal imported?
10. Is coal exported?
11. Are more petroleum products exported or imported?
12. Are more autos imported or exported?
13. How many tons of baled hay are exported?
14. How much old newspaper and waste are exported?
15. How many tons of chilled and frozen beef are exported?
16. How much coffee is imported?
17. In what year were these amount of imports or exports recorded?
18. Was more cement imported in 1981 or in 1982?
19. Which commodity was imported in the greatest amount?
20. Which commodity was exported in the greatest amount?

THE COLUMBIA RIVER

FOREIGN COMMERCE CHART

(Summary of foreign imports to and exports from Portland via water)

Commodity	Export (short tons)	Import (short tons)	Commodity	Export (short tons)	Import (short tons)
Alcoholic Beverages	3,497	1,528	Fish, Canned & Frozen		57
Alfalfa Pellets	145		Fish, NOS	2,258	
Aluminum	28		Flour	92	
Aluminum, Mfgs.	55,474		Food Byproducts	4,340	
Apples, Fresh (654,500 bxs)	16,363		Foodstuffs	18,275	
Appliances	817		Foodstuffs, NOS		5,450
Auto Parts	6,265		Footwear		5,857
Autos	14,297		Fruits, Fresh	523	
Autos, Vans & Parts		355,942	Fruits & Juices, Canned	6,036	
Bambooware		111	Fruits & Juices, Frozen	3,324	
Barley (21,489,183 bu)	515,740		Furniture		1,675
Basketware/ Wovenware		168	Gasoline		196,080
Batteries & Parts	1,655		Glass Products		832
Beans, Dried	1,568		Hardware & Tools	107	2110
Beef, Chilled & Frozen	2,384		Hay, Alfalfa Cubes	56,941	
Bentonite Clay	195,045		Hay, Baled	120,282	
Buckwheat	379		Hides	59,933	
Building Materials	18,989	1,268	Hops & Extracts	34	
Buildings, Precut/ Prefab	2,497		Ink	20	
Bulbs & Flower Seed	20		Lab & Tech. Equip.	64	
Bullets & Explosives	14		Lentils	8,546	
Burlap & Bags		1,611	Lignin Pitch	3,990	
Carbon Products		1,257	Logs & Lumber	543,800	598
Cathodes, Copper	28		Machinery & Parts		13,919
Cement		225,001	Machinery & Parts, Agriculture	819	
Chemicals	28,516	6,840	Machinery & Parts, Lift Truck	1,179	
Cherries, Fresh	829		Machinery & Parts, Lumber	406	
Coal Tar Pitch		34,795	Machinery & Parts, Mining	405	
Coconut, Dessicated		308	Machinery & Parts, NOS	7,921	
Coconut Oil		27,154	Malt	11,402	
Coffee		740	Marble, Granite & Stone		223
Copper Products	137		Meat, NOS	33	
Corn (15,068,630 bu)	421,922		Merchandise, NOS	11,427	
Corn, Canned	16,107		Metal - Misc. Iron & Steel Prod.		184,958
Corn, Frozen	7,739		Metal, NOS	132	
Cotton	227		Metal Scrap	228,551	
Drugs, Dental/ Med. Supplies	345		Methanol		40,910
Dry Goods & Clothing		29,206	Misc./Household Goods	582	
Earthen/Stone/ Porcelainware		453	Miscellaneous		13,444
Electric Mfg.		1,030	Molds, Pottery	871	
Electrical Goods	287		Motorcycle Parts & Access.		105
Electronic Equipment		3,257	Mushrooms		84
Fertilizers	25	154			
Fiberboard	25,023				

THE COLUMBIA RIVER

Commodity	Export (short tons)	Import (short tons)	Commodity	Export (short tons)	Import (short tons)
Nursery Supplies	1,734		Soda Ash	1,416,433	
Nuts	387		Sorghum		
Oil, Pmint, Sprmint, & Essence	15		(1,011,735 bu)	28,329	
Oil, Tall	8		Soybeans		
Onions	11,301		(1,125,616 bu)	33,768	
Oranges, Canned		120	Steel Bars	290	
Ore	34		Steel Coils	104	
Ore - Alumina		593,468	Steel Plate	5,103	
Ore - Limestone		494,633	Tallow	551	
Ore - Manganese		9,083	Tires & Tubes		8,162
Ore, NOS		6	Toys		1,242
Paints & Resins	1,912		Tuna, Canned		1,105
Palm Oil		28,478	Vegetables, Canned	885	
Paper & Mfg.		613	Vegetables, Fresh	82	
Paper & Newsprint	5,860		Vegetables, Frozen	2,513	
Paper Products	579		Wastepaper	77,699	
Paperboard/ Linerboard	210,785		Wheat		
Particle/Chipboard	60,585		(202,485,721 bu)	6,074,572	
Pears, Fresh			Whey Powder	1,727	
(17,162 bxs)	429		Wire		968
Peas, Dried	18,157		Wood Buris & Logs	1,059	
Petroleum Products	621	82,665	Wood Mfg.	751	555
Pineapple		998	Wood Pulp	79,121	
Pipe, NOS		23,257	Woodchips	683,311	
Plastic Scrap	3,703		Wool		2
Plywood & Vencer	29,643	489	Yarn, NOS		50
Popcorn	952				
Pork, Frozen	519				
Potatoes, Dehydrated	6,249				
Potatoes, Frozen	55,236				
Poultry, Frozen	395				
Poultry, Pet & Stock Feed	15,889				
Recreational Equip.	2,289	678			
Rubber, Crude	5				
Rubber, Crude/Synthetic		9			
Rubber Mfg.		377			
Salmon, Canned & Frozen	1,382				
Salt, Crude		289,487			
Sandblasting Grit	1,223				
Seed		427			
Seed, Bentgrass	29				
Seed, Clover	17				
Seed, NOS	3,449				
Seed, Ryegrass	540				
Seed Grass, NOS	4,309				
Shellfish, Canned & Frozen	19				
Soap & Cleansers	3,829				

Activity: Ships That Use the Columbia

I. Concepts

1. Much of the Columbia River trade is with Pacific Rim countries.
2. Farm and forest products are the main items exported from the Columbia, whereas manufactured goods and raw materials are the major items imported.
3. Ships of different types are used to carry the different items.

II. Objectives

The students will be able to:

1. identify different exports and imports passing in and out of the Columbia River.
2. identify some of the countries trading with ports on the Columbia River.
3. identify different types of ships using the river.

III. Teacher Prep

1. Gather appropriate materials for activities.

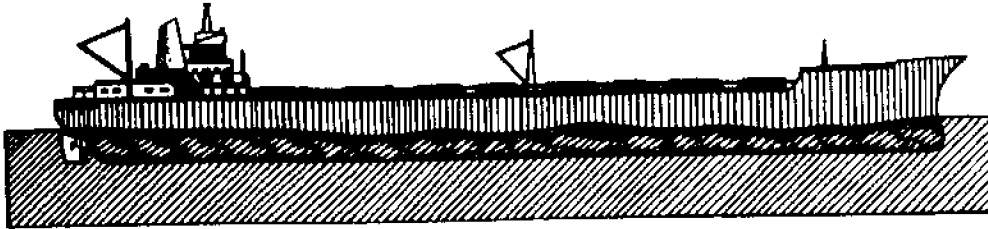
IV. Materials

1. toy cars
2. salt
3. small items of iron or steel
4. lumber twigs to represent logs
5. wheat
6. barley

V. Procedures

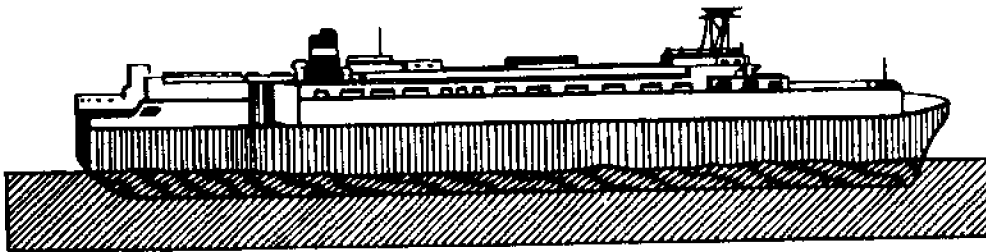
1. Collect items that are exported and imported into the Columbia. Separate them into an export group and an import group. For example, the import group could comprise toy cars, salt to represent crude salt, and small items of iron or steel. Wheat, small pieces of lumber, and twigs to stand for logs could represent the export group.
2. From the drawings and descriptions of ships included in this section, identify the types of ships that would carry the represented goods, i.e., a dry bulk carrier for wheat, car ships for cars, and so on. Discuss why different ships have different designs.
3. Check the ship's log in the *Oregonian* to record the types of ships scheduled to visit the Port of Portland. Record the countries they are from and the type of goods they might be carrying.
4. Have students conduct a scavenger hunt in their homes for goods that might have been imported into the United States. List the items in class.

THE COLUMBIA RIVER



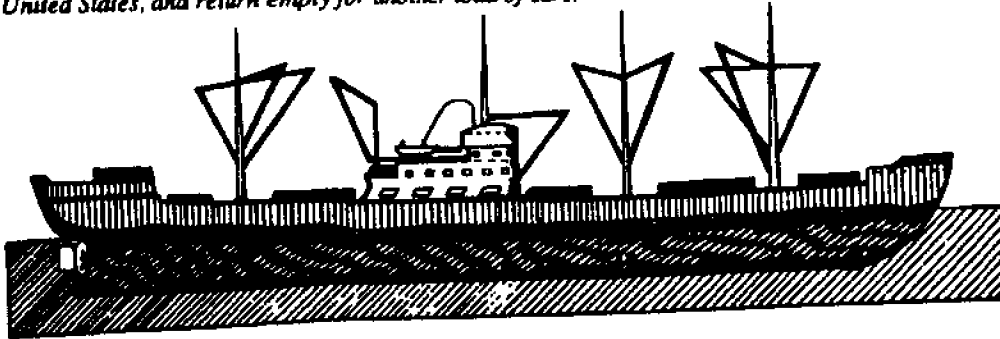
Dry Bulk Carrier

Large compartments in the holds of dry bulk carriers are filled with grain, sugar, ores, fertilizers, or other dry materials. These ships are often seen at dock with long, round hoses that drop down into the holds to fill up the compartments.



Car Ships

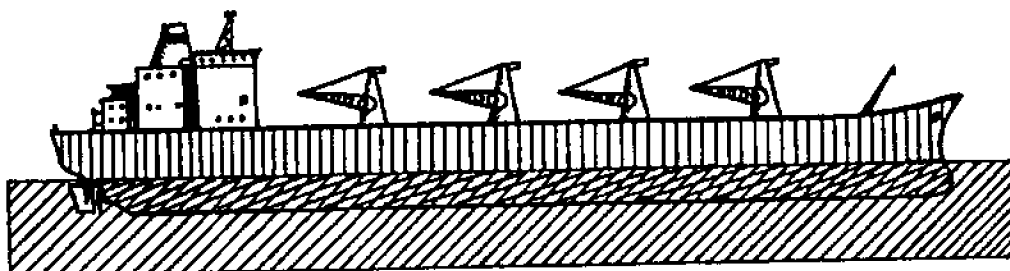
Car ships are designed to transport one item, cars. Cars can be driven on and off these ships by ramps which lower from the ship onto the dock. These ships usually carry no other item, and so they are loaded on only one half of their trip. They pick up cars in Japan, deposit them in the United States, and return empty for another load of cars.



Cargo Ships

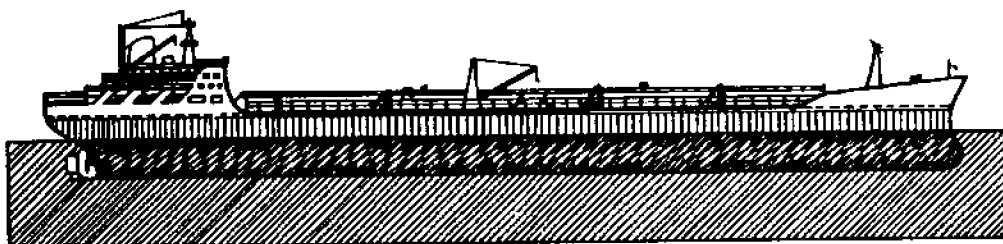
Unlike the large container ships, cargo ships, or freighters, can carry containers of all sizes. The type of goods they carry varies greatly, from tractors, to canned foods, to cartons of apples, and so on. These ships have large derricks on board which are used to unload their cargo.

THE COLUMBIA RIVER



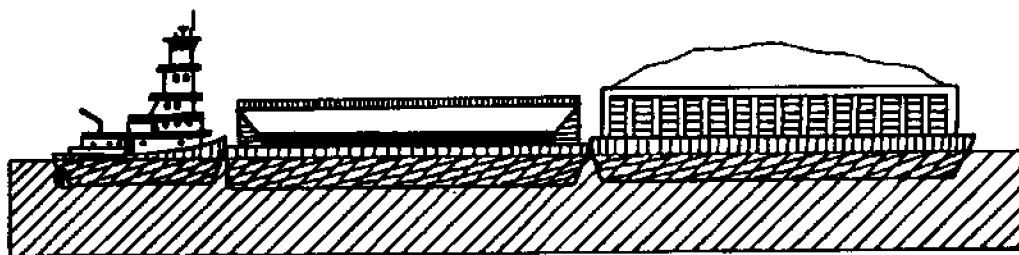
Container Ships

Container ships carry large containers of one size. Large dockside cranes lift the containers on and off the ships. The containers are then moved by truck or train to their final destination. Containers can be filled with any number of items, from stereos and cameras to lumber. Some of the containers are refrigerated and can be used to transport food.



Tankers

Tankers transport liquid materials. The most common material carried by tankers is oil, but they also carry such liquids as vegetable oil, molasses, and tallow. Small tankers can enter ports, but supertankers must be anchored at sea and offloaded near shore.



Columbia River Tug and Barge

Tugs and barges are designed for use only on the river. They are a common sight moving goods up and down the river system. The bottom part of some of the barges is designed to carry fuel while the upper part carries grain. With this design, they can transport grain from inland farm areas to Portland for export and pick up fuel to be carried upriver to ports in Washington, Oregon, and Idaho.

THE COLUMBIA RIVER

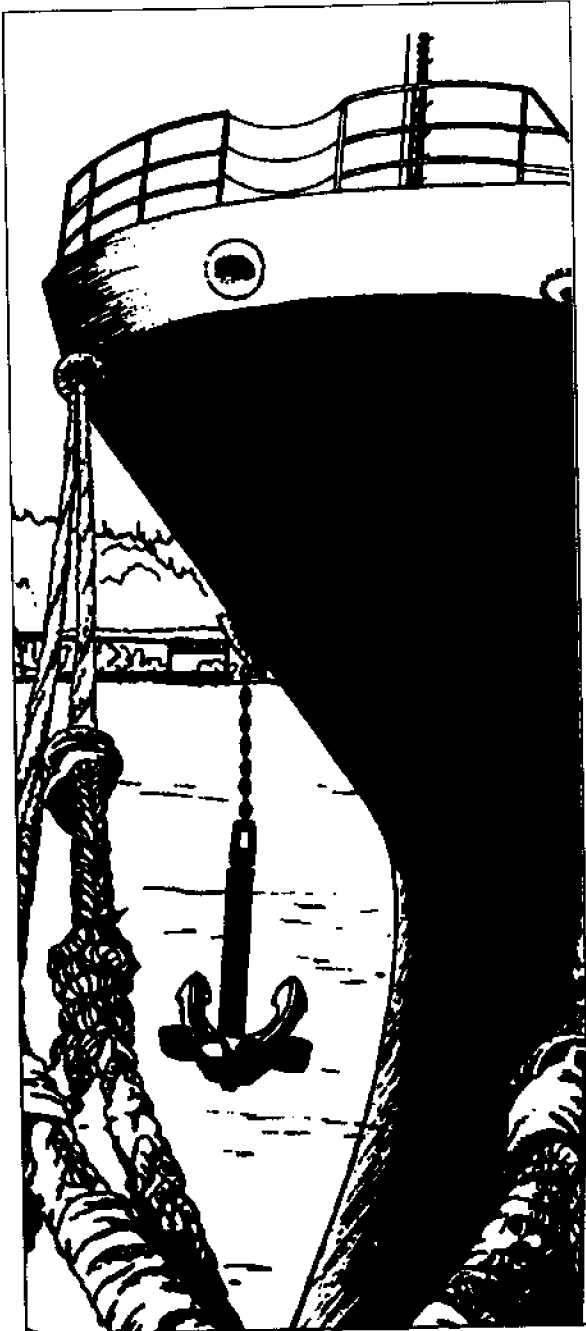
Charter Boats

Most ports and harbors in Oregon offer recreational boating facilities. One type of pleasure boat often seen in harbors is the charter boat. Charter boats can carry from 6 to 30 passengers and are used for ocean fishing, whale watching, or even pleasure excursions.

Commercial Fishing Vessels

Commercial fishing vessels dock in Oregon harbors. The type of equipment these boats carry is geared for the type of animals they are fishing. For example, if they fish for bottomfish, they are equipped with large nets. Salmon boats have troll poles and lines, and crab boats are equipped with crab pots and winches for pulling the pots on board.

SUMMARY



SUMMARY: A READING

In our study we have learned that the Columbia River is very important in our daily lives. We could say that it is the lifeblood of the Pacific Northwest. Because of its many applications, we are constantly using this resource—in the energy we consume, in the food we eat, in the products we buy.

We have discovered that some of these uses compete with one another for the water of the Columbia. We now may have to make trade-offs in the way these waters are used, since there may not be enough water to meet all our needs. Because of the size of the river system and the number of people involved in managing it, making these trade-off decisions is not easy.

The Columbia Basin includes parts of seven states plus the Canadian province of British Columbia. Some tributaries of the system cross the international border three times before entering the Pacific Ocean. Management authority for power generation, flood control, commerce, and other use is fragmented among local, state, regional, federal, and international agencies. Dozens of specific interest groups as well as local, regional, and national committees are also involved in some aspect of the Columbia Basin policy. Because of the complexity and variety of the institutions and interests involved, over time a piecemeal, fragmented approach has evolved toward the problems and management of the waters of the Columbia River basin.

It is urgent that something be done. The Columbia River is no longer resilient and inexhaustible. It has clearly begun to show its

vulnerability to overuse and to inadequate, uncoordinated, and inconsistent management. The river has been extensively developed for some uses without regard to the effects of these uses on other activities, on people, and on the environment.

Over the next few years, the citizens of the Pacific Northwest will be faced with vital regional choices about how, where, and under what conditions our water resources should be used. It will be a difficult time of decision and will involve a question of balance. In this decision-making process, we all have a role to play. By becoming aware of the issues and conflicts, and by understanding them, we will have an opportunity to voice our concerns so that rational decisions regarding the Columbia River will be made. By getting involved ourselves, we can help to ensure that the waters of the Columbia system are allocated in the future to allow a compatible mix of resource uses for the benefit and enjoyment of all. The choice is up to us.

Activity: Word Find

I. Concepts

1. The Columbia River has many uses.
2. The Columbia River is important in the Pacific Northwest.
3. The Columbia River system must be carefully managed.

II. Objectives

The students will be able to

1. categorize given words related to the Columbia River.
2. locate words related to the Columbia River system which are hidden in a puzzle.
3. tell why the Columbia River system must be managed carefully.

III. Teacher Prep

Duplicate student copies of the word list and the word-find puzzle.

IV. Materials

class set of word list and word-find puzzle

V. Procedures

1. Distribute copies of the word list to students. Have volunteers read the list aloud. Ask students to look for ways to organize the word list into categories about the Columbia. List suggested categories on the board. Have students group the words according to the suggested categories. Encourage various groupings.

2. Distribute the word-find puzzles. Ask students to search for words from the word list hidden in the puzzle. Explain that words are horizontal, vertical, diagonal, forward, and backward. Some letters are used in more than one word.

Example:



A message can be formed by putting all the unused letters together when the puzzle is completed.

3. When students are finished, have a volunteer share the hidden message. (The puzzle takes time. It is a good project to begin together and have students finish in their free time or as homework.)
4. Ask students to write a paragraph explaining the message. Why should the river be managed carefully? Give students an opportunity to share their paragraphs with the class. During this discussion, stress that the students may be faced with making river management decisions in the future.

VI. Extended Activities

Have students design their own word-find puzzles, complete with word list, about one aspect of the Columbia River. Duplicate the puzzles so that students can exchange puzzles and try to solve those designed by other students.

THE COLUMBIA RIVER

Activity: Hidden Word Puzzle

CLARK
PEARS
LEWISTON
GORGE
BONNEVILLE
MANAGEMENT
COLUMBIA
THE DALLES
LOCK
DAM
CORN
HYDROPOWER
NAVIGATION
IRRIGATION
ENERGY
BRIDGE OF THE GODS
AGRICULTURE
TRANSPORTATION
INDIAN

ANADROMOUS
STEELHEAD
COYOTE
TROLLING
HOOK-AND-LINE
SHAD
RIVER
RECREATION
SALMON
TUG
PEAS
MONTANA
IDAHO
DOUGLAS
ASSIMILATION
GRAY
GAS
RUTS

WASHINGTON
CELILO FALLS
SEA
OREGON
SPAWNING
TRIBUTARIES
COHO
CANADA
HATCHERY
HABITAT
USA
SNAKE
BASIN
GRAND COULEE
BASIN
FISH WHEELS
FLOW
RAFT

BARGES
EXPLORER
LEGENDS
PRODUCTS
ROE
RAIN
WIND
USES
MIST
STEAMBOAT
LENTIL
WHEAT
LEWIS
COAT
BEAVER
ANT
NEW
HUT
POW

A Message for the Future

R O C O R N O T G N I H S A W L O U R
E R L O * B H Y D R O P O W E R C O L
C E E U G O R G E M Y A R G I D A H O
R G W V B N I A R U S A E W O L F G I
E O I T A N S N A I D N I M A D R S A
A N S U * E T S I M D A R I V A S T C
T O E G R V B * N S S D Y S N E D E A
I T A G R I C U L T U R E D L H O A N
O S K C O L E E E L U O C T E L G M A
N I M R E L L D A H S M M * N E E B D
N W A E M E I U S T C O Y O T E H O A
O E N R F A L L S * B U E * I T T A N
I L A O P R O D U C T S M A L S F T A
T S G L A S S I M I L A T I O N O F T
A A E P N C L A R K S A L M O N E A N
T L M X A A H A B I T A T G T E G R O
R G E E N I L D N A K O O H D * D D M
O U N V T E S E G R A B E R Y W I N D
P O T G N I N W A P S D * E N E R G Y
S D R C A I R R I G A T I O N R B S B
N F I S H W H E E L S O H O C E F A A
A U V T A E H W L A I B M U L O C E S
R S E S U N O E G R U T S L T O S P I
T S R A E P S L Y N A V I G A T I O N
H A T C H E R Y S E I R A T U B I R T

THE COLUMBIA RIVER

A Message for the Future—The Answer

R O C O R N O T G N I H S A W L Q U R
 E R L O * B H Y D R O P O W E R C Q L
 C E E U G O R G E M Y A R G I D A H O
 R G W V B N I A R U S A E W O L F G I
 E O I T A N S N A I D N I M A D R S A
 A N S U * E T S I M D A R I V A S T C
 T O E G R V B * N S S D Y S N E D E A
 I T A G R I C U L T U R W D L H O A N
 O S K C O L E E E L U O C T E L G M A
 N I M R E L L D A H S M M * N E E B D
 N W A E M E I U S T C O Y O T E H O A
 O E N R F A L L S * B U E * I T T A N
 I L A O P R O D U C T S M A L S F T A
 T S G L A S S I M I L A T I O N O F T
 A A E P N C L A R K S A L M O N E A N
 T L M X A A H A B I T A T G T E G R O
 R G E E N I L D N A K O O H D * D D M
 O U N Y T E S E G R A B E R Y W I N D
 P O T G N I N W A P S D * E N E R G Y
 S D R C A I R R I G A T I O N R B S B
 N F I S H W H E E L S O H O C E E A A
 A U V T A E H W L A I B M U L O C E S
 R S E S U N O E G R U T S L T O S P I
 T S R A E P S L Y N A V I G A T I O N
 H A T C H E R Y S E I R A T U B I R T

The message will read: "OUR COLUMBIA IS A RIVER SYSTEM . . . MUST BE
MANAGED VERY CAREFULLY"

Activity: Constructing an Octahedron

I. Concepts

1. The Columbia River is a heavily used resource.
2. Uses include power production, transportation, fishing, irrigation, water supply, waste assimilation, and recreation.

II. Objectives

The students will be able to

1. list several uses of the Columbia River.
2. illustrate detailed knowledge of the uses of the Columbia.

III. Teacher Prep

1. Make a class set of octahedron patterns on tagboard or heavy construction paper.
2. Gather necessary materials.

IV. Materials

1. octahedron patterns with instructions
2. construction paper or tagboard
3. felt markers, crayons, or colored pencils
4. glue
5. scissors

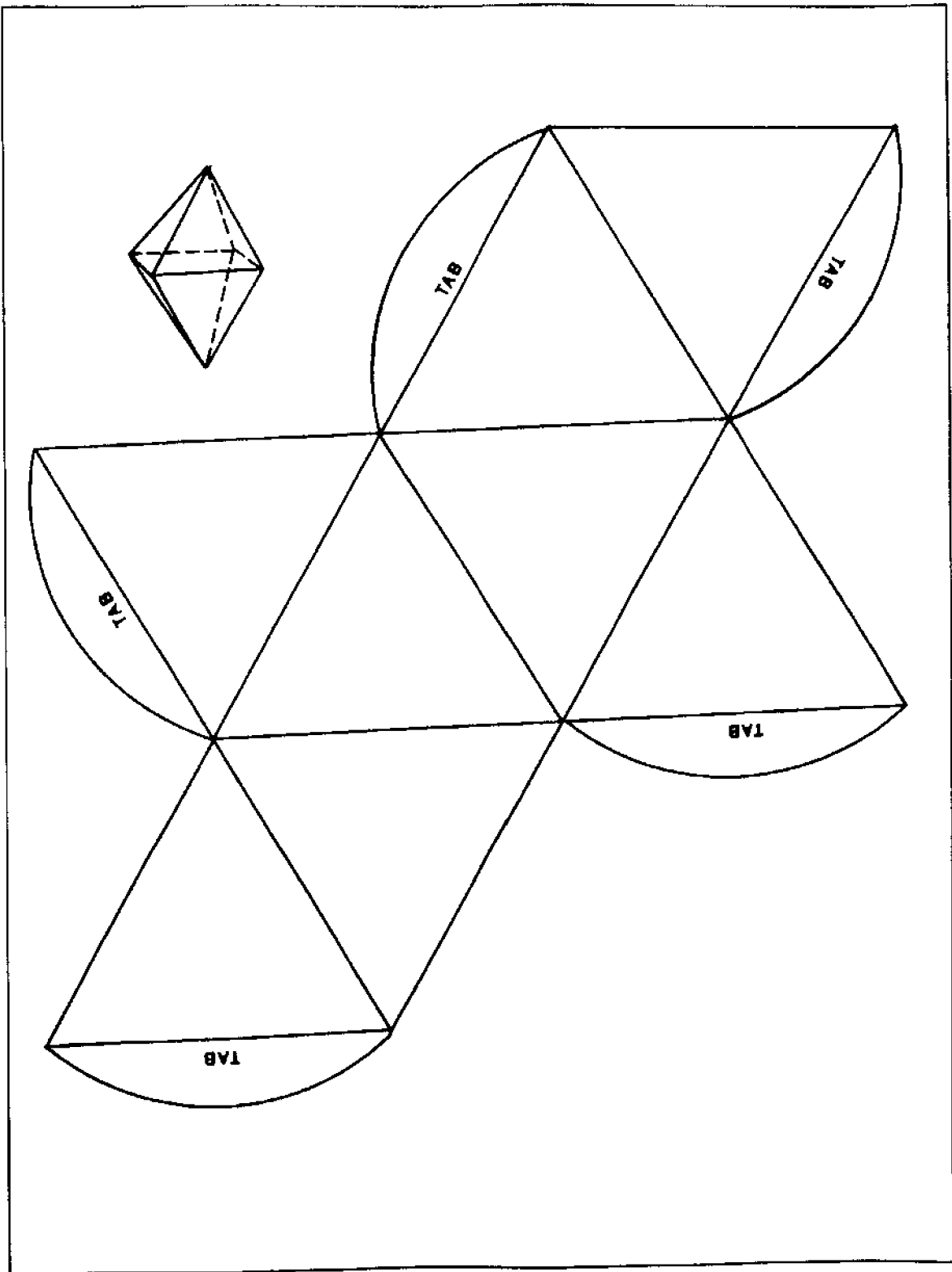
V. Procedure

1. Review the many uses of the Columbia River. Ask students to name a way the river is used and to tell what picture comes to mind when they think of that use. List several examples on the board. If necessary, remind students that the river is used as a water supply and for waste assimilation.
2. Distribute octahedron patterns. Have students draw a detailed illustration of river usage on each face of the octahedron. Instruct students to cut out the shape (after finishing the illustrations) and glue the shape together. You might wish to construct a sample.
3. Give students an opportunity to share their completed octahedrons with the class. During the sharing discussion, stress that the Columbia River is a heavily used resource.
4. Suspend the finished octahedrons by string from the classroom ceiling for display.

VI. Extended Activities

Have students create their own geometrically shaped patterns and decorate each face of the shape with a detailed illustration of one topic covered in this Columbia River study (for example, an Indian legend cube or an agricultural products tetrahedron).

THE COLUMBIA RIVER



THE COLUMBIA RIVER

